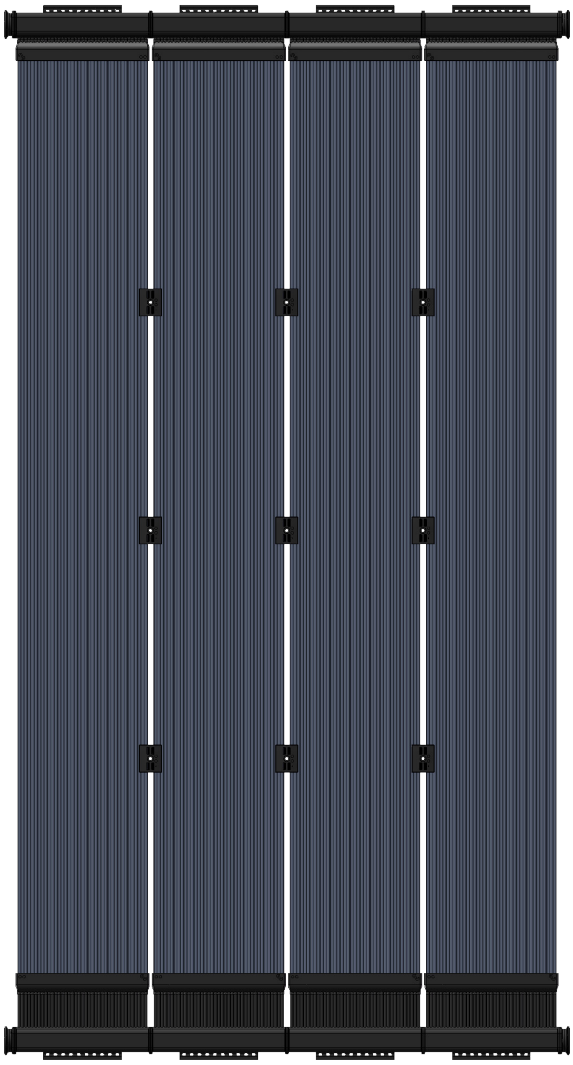
ECO SPARK®
SOLAR POOL HEATING

RESIDENTIAL INSTALLATION MANUAL FOR SOLAR POOL HEATING



Before attempting installation, read these instructions and acquaint yourself with the component names. Great care has been taken to make this an easy-to-follow procedure. A little time spent understanding the system and its parts will assure a successful, trouble-free installation.

CAUTION: SAFETY COMES FIRST

When working on or around your roof or pool, please take care to avoid hazards such as electrical wires and loose shingles. If you have any product or installation questions, contact your SunStar representative.

INTRODUCTION

eco-SPARK solar collectors are manufactured utilizing state-of-the-art solar technology and the most advanced production techniques. eco-SPARK collectors are sleek and simple, yet the patented over-molded design makes eco-SPARK durable enough to last a lifetime. However, a professional installation is very important to the overall success of a system. Installed properly, a eco-SPARK System will be virtually maintenance free as it captures free, abundant, and reliable energy from the sun year after year.

Take time to read through this manual. It will guide you through the most efficient way to correctly install a eco-SPARK solar system. By following this step-by-step guide, your system will meet the installation standards recommended by the factory (see disclaimer on front page). In addition, because we have included techniques and tips gathered from experienced eco-SPARK contractors throughout the country, using this installation will save you time and effort.

PRE-INSTALLATION NOTES

BEFORE YOU START YOUR INSTALLATION, HERE ARE A FEW IMPORTANT TIPS:

1. CAUTION: SAFETY COMES FIRST! There is no substitute for safety. Always exercise extreme caution, care, and good judgment when working on or around the roof and/or pool.
   - Please take care to avoid hazards such as overhead electrical wires or loose shingles.
   - Be sure to secure ladders so they will not slip or fall.
   - Wear shoes with proper tread to prevent slipping on the ladder or sloped roof areas.
   - We recommend utilizing fall-protection equipment whenever working on a roof. (Refer to OSHA for requirements.)
   - Do not allow extension cords to lie in the pool or in standing water.
   - Disconnect all power to the pool equipment when installing an automatic control system.
2. Check with your local building department to determine permitting and code requirements in your area. A licensed engineer may need to provide plans for the installation of eco-SPARK collectors.

PRE-INSTALLATION NOTES (CONTINUED)

3. While this manual explains how to install eco-SPARK solar collectors properly in typical situations, it cannot possibly address all the unique or individual circumstances possible. If you have any installation questions, contact your eco-SPARK representative for assistance.

4. Before starting any work, determine the location of your system and prepare a schematic drawing of the installation area. Include the location of the feed and the return lines in this drawing. Roof areas often appear larger than they really are, so be sure to measure the available area before making your schematic. Be sure that the layout of the collectors will allow the collectors to automatically drain when the pool pump shuts off.

5. Familiarize yourself with all the eco-SPARK components and plumbing materials that you will need to complete the installation.

6. Do not take shortcuts. Whenever possible, collectors should be installed so they are accessible without being walked on. Walking on the collectors should only take place when necessary.

7. Depending upon your specific job, you will need various plumbing items and materials. Be sure to use quality products that will withstand direct sunlight year after year. All components should meet minimum standards set forth by the local building code.

    - PVC Pipe - Use PVC Schedule 40 or 80 pressure-rated pipe (Conforming to ASTM D 1785). CPVC pipe is allowable. Do not use ABS pipe or metallic piping.
    - PVC Fittings - Use PVC pressure-rated fittings to match your PVC pipe (Conforming to ASTM D 2466). DO NOT USE - “Plumber’s” fittings or DWV fittings (drain, waste, vent).
    - PVC Cleaner and Cement - It is important to both clean and cement each PVC joint. When gluing CPVC fittings to PVC pipe, such as the CPVC pipe connector, it is necessary to use a “multi-purpose” cement designed for use on both PVC & CPVC components. Standard cement used for PVC joints will not work for CPVC fittings or pipe.

REQUIRED TOOLS & MATERIALS

DEPENDING UPON THE NATURE OF THE INSTALLATION, YOU WILL NEED OTHER TOOLS, PLUMBING ITEMS, AND MATERIALS SUCH AS:

TOOLS

- Screwdriver(s)
- Power Drill & Driver(s)
- Pipe Cutter
- Channel Locks
- Needle Nose Pliers
- Pipe Wrench
- Caulking Gun
- Ladder
- Fall-Protection Equipment
- Digital Multimeter
- IR Thermometer

STRUCTURAL COMPONENTS

- Stainless Steel Lag Bolts
- Concrete Anchors
- Roof Sealant & Flashings

ELECTRICAL COMPONENTS

- Wire Ties
- Wire Nuts
- Sensor Wire
- Electrical Conduit

PLUMBING ITEMS

- PVC Piping, Fittings, and Valves
- PVC Cleaner & Cement
- Silicone Spray
- Teflon Tape
- Pipe Supports

NOTE: As the installer, you are responsible for exercising good judgment when installing eco-SPARK systems to protect the long-term integrity of the collectors as well as the mounting surfaces.

SYSTEM DESIGN & SIZING

For pool heating applications the design and sizing of systems is relatively simple and is a function of several factors including pool size, location, and orientation. What follows is a walkthrough of the design and sizing process for solar pool heating systems.

SYSTEM SIZING

For most pool heating applications, the optimal system size will be 75-100% of the pool surface area. This can be achieved using one or multiple collector sizes and will vary based on usage, location, and roof orientation, among other things. The optimal system size must be balanced with the available roof area and flow rate through the pool's filtration system.

Systems larger than 100% of the pool's surface area may be required for optimal heating for pools that are heavily shaded or indoors. Systems smaller than 75% will still add heat to the pool but may not function as well as system closer to the size of the pool.

ROOF ASPECTS

Host roofs used for mounting solar pool heating systems must simultaneously be large enough, strong enough, and oriented in a way that will facilitate the best performance possible. Ideally, collectors should be located on a south-facing, pitched roof. Western and eastern orientations are also acceptable with east-facing systems producing more in the morning and west-facing systems the afternoon. Collectors should never be installed facing north in the northern hemisphere.

Most residential roofs are perfectly capable of supporting solar pool heating systems and the water that runs through them. At minimum, a roof is normally built to withstand a 20 PSF live load (for people walking on a roof) and eco-SPARK systems only exert a 1 PSF gravity load while operating.

When deciding on a location for the solar pool heating system the roof area must be large enough for the collectors, mounting hardware, and piping while still allowing for proper setbacks from ridges, valleys, edges, and vents. Proper planning is critical to make sure the roof area is sufficiently larger enough for the system being installed.

Installations on low-slope roofs and ground-based structures are also allowable but require special consideration. In these cases, please contact your eco-SPARK representative for assistance.

SYSTEM DESIGN & SIZING (CONTINUED)

ROOF ANCHOR SPACING

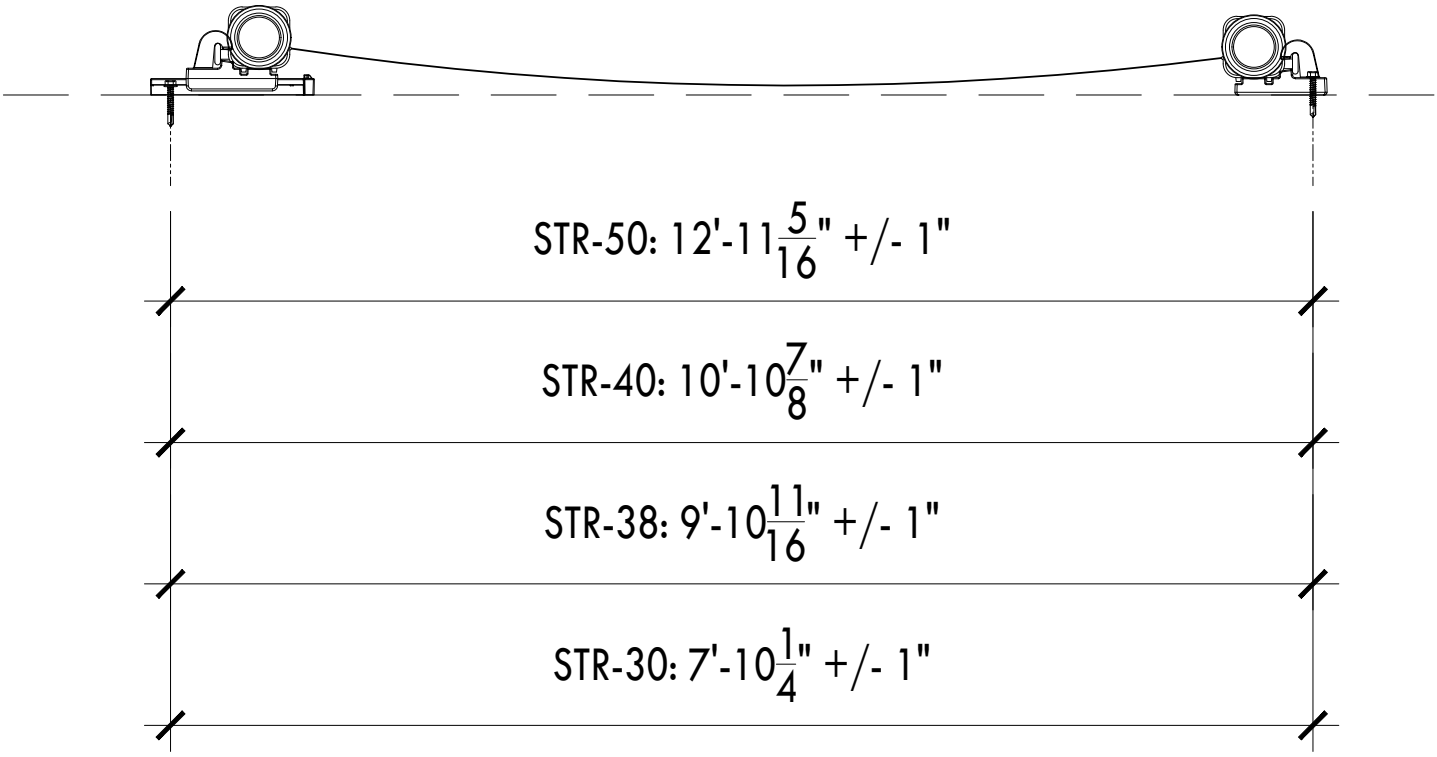


Fig. 1

SYSTEM DESIGN & SIZING (CONTINUED)

COLLECTOR CONFIGURATIONS

There are many ways to configure a solar pool heating system using eco-SPARK collectors. The most common and preferred method is in a single, continuous row, or bank of collectors. Bank sizing is limited by the size and quantity of eco-SPARK collectors used to achieve even flow throughout the bank. This is based on an ideal, maximum flow rate of 40 GPM to any bank of collectors. Below is a table displaying each model of eco-SPARK collector and the maximum bank size. (See Table 1)

TABLE 1

PANEL	SIZE
STR-8	1' x 8'
STR-9.5	1' x 9.5'
STR-10.5	1' x 10.5'
STR-12.5	1' x 12.5'
STR-30	4' x 8'
STR-38	4' x 9.5'
STR-40	4' x 10.5'
STR-50	4' x 12.5'

Banks of collectors may exceed the maximum limit provided so long as adequate pumping power and a means of flow balancing (ball valves) exist within the solar loop. The maximum bank sizes should never be exceeded by more than (2) collectors for pool heating applications. (See Table 2)

TABLE 2

PANEL	SIZE
STR-30	12
STR-38	10
STR-40	10
STR-50	8

SYSTEM DESIGN & SIZING (CONTINUED)

For larger systems or where the roof design presents a challenge multiple banks may be used. For more information on this please see the section ***Collector Layout & Plumbing*** later in this manual. Roof obstacles like vents, stacks, or skylights may also require multiple banks to be used. In certain situations, banks may be separated but still connected as a single bank to get around these obstacles. For more information on this please see the section ***Roof Obstacles*** later in this manual.

SYSTEM PLUMBING

It is critical that you use the proper size piping for the size of the solar pool heating system. Under sizing the pipe will cause high amounts friction head loss leading to low flow rates, more load on the pump, and reduced pool performance from the solar pool heating system. Below (Table 3) lists out total system flow rates and the minimum Sch. 40 PVC pipe size to use.

TABLE 3

FLOW RATE	MINIMUM PIPE SIZE
0-50 GPM	2” Sch. 40 PVC
50-70 GPM	2-1/2” Sch. 40 PVC
70-100 GPM	3” Sch. 40 PVC
100-200 GPM	4” Sch. 40 PVC
200-440 GPM	6” Sch. 40 PVC

For larger systems, the main supply and return piping may be larger than the piping directly connected to each bank on collectors. It is recommended that 2” Sch. 40 PVC be used to connect directly to the collector banks.

Plumbing runs should be as short as possible and the return pipe to the pool should have the shortest run to reduce the potential heat loss. Horizontal pipes should be supported with a pipe clamp at least every 4 ft. to prevent sagging or “snaking”. Piping runs should always be designed to handle thermal deformation (expansion and contraction) and pipe supports used must allow for this. Pipe supports used to secure piping to a wall should be installed every 10’ at minimum.

SYSTEM DESIGN & SIZING (CONTINUED)

PUMP & FLOW RATE

Many solar pool heating systems will employ the existing pool filtration pump to supply flow to the solar collectors via a manual or motorized diverter valve. In these configurations the water will flow through the solar collectors after exiting the filter before returning to the pool instead of going to the pool directly. It is important that the pump have enough power to produce adequate flow to solar pool heating system while maintaining the required turnover for health and safety purposes. A solar pool heating system is an additional load on the pump and must be factored in when designing the system.

The optimal flow rate for the solar pool heating system is a function of the size & quantity of collectors being installed and how they will be plumbed. This flow rate should be compared to the existing filtration system flow rate and should be equal to, or less than, the pool's current flow rate. If the flow rate is greater than the pool's current flow rate, then series-parallel plumbing or alternate connection to the pool may be employed. For more information see the sections ***The Solar Collector*** and ***Collector Layout & Plumbing*** later in this manual.

AUTOMATIC DRAINDOWN & FREEZE PROTECTION

The collectors & piping should be installed in a manner that allows them to drain down by gravity when the pool pump shuts off. This is especially important in areas of the country where freezing conditions occur.

Like most plumping components, eco-SPARK collectors will be damaged if water is left to freeze inside them. While eco-SPARK collectors can handle freezing temperatures they cannot withstand, nor are they warrantied against, water freezing within them. If, as a result of a unique roof design or adverse pool equipment locations, it is not possible to achieve complete automatic draindown, manual drain down valves should be installed in appropriate places in the plumbing or at the end of the bottom (feed) manifold. These valves should be opened when shutting down the system for the winter months or when freezing conditions are possible. Your eco-SPARK representative can assist you with the parts necessary for manual draindown installations. Water should never be trapped anywhere in the solar pool heating system when not in operation.

THE SOLAR COLLECTOR

eco-SPARK collectors are comprised of two manifolds overmolded onto a quantity of separate riser tubes held in place by spacer bars on the underside of the collector. Each riser tube represents a full flow path for water from one manifold to the other. As a finished unit eco-SPARK collectors have the ability to accept and heat a large volume of water efficiently with very little head loss.

eco-SPARK collectors are light and durable with functional lifespans exceeding (15) years in many cases. The open riser tube design allows wind to pass through the collectors which reduces wind loads imposed on the roof and how many anchor points are required to penetrate the roof. Collectors can be mounted on pitched and low-slope roofs as well as on ground-based structures offering a large amount of flexibility with system design. Proprietary mounting hardware is used to mount the collectors to a variety of roof types and other structures.

eco-SPARK collectors come in a variety of sizes and are configured into one or multiple collector banks to form a solar pool heating system. The size, quantity, and arrangement of the collectors is used to determine the proper flow rate for the system. The optimal flow rate through any collector is based on 0.1 GPM/ft2 of collector area.

TABLE 4

PANEL	STR-50	STR-40	STR-38	STR-30
Size, Nominal	4' x 12.5'	4' x 10.5'	4' x 9.5'	4' x 8'
Width	48.41"	48.41"	48.41"	48.41"
Length	152.88"	128.44"	116.28"	91.94"
Aperture Area	48.23 sq ft	40.68 sq ft	36.68 sq ft	29.15 sq ft
Manifold Diameter	2"	2"	2"	2"
Dry Weight	24 lbs	22 lbs	19 lbs	16 lbs
Volume Capacity	3.7 gal	3.1 gal	2.8 gal	2.4 gal
Working Pressure	90 psi	90 psi	90 psi	90 psi
Burst Pressure	270 psi	270 psi	270 psi	270 psi
Typical Flow	5 - 7 gpm	4 - 6 gpm	3.8 - 5.5 gpm	3 - 4.4 gpm

THE SOLAR COLLECTOR (CONTINUED)

STR-50

Solar Insolation

Category T(°F)		2,000 BTU/ft²	1,500 BTU/ft²	1,000 BTU/ft²
Water Temp. Minus Air Temp.	A (-9)	101.28	77.17	57.88
	B (+9)	48.23	28.94	9.65
	C (+36)	4.82	0	0
	D (+90)	0	0	0

Thousands of BTU's per day per panel

STR-40

Solar Insolation

Category T(°F)		2,000 BTU/ft²	1,500 BTU/ft²	1,000 BTU/ft²
Water Temp. Minus Air Temp.	A (-9)	85.43	65.09	48.82
	B (+9)	40.68	24.41	8.14
	C (+36)	4.07	0	0
	D (+90)	0	0	0

Thousands of BTU's per day per panel

STR-38

Solar Insolation

Category T(°F)		2,000 BTU/ft²	1,500 BTU/ft²	1,000 BTU/ft²
Water Temp. Minus Air Temp.	A (-9)	77.03	58.69	44.02
	B (+9)	36.68	22.01	7.34
	C (+36)	3.67	0	0
	D (+90)	0	0	0

Thousands of BTU's per day per panel

STR-30

Solar Insolation

Category T(°F)		2,000 BTU/ft²	1,500 BTU/ft²	1,000 BTU/ft²
Water Temp. Minus Air Temp.	A (-9)	61.22	46.64	34.98
	B (+9)	29.15	17.49	5.83
	C (+36)	2.92	0	0
	D (+90)	0	0	0

Thousands of BTU's per day per panel

KEY: **A** - Pool Heating (Warm Climate) **B** - Pool Heating (Cool Climate) **C** - Water Heating (Warm Climate) **D** - Space & Water Heating

INSTALLATION KITS

The following is a description of the installation kits that are required for a complete Heliocol installation. The **System Kit** and **Collector Kit** are always required while the **Row Spacer Kit** is only required for certain installations. The **Pressure Test Kit** is used at the end of the installation to test the system while the **Repair Tool Kit** is used if you ever need to repair a collector.

COLLECTOR KIT

One of these kits is required for each collector, it contains:

- 2 Top Mounting Pads
- 2 Bottom Mounting Pads
- 2 Panel Clamps (Top, Bottom, Latch & Gasket)

SYSTEM KIT

One of these kits is required for each row or bank of collectors. It contains the parts necessary to connect the collectors to the feed and return lines.

- 2 Panel Clamps (Top, Bottom, Latch & Gasket)
- 2 Pipe Connectors
- 2 End Caps

ROW SPACER KIT

One of these kits is required if you need to bypass a vent pipe or obstacle larger than 6”. It is also used to connect collectors into one row that are on different roof levels or that are facing different directions. It contains the part necessary to connect the collectors to the PVC pipe between them.

- 2 Panel Clamps (Top, Bottom, Latch & Gasket)
- 4 Pipe Connectors

PRESSURE TEST KIT

This kit gives you the components you need to pressure test the system once installation is complete.

- 1/2” Ball Valve
- 0-60 PSI Pressure Gauge
- Pressure Test “T” Assembly

REPAIR TOOL KIT

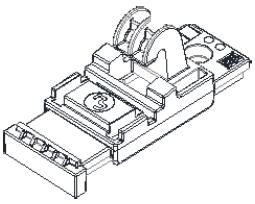
In the event a collector is damaged, this kit contains everything needed to make a repair to a riser tube.

- Pin Insert Tool
- 1/4” Chisel

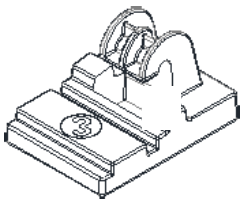
COMPONENTS

TABLE 5

ITEM #	DESCRIPTION
2-1160-002	Bottom Mounting Pad
2-1160-003	Top Mounting Pad
2-1810-003	End Cap
2-1810-020	Panel Clamp Top
2-1810-015	Panel Clamp Bottom
2-1810-018	Panel Clamp Latch
2-1810-017	Panel Clamp Gasket
2-1810-005	Pipe Connector
1-5115-028	½" Ball Valve
2-3020-001	0-60 PSI Pressure Gauge
2-1810-007	Pin Insert Tool
2-1910-008	1/4" Chisel
2-1810-029	Vacuum Breaker
2-1020-007	Repair Plugs
2-2015-064	Two-Way Valve
1-5060-021	3/8" x 4" Stainless Steel Lag Bolt

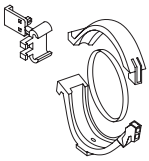


2-1160-002

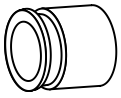


2-1160-003

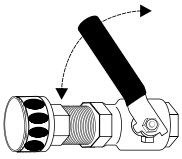
2-1810-003



2-1810-020
2-1810-015
2-1810-018
2-1810-017

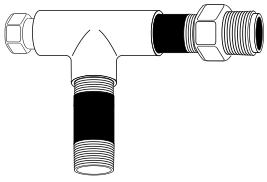


2-1810-005

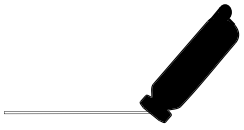


1-5115-028

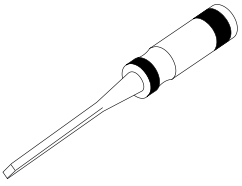
2-3020-001



Pressure Test
"T" Assembly



2-1810-007



2-1910-008

COLLECTOR LAYOUT & PLUMBING

Collectors can be installed in a multitude of configurations and methods, but systems should adhere to a few key rules for optimal performance.

1. Systems that are pitched should be installed with the feed line(s) entering the collector bank(s) on the lower manifold and the return lines exiting the banks(s) on the opposite, upper manifold end. Systems that are on low slope roofs or otherwise “flat” surfaces may should still ensure that the feed and return on are opposite manifold ends from each other.

2. Systems should be plumbed in a reverse-return fashion whenever possible. This means that the return to the pool occurs as high up and/or as far away from the feed as possible to ensure even, full flow through the system. If reverse-return plumbing is not feasible it is important to use balancing valves through the system to ensure balanced flow to all collectors and avoid short-circuiting any point in the system.

3. Systems should always have a means to drain down from the roof, preferably automatically by gravity when the pump shuts off. For systems that cannot automatically drain a means of manual drainage should be installed as required. Never create a situation where water can be trapped in the system. Large diameter piping (2” and above) will drain even if perfectly horizontal so there is no need to further slope horizontal piping runs.

4. Vacuum relief valves should be installed on all systems to facilitate proper drainage. Vacuum relief valves allow air into the system as water exits to equalize pressure with the atmosphere. The valves may be placed on the supply line at least 6 ft. above the pool equipment or near the top of the system at the collectors. Failure to install vacuum relief valves can cause damage to due freezing water and/or collapsed piping.

COLLECTOR LAYOUT & PLUMBING (CONTINUED)

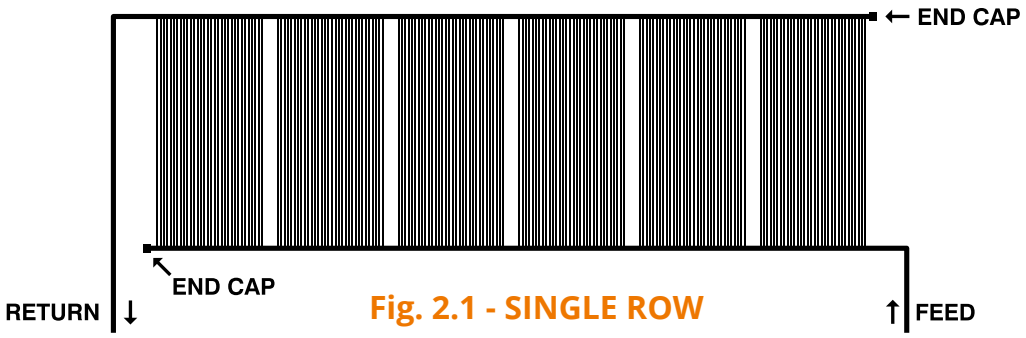


Fig. 2.1 - SINGLE ROW

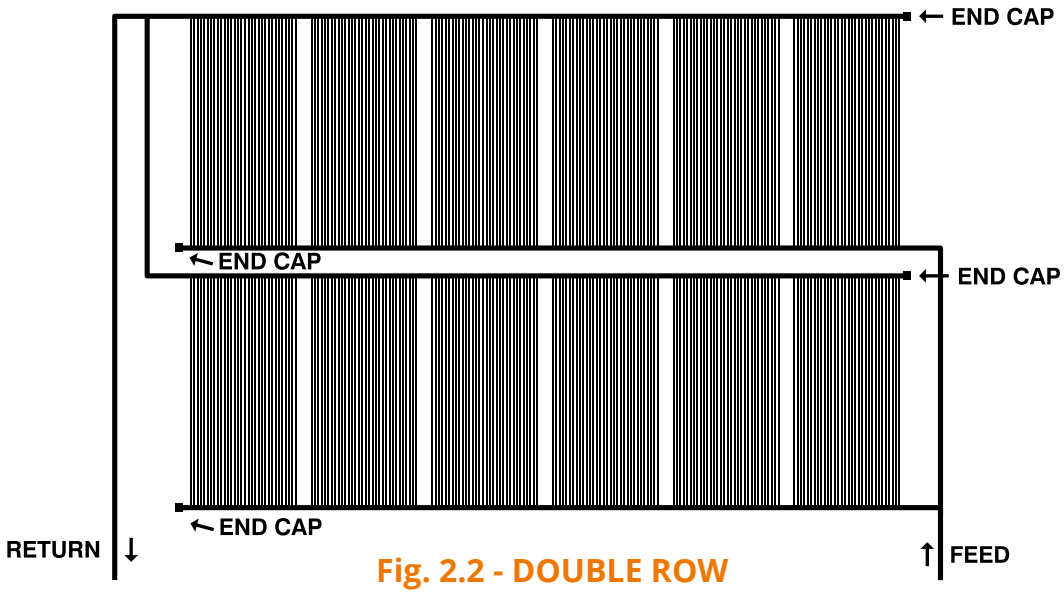


Fig. 2.2 - DOUBLE ROW

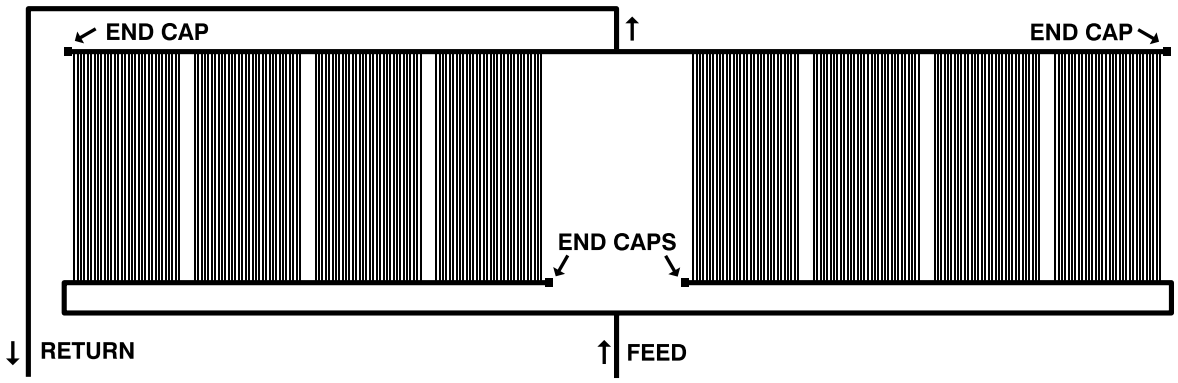


Fig. 2.3 - SINGLE ROW SPLIT FEED

COLLECTOR LAYOUT & PLUMBING (CONTINUED)

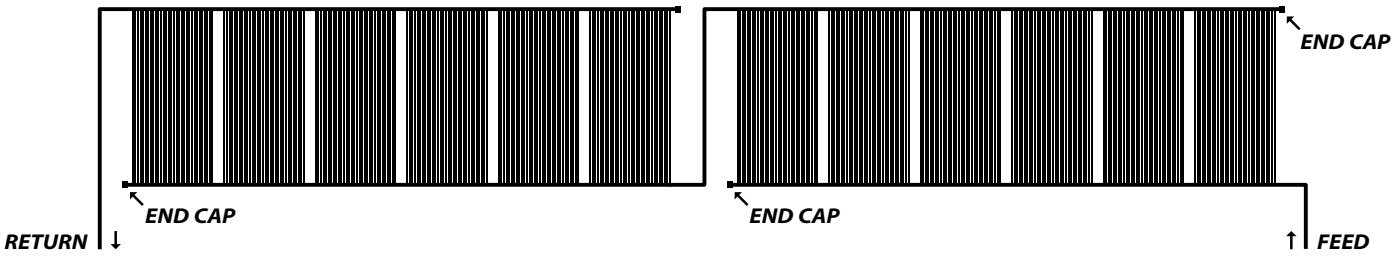


Fig. 2.4 - SERIES FEED

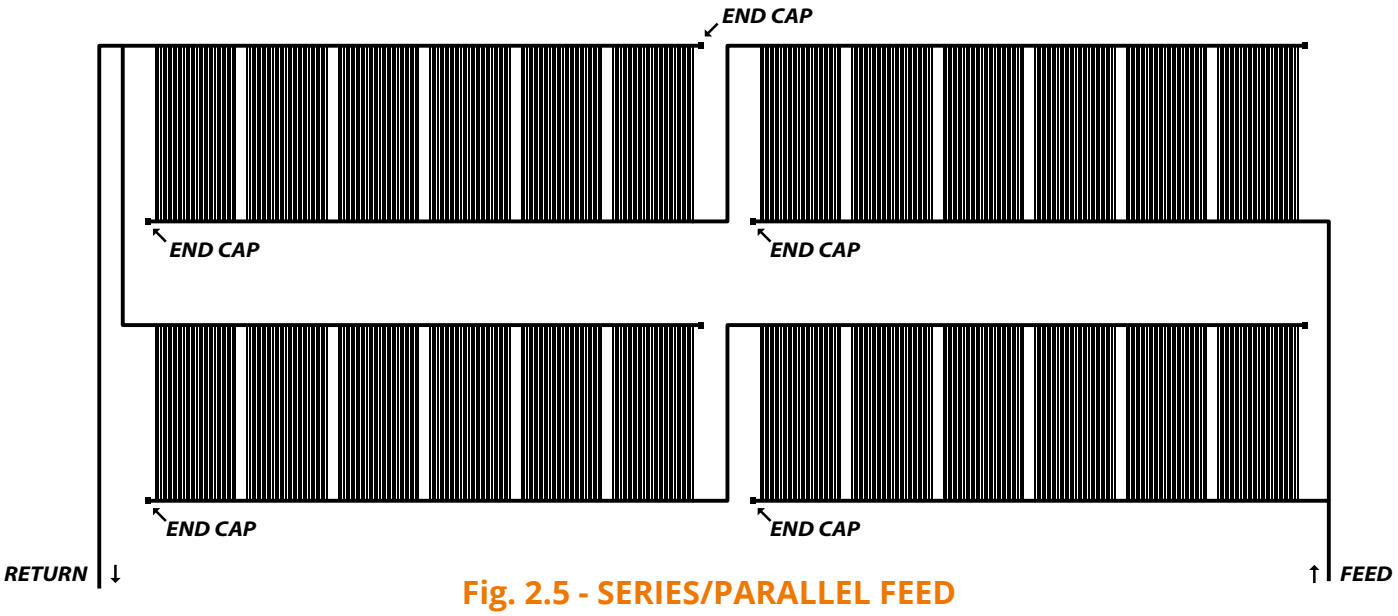


Fig. 2.5 - SERIES/PARALLEL FEED

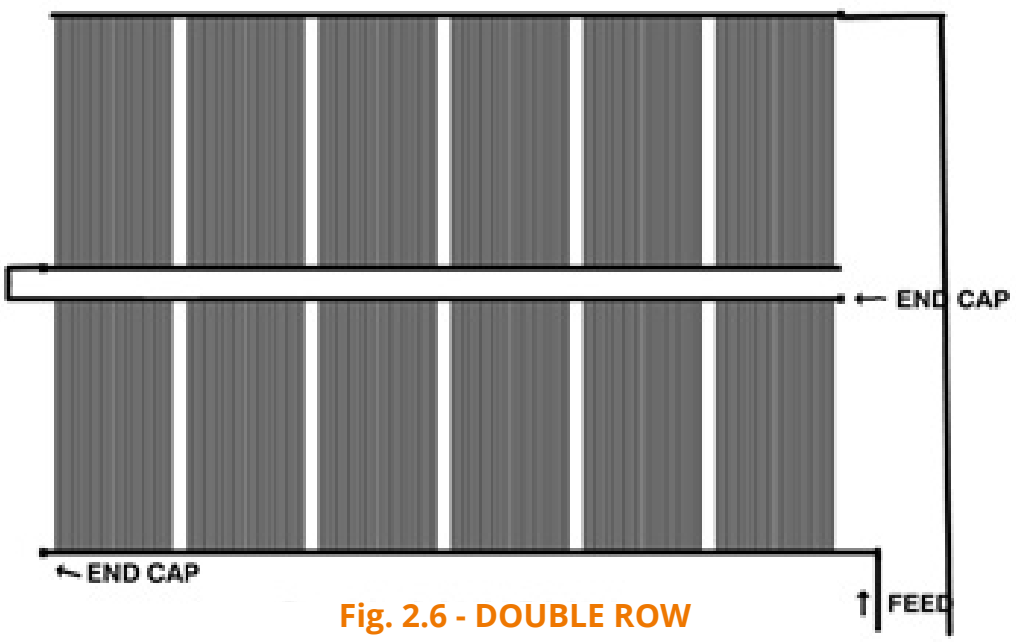


Fig. 2.6 - DOUBLE ROW

CONNECTING COLLECTORS TOGETHER

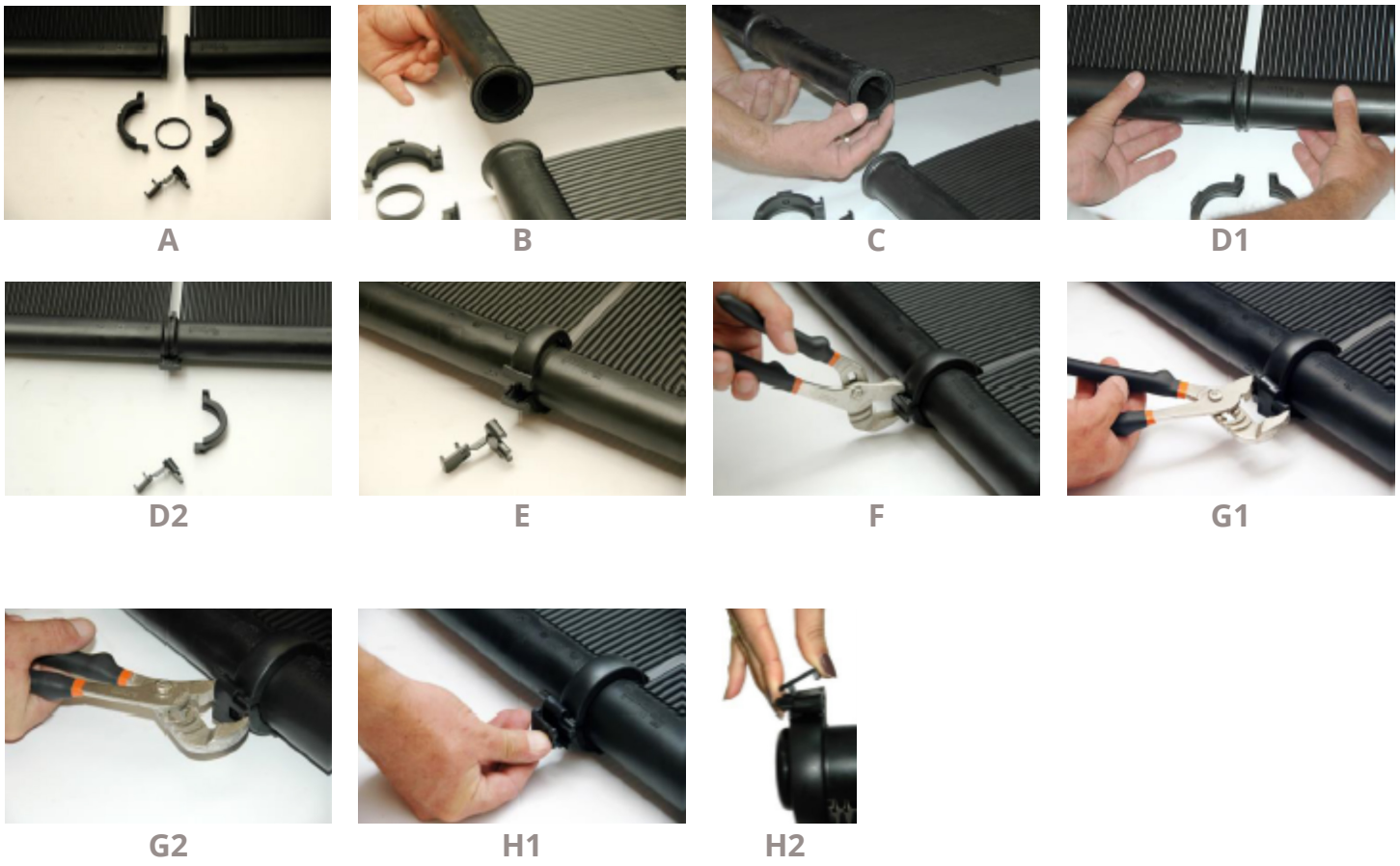


Fig. 3

1. Place two collectors next to each other. The spacer bars that hold the individual riser tubes together should be facing down. Lay a plastic collector clamp top, bottom, gasket, and latch where the two manifolds meet. (Fig. 3-A)

2. Clean the groove of both manifolds.

3. Spray the gasket with silicone and insert it into the groove of one of the manifolds. Make sure that the gasket is fully seated into the manifold groove by pushing firmly with your thumb all the way around the gasket. (Fig. 3-B)

4. Place the bottom half of the plastic collector clamp under the collector manifold with the hook portion of the collector clamp facing toward the riser tubes. (Fig. 3-C)

CONNECTING COLLECTORS TOGETHER (CONTINUED)

5. Seat both manifolds together by inserting the gasket into the opposite manifold groove and placing the ends of both manifolds into the open space in the collector clamp bottom. (Fig. 3-D)

6. Interlock the top half of the collector clamp with the hook on the bottom half. Swing top half over top of collector manifolds. Squeeze the top and bottom portions of the collector clamp together using channel lock pliers and lock both halves of the clamp together using the latch. (Fig. 3 - E & F)

NOTE: Slide large end of locking clip over small end of plastic collector clamp assembly.

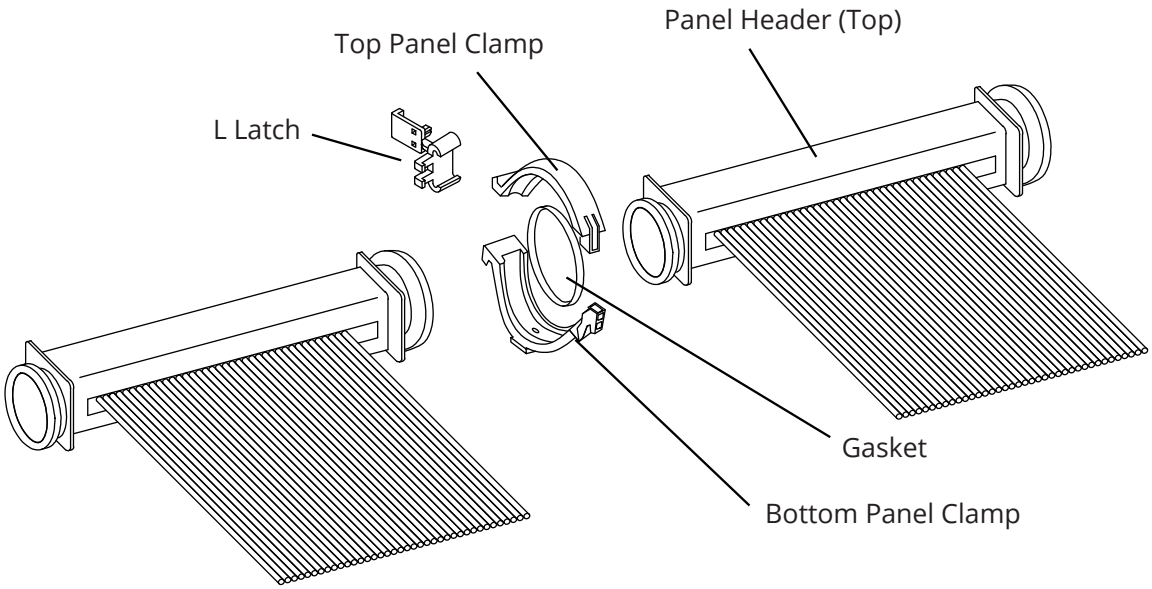
7. Use channel lock pliers to tighten the clip grip by squeezing it with reasonable force until it seats flush or even slightly farther so it cannot slide out of its position. (Fig. 3-G)

8. Insert locking clip into slots on latch. (Fig. 3-H)

9. Use this same procedure to connect both top and bottom manifolds of the collectors.

COLLECTOR ROOF MOUNTING – SHINGLE ROOFS

Top Mounting Pad



Bottom Mounting Pad

Top S roof mounting pad “left”.
Bottom S roof mounting pad “right”.

(2) mounting pads required for each side.

Fig. 4

NOTE: A secure, permanent connection to the roof is important to the performance and longevity of the eco-SPARK system. Even more important, however, is to ensure no harm is done to the structural integrity or weatherproofing of the host roof. It is highly recommended that approved roof sealants and flashings be used when making any roof penetrations.

COLLECTOR ROOF MOUNTING – SHINGLE ROOFS (CONTINUED)

The vast majority of residential roofing in the US is asphalt shingle roofing. For the purposes of this manual only installations for asphalt shingle roofs will be detailed in depth.

1. Snap a chalk line across the roof or rack where you want the top edge of the collectors to be located.

2. Locate and mark the locations of the roof trusses along the first chalk line made.

3. Slide the mounting pad onto the first mounting track (Fig. 5-A) on the manifold and Position it on the chalk line and centered over a roof truss. No matter the truss location a minimum of (2) mounts are required at the top and bottom manifold of each collector (four in total).

4. Subsequent Top Mounting Pads should be spaced out evenly along the chalk line where roof trusses occur. Each top mounting pad must be located over a roof truss and within the middle third of the mounting track on the collector manifold. Be sure to connect collector manifolds together with a Plastic Panel Clamp (PPC) and slide the mounting pad onto the track before mounting (Fig. 5-B). If the mounting location at a truss does not align with the middle third of a mounting track, then use one of the methods described in the section following this one.

5. Direct mounting application:

   NOTE: While direct mounting Mounting Pad to the roof has been common practice and is a structurally sound method of mounting it does create a risk for roof leaks if not done perfectly. Current building codes call for all roof penetrations to be sealed & flashed using approved products. If flashings are required, then skip to Step 6 detailing the use of RoofTech RT-Mini Mounts.

   - Apply ample sealant to both the bottom and top of the anchor hole on the bottom portion of the Mounting Pad. (Fig. 8.4-A). Position the Mounting Pad perpendicular to the chalk line with the lower hole being placed right on the chalk line. Anchor the Mounting Pad to the roof through the hole using a 1⁄4” lag bolt (Fig. 5-C). The length of the lag bolt used is based on how much embedment into the truss is required. Typically, this is 2” of embedment but the engineering plans will specify this.

COLLECTOR ROOF MOUNTING – SHINGLE ROOFS (CONTINUED)

6. Mounting using the RoofTech RT Mini Mount (See RoofTech RT-Mini installation manual for specifics on mount placement and roof sealing specific to this mount.)

NOTES: Mounting using RoofTech RT Mini's may be used on asphalt shingle or metal roofs with an underlying wood deck and structure. Metal roofs shall be maximum 20 Ga. with at least 4-1/4" x 4-3/4" flat area flush with the roof deck for mounting.

a. Snap a chalk line across the roof or rack where you want the top edge of the collectors to be located.

b. Locate and mark the locations of the roof trusses along the first chalk line made.

c. If mounting into trusses, position the first RT-Mini on the chalk line and centered over a roof truss (Fig. 6-B1). If deck-mounting, position wherever the first Mounting Pad will be located (Fig. 6-B2).

d. Peel off the protective paper and firmly press the RT-Mini onto the roof making sure the butyl sealant has adequate contact with the roof surface. Slide the stainless steel ¼-20 HWH bolt into the top slot in the RT-Mini (Fig. 6-A).

e. If mounting into the roof truss install the (2) included M5 x 60 mm (#10 x 2.375") wood screws through the two holes in the center of the mount. If deck mounting, then (5) screws are required with (4) on the outer holes one in a center hole of the mount (Fig. 6-C2).

- ***Deck mounting requires that the deck be minimum APA-rated 7/16" OSB or 15/32" plywood.***
- ***For metal roofs pre-drill screw locations with 1/8" drill bit.***

f. Ensure that the screws are properly tightened and that the rubber washers on the screws are compressed. Do not over tighten.

g. Apply roof sealant to the top and each side edge of the brackets (Fig. 6-D).

h. Once the RT-Mini is anchored into the roof attach the Mounting Pad by placing it on top of the RT-Mini with the stainless steel ¼-20 HWH bolt coming up through the hole. Fasten the mount by tightening a stainless steel 1/4-20 HWH nut onto the bolt (Fig. 6-A).

COLLECTOR ROOF MOUNTING – SHINGLE ROOFS (CONTINUED)

7. Ensure that all mounts are properly anchored & sealed into the roof and all top collector manifolds are connected with PPCs. Move to the lower side of the collectors.

8. Locate and mount the bottom mounting pads on the mounting tracks opposite those on the upper manifold. The bottom mounting pads should be mounted in the same way and mirror those on the upper manifold. See details later in this manual on how the bottom mounting pad assembly functions.

9. Slide the bottom mounting pads onto the tracks opposite the top mounting pads. These should be aligned along the same truss

10. Pipe supports should be used at the feed and return piping connected to the collector banks(s).

A B C

Fig. 5

COLLECTOR ROOF MOUNTING – OTHER ROOFS

While pitched, asphalt shingle roofs make up most of the roofing in the US there are a variety of other roofs types that may be encountered in the field. Concrete tile, metal, and low-slope roofing are less common but are still able to support eco-SPARK systems. These roof types will require different strategies and mounting hardware, please contact your Heliocol representative for assistance.

NOTE: eco-SPARK systems should always be mechanically attached to the host structure. The use of adhesives to mount collectors to a roof surface is strictly prohibited.

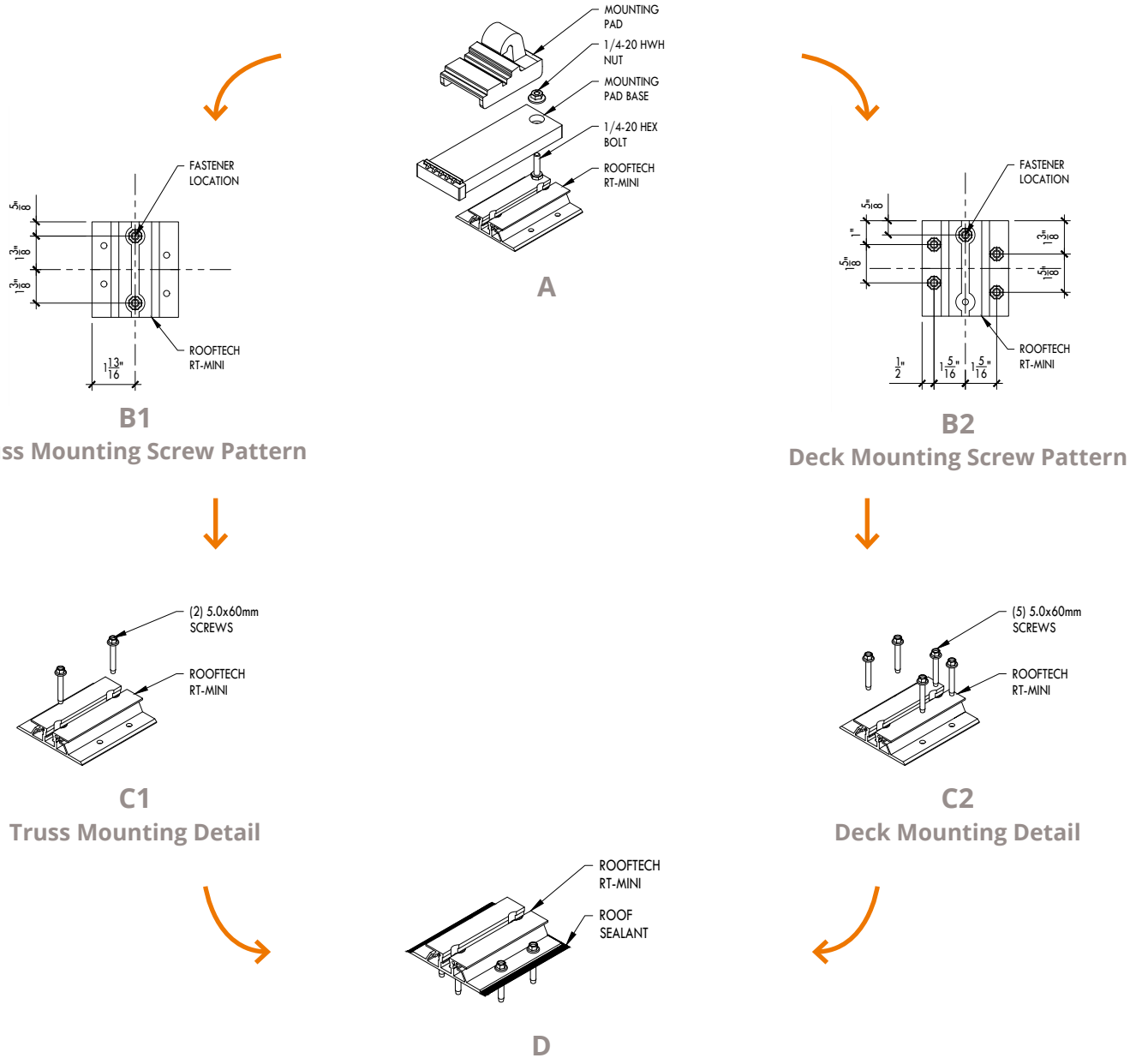


Fig. 6

ROOF OBSTACLES

ROOF OBSTACLES UP TO 6" WIDE:

Roof obstacles up to 6" wide (small vents or stacks) may be circumvented by unsnapping the riser tubes from the spacer bar and spreading them out to allow the obstruction to pass through the risers.

1. Obstructions must be less than, or equal to, 6" in diameter. For larger obstructions use the Row Spacer Application.

2. This method may not be used between the manifolds and the spacer bars closest to the manifolds. Spreading the riser tubes out close to the manifold places too much stress on them and could cause damage and/or leaks.

3. Unsnap the riser tubes at the obstruction from the spacer bar.

4. Spread half of the tubes to the right and half to the left of the obstruction.

5. Use zip ties around the bundles of tubes to keep them in place around the obstruction. It is recommended to wrap the bundles in an isolator (like foam pipe insulation) to prevent the tubes from directly contacting the obstruction. (Fig. 7)

Fig. 7

Flexible riser tubes are snapped out of the spacer bars to go around small obstructions.

ROOF OBSTACLES (CONTINUED)

ROW SPACER APPLICATION

(Roof Obstacles Greater Than 6” Wide):

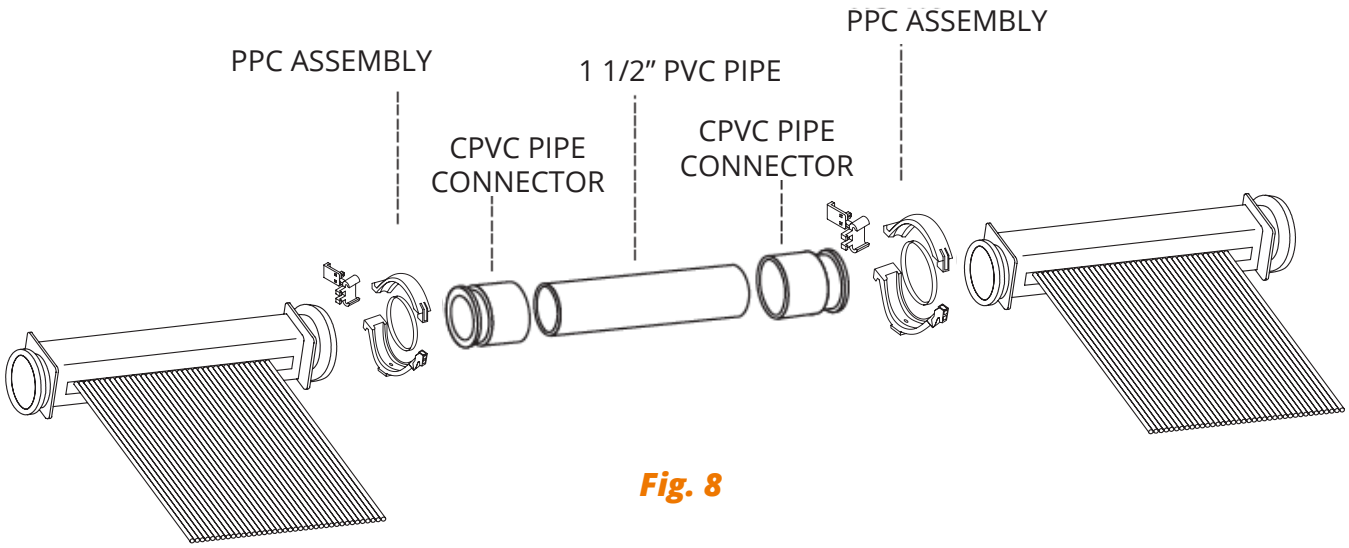


Fig. 8

1. Connect (4) of the CPVC Pipe Connectors to the manifolds of the collectors with PPC sets using the same procedures outlined in the section on ***Connecting Collectors Together***.

2. Cut two lengths of PVC pipe long enough to overcome the gap created by the obstruction.

3. Cement the PVC pipe to the CPVC Pipe Connectors as shown in Fig. 8. This should be done on both the top and bottom manifolds.

4. If the distance between the collectors is over 4’, a pipe support should be used on both pipes to prevent sagging.

CONTROLLING THERMAL DEFORMATION

PIPING

Thermal deformation (expansion & contraction) occurs in all materials subject to change in temperature. Piping will expand & contract in all directions, but the greatest change will occur with the length of the pipe. Very long pipe runs subject to a large change in temperatures during the year will require controls for thermal deformation designed in.

Pipe loops or expansion fittings are both allowable means for absorbing thermal deformation. Piping runs that will experience more than 1" of length change should have some means of controlling thermal deformation. Uncontrolled expansion and contraction can lead to pipe ruptures and damage to other system components.

COLLECTORS

eco-SPARK collectors are designed to allow for normal, vertical expansion & contraction (along the riser tubes) using the mounting hardware design for the collector. The Top Mounting Pads are designed to be a fixed position for the collector while Bottom Mounting Pads are designed to be a secure connection while allowing for the collector to change length with the ambient temperature.

During installation take note of the ambient temperature to determine how to position the Bottom Mounting Pad with respect to the lower manifold of the collector. In very warm conditions the bottom manifold should be set at the farthest position possible (most extended) while cold conditions require the opposite (most contracted). (Fig. 9.1 & 9.2)

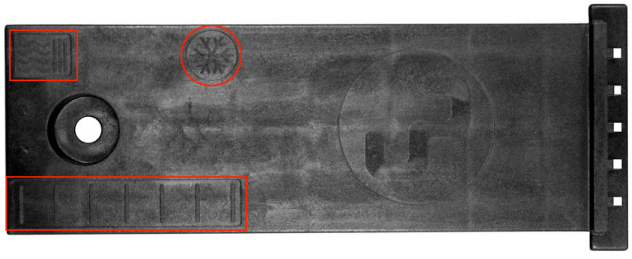


Fig. 9.1

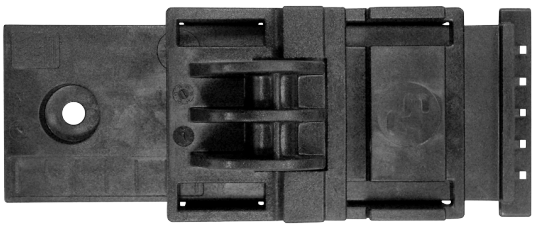


Fig. 9.2

CONTROLLING THERMAL DEFORMATION (CONTINUED)

For horizontal expansion & contraction it is preferable to lock the center of each bank in place so that the expansion and contraction takes place evenly to the left and right of this center point.

1. The The center collector of a bank may be locked in place by locating the mounting pad in place and using a heavy-duty zip ties on either side of the mounting pad. The zip ties should be fed through the slots in the mounting track and tightened that the track and mounting pad are locked in place (See Fig. 9.3).

2. Repeat this with at the bottom manifold with Bottom Mounting Pad. Do not use this procedure more than once on any bank of collectors.

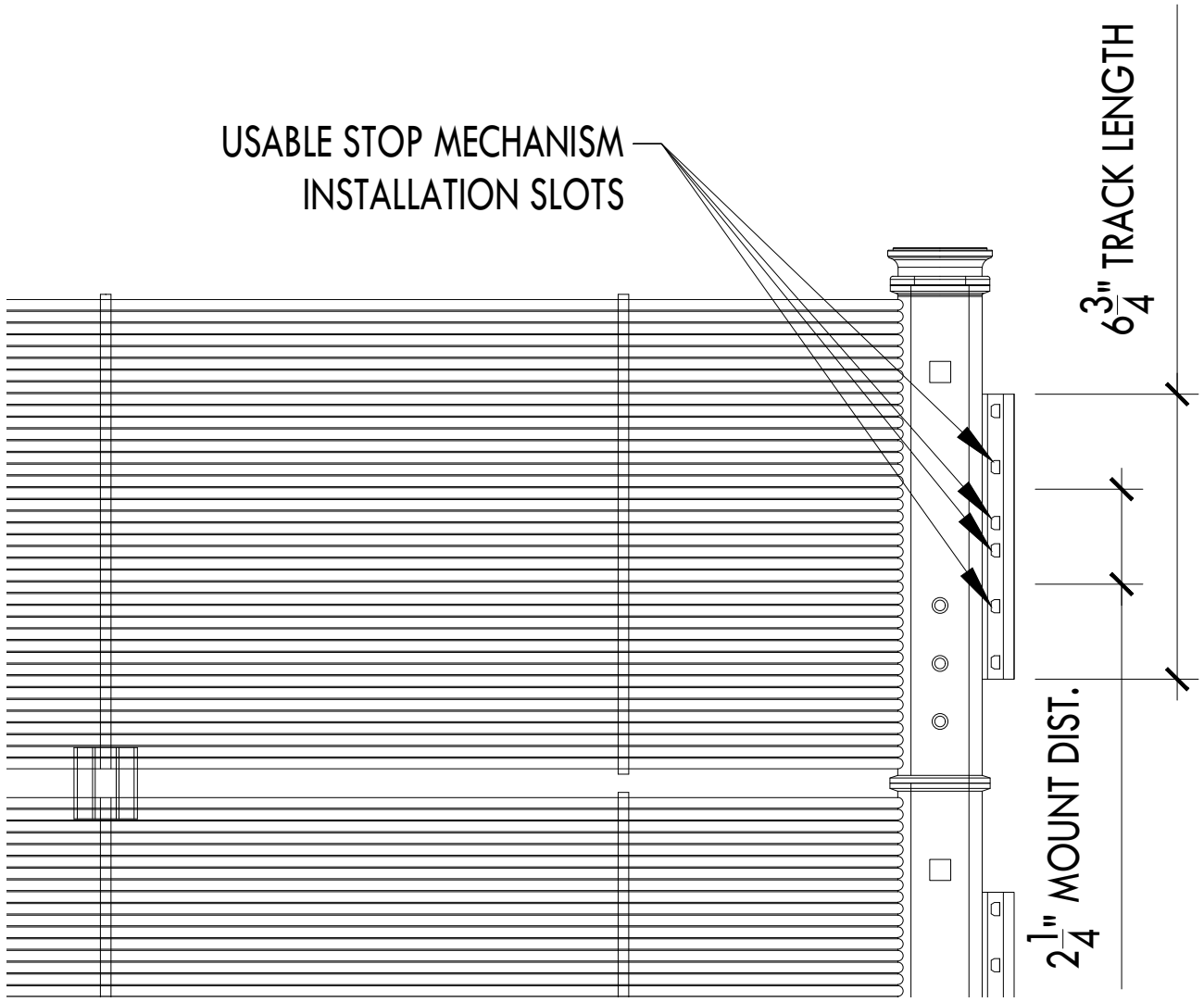


Fig. 9.3

ROOFTOP PLUMBING

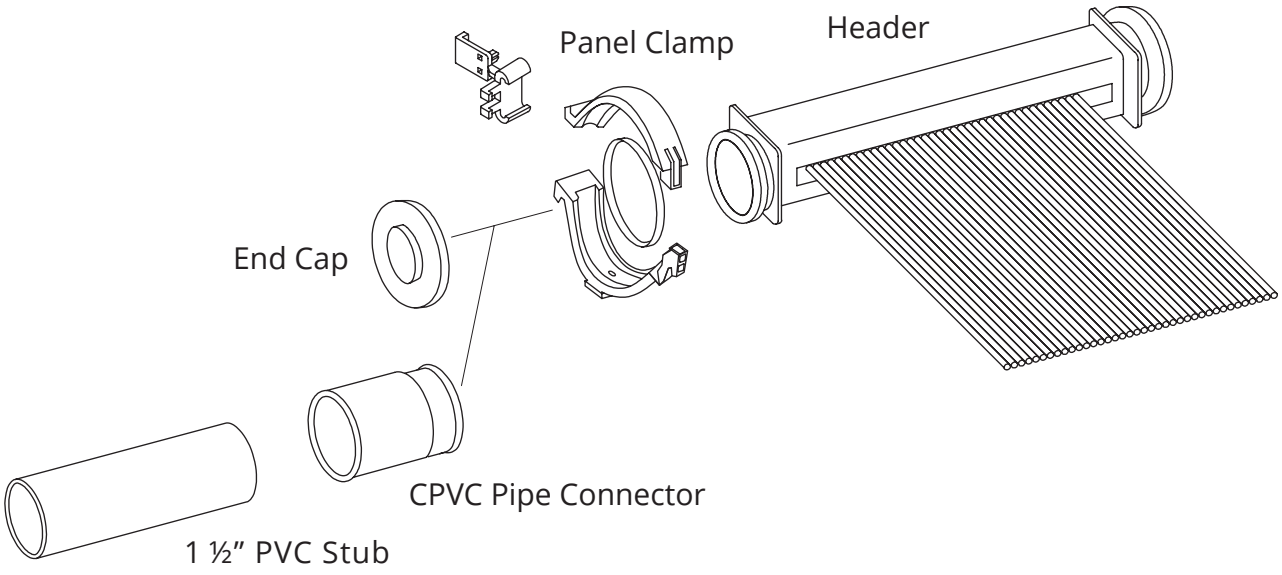


Fig. 10

1. The feed line will be connected to one end of the bottom manifold, which should preferably be the corner farthest from the pool equipment. The return line will be connected to the top manifold on the opposite end of the bank. This provides the heated pool water with the shortest path back to the pool.

2. End caps will be located on the unused corners of the collector bank(s). Attach the end caps using the PPC sets as described in the section on ***Connecting Collectors Together***. (Fig. 11)

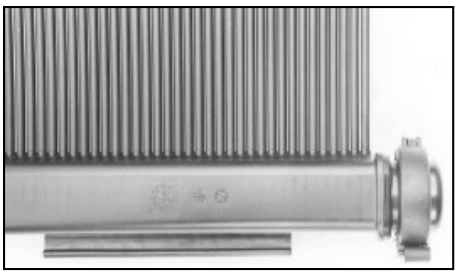
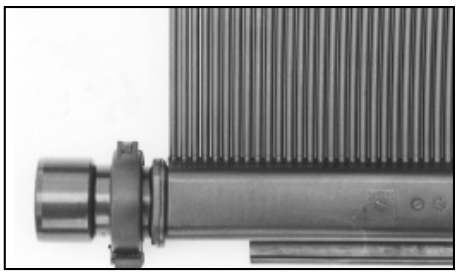
A   B

Fig. 11

ROOFTOP PLUMBING (CONTINUED)

3. Attach the CPVC Pipe Connectors to the corners of the bank where the feed and returns lines will be using the PPC sets. (Fig. 11-B). All four manifold ends should have either an end cap or CPVC Pipe Connector attached.

- ***If attaching a vacuum relief valve to the collector bank the end cap on the upper manifold may be replaced by a CPVC connector with a ¾" female threaded adaptor to accept the vacuum relief valve.***

4. The CPVC Pipe Connector allows a 1-½" PVC fittings to be inserted into the socket or 2" PVC fittings to be fit over it. Multi-purpose cement used for cementing CPVC to PVC should be used when attaching PVC fittings or pipe to the CPVC Pipe Connectors.

5. Connect the feed and return piping using standard plumbing techniques.

INTERMEDIATE PLUMBING

The following procedure represents the most straightforward way of plumbing the system from the pool equipment to the collectors. While every installation is unique there are a few aspects that should always be included:

- Whenever possible, the return line should have the shortest run between the collectors and the pool equipment.

- All piping should be installed in a manner that avoids “traps” for water when draining. It is preferable that the system can drain down automatically when the pump is off. If this is not possible manual drains should be used.

- Piping should be properly supported and routed on the wall between the pool equipment and the rooftop piping.

1. Cement the appropriate size PVC 90-degree elbow to the return line connection facing down toward the bottom manifold. Repeat the process for the feed line manifold connection and face the elbow down away from the bank. (Fig. 12)

2. Determine where the feed and return piping will transition over the eave or edge of the roof.

3. Measure the distance from the return elbow down to the location of the next transition (either over the edge of the roof or to the next elbow). Be sure to include the depth of the fitting socket(s) in your measurement. Cut a section of PVC pipe to this length.
   - ***It is advisable to dry-fit piping prior to cementing to ensure it is correct.***
   - ***De-burr all cut piping prior to inserting it into any fittings.***

4. Repeat this process for the feed line. The feed line should run parallel to the bottom manifold of the collectors.

5. The feed and return piping should be located close together once they meet near the bottom of the collector bank opposite the feed line connection.

6. Continue the piping runs to the roof transition point and then down the wall to the pool equipment location. Piping should be as short as possible and properly secured to the roof and wall with pipe supports.

INTERMEDIATE PLUMBING (CONTINUED)

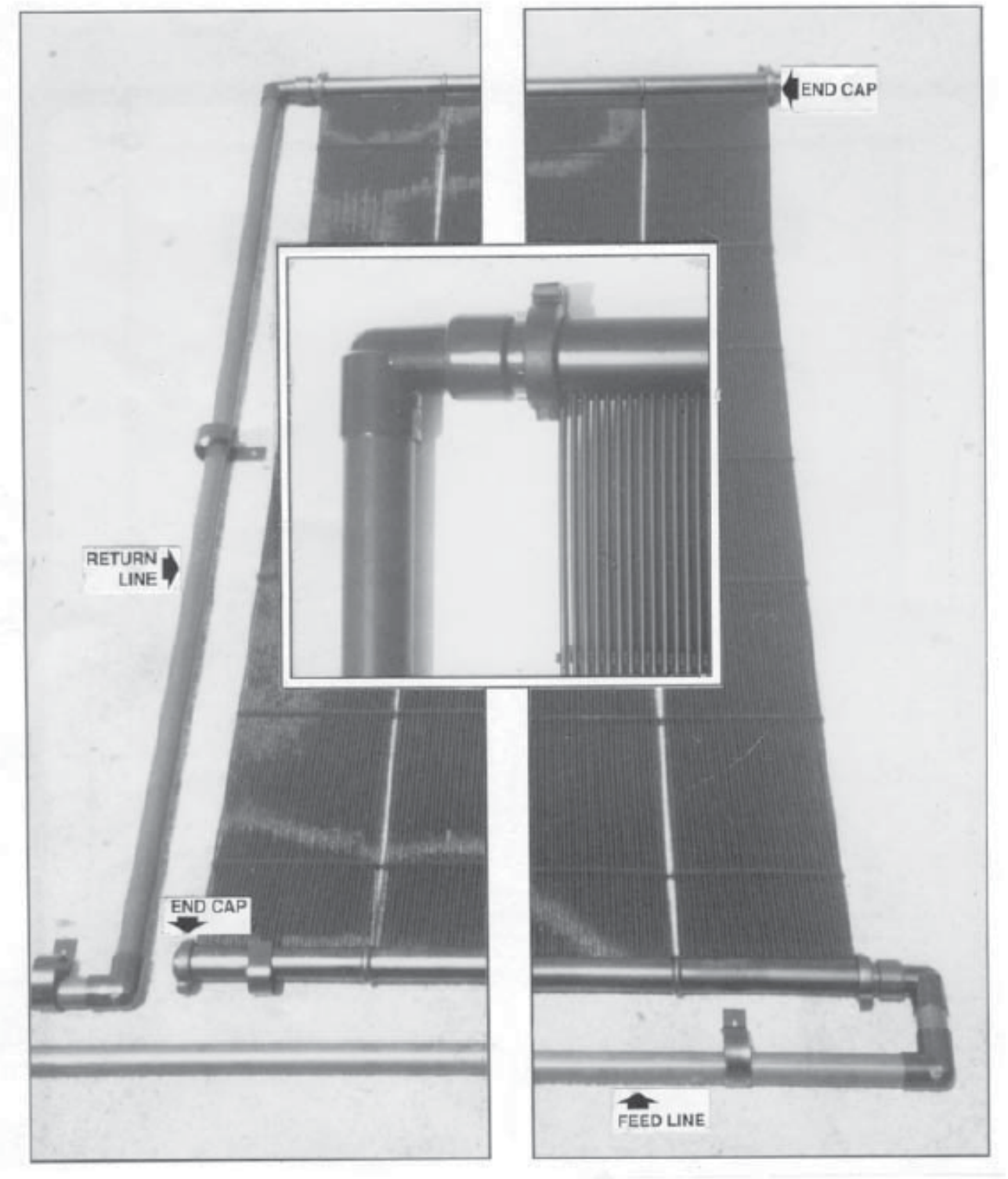


Fig. 12

CONNECTING TO THE POOL EQUIPMENT

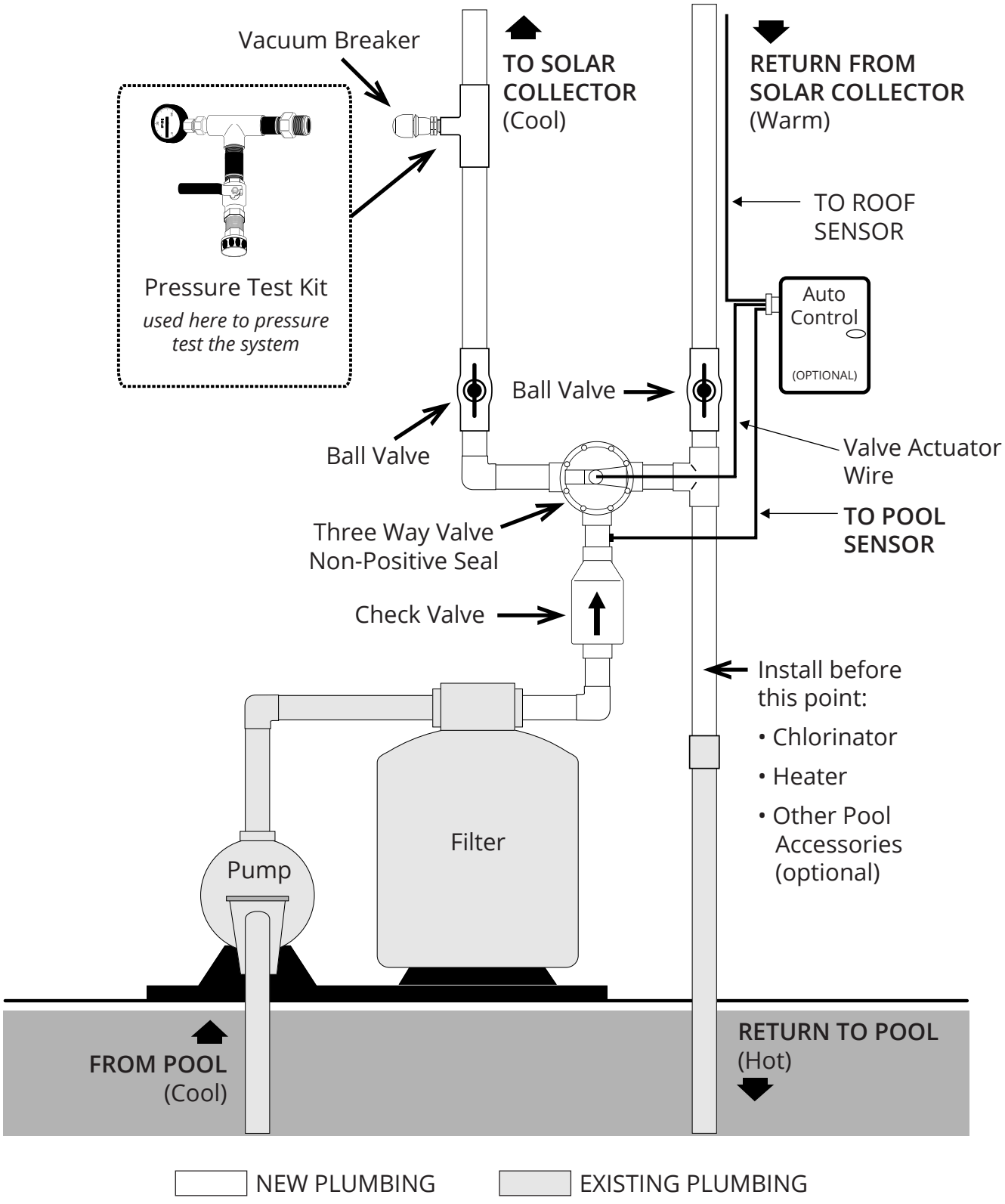


Fig. 13

CONNECTING TO THE POOL EQUIPMENT (CONTINUED)

Fig. 13.1 shows how a typical eco-SPARK solar pool heating system is plumbed into existing pool plumbing. While the pool equipment may not always be configured exactly as shown it illustrates the key points for interconnecting the solar pool heating system to pool's filtration loop.

- The interconnection point for eco-SPARK systems should always occur between the filter and the remaining pool equipment (conventional heaters, chemical feeders, etc.).
- A check valve should always be installed at the outlet of the filter to prevent backflow from the solar through the filter during drainage.
- A three-way diverter valve should be used to direct water through the collectors when solar energy is available or directly to the pool when the solar pool heating system is not being used. Three-way diverter valves used at this point should allow for the system to drain back to the pool (non-positive seal, internal check valve, etc.).
- Isolation valves (two-way ball valves, etc.) should be included on the supply and return lines.

1. Ensure that the pool system is turned off and isolated if possible.

2. Locate a point in the filtration line after the filter and prior to any other pool equipment to make the interconnection for the solar loop (See Fig. 13.1). Pool equipment that has been plumbed tightly together may require significant reconfiguration. All piping being used in the solar loop should be minimum 2" Sch. 40 PVC.

3. Cut the pipe after the filter at the location where the solar loop will interconnect. There should be enough room to plumb in a check valve and tee as shown in Fig. 13.

4. Install a check valve on the pipe coming out of the filter. The check valve should be installed so that flow is only allowed to move away from the filter (I.E. the flow indicator should be pointing away from the filter).

5. The three-way diverter valve should be installed after the check valve. It is advisable to install the valve in the standard position with the common port facing the check valve as shown in Fig. 13. This will allow for installing an actuator motor without having to reset the cams for automatic systems.

CONNECTING TO THE POOL EQUIPMENT (CONTINUED)

6. Plumb the solar feed line to one of the ports on the 3-way diverter valve. A two-way isolation valve should also be plumbed into the feed line after the diverter valve in an accessible location at the pool equipment area.

7. If installing the vacuum relief valve on the feed line, a PVC tee and ¾" threaded reducer bushing should be plumbed into the feed line at least 8 ft above grade level (I.E. beneath the roof overhang prior where the piping transitions to the roof). Wrap the threads of the vacuum relief valve with Teflon tape and screw into the reducer bushing.

NOTE: The vacuum relief valve may also be installed at the collector bank. The end cap on the upper manifold may be replaced by a CPVC connector with a ¾" female threaded adaptor to accept the vacuum relief valve.

NOTE: If not installing the vacuum relief valve on the supply line a tee should still be installed with a threaded reducer bushing to facilitate pressure testing. A ¾" threaded plug should be used when the system is operating.

8. Install a tee fitting on the pipe going back to the filter. One port should be connected to the remaining port on the three-way diverter valve. The remaining port should be connected to the return line from the solar collectors.

9. A two-way isolation valve should be plumbed into the return line and should align with the isolation valve on the feed line so both may be easily accessed.

AUTOMATIC CONTROL SYSTEMS

IF USING AN AUTOMATIC CONTROL SYSTEM TO CONTROL THE SOLAR POOL HEATING SYSTEM, FOLLOW THESE ADDITIONAL STEPS:

1. Follow all instructions outlined in the installation manual of the automatic control system being used.

2. Install the actuator motor onto the three-way diverter valve and wire it to the controller per manufacturer instructions.

3. Install the roof temperature sensor on the roof adjacent to the solar collectors. The sensor should be attached to the roof (not the solar collectors or piping) using a roofing screw and sealant. The sensor element needs to be in contact with the roof surface to read an accurate temperature.

4. Use approved sensor wiring and connect the roof temperature sensor to the controller per manufacturer instructions.

5. Install a pool water sensor into the pool filtration piping. The sensor should be installed in a location that allows it to read the true temperature of the water from the pool. The sensor probe should be in contact with the water in the pipe.

6. Use approved sensor wiring and connect the water temperature sensor to the controller per manufacturer instructions.

7. Follow controller manufacturer instructions to complete the installation and wiring of the controller.

PRESSURE TESTING

Upon completion of the installation of a solar pool heating system the system should be pressure tested to verify that all connections are sound and watertight. The system should be tested to 40-50 PSI to ensure proper installation.

1. Wrap the threads of the Pressure Test "T" assembly, ½" ball valve, and pressure gauge with Teflon tape. Temporarily replace the vacuum relief valve (or ¾" plug) with the Pressure Test "T" assembly. Thread the ½" ball valve and pressure gauge into the Pressure Test "T" assembly.

2. Attach a garden hose to the ½" ball valve. Make sure the ½" ball valve is in the "OFF" position.

3. Turn the solar function "ON" to allow the pool pump to completely fill the solar loop. If the pool pump is not operational, shut the isolation valve on the feed line and use the garden hose to fill the system.

4. Once the solar loop is completely full of water, turn off the pool pump and/or turn the three-way diverter valve to bypass the solar loop. Quickly turn off the isolation valves on both the feed and return lines.

5. Turn on the water to the garden hose and open the ½" ball valve on the Pressure Test "T" assembly until the pressure gauge reads 40-50 PSI and then turn off the ½" ball valve. Turn off water at the hose bib.

6. With the solar loop under pressure, check the whole loop for any leaks. A drop in pressure on the pressure gauge indicates a leak in the system.

7. If there are leaks, open the ball valve on the return line to relieve the pressure. Repair any leaks. Repeat the pressure testing procedures as needed until no leaks are present and the solar loops holds the test pressure.

8. Return the system to normal operation when pressure testing is complete. Be sure to open both isolation valves and replace the pressure test "T" assembly with the vacuum relief valve or plug.

OPERATION & CHECKOUT PROCEDURES

BEFORE WATER IS RUN THROUGH THE SYSTEM:

1. Allow the cemented fittings adequate time to dry per manufacturer's instructions.

2. Verify that all check valves, control valves, and vacuum relief valves are installed properly.

3. Verify that all Plastic Panel Clamps are properly assembled and seated.

4. Pressure test the system as detailed in this manual.

5. Verify that all collectors are mounted properly and that all roof penetrations have been flashed and/or sealed as required by governing codes.

6. Ensure all collector riser tubes are snapped into the spacer bars (except where they circumvent obstructions).

7. Ensure that collector riser tubes are NOT rubbing on the roof surface between the spacer bars. If they are, adjust the spacer bars as needed to prevent this or the riser tube may erode over time.

8. Ensure that the system will automatically drain down when the pump is shut off or that enough manual drain valves have been installed.

9. Verify that all pipe runs are properly supported with pipe supports.

OPERATION & CHECKOUT PROCEDURES (CONTINUED)

MANUAL SYSTEMS: TURNING THE SYSTEM ON

1. Turn the pool pump off.

2. Turn the three-way diverter valve so the “closed” indicator points toward the pool return side of the valve.

3. Be sure that the isolation valves on the feed and return lines are open.

4. Turn the pool pump on.

5. If using a pool pump timer, set the timer so that the pump will run when the solar collectors receive solar radiation, usually 10:00 AM to 4:00 PM, but this will vary with geographical location and time of year.

6. When the solar pool heating system is running, you should notice:

   - ***A slightly higher pressure reading on the filter pressure gauge.***

   - ***If the sun is out warmer water should be coming into the pool. This water should be 3-5 °F warmer than the surrounding pool temperature.***

   - ***All the collectors should feel cool to the touch when the sun is on them.***

7. During the cooler months of the year, it is essential that the pool surface be covered at night with a “pool blanket” to maintain a comfortable water temperature. Low nighttime temperatures can lower the water temperature more than the solar can recover during the day.

OPERATION & CHECKOUT PROCEDURES (CONTINUED)

MANUAL SYSTEMS: TURNING THE SYSTEM OFF

1. Turn the pool pump off.

2. Turn the three-way diverter valve so the “closed” indicator points toward the solar feed side of the valve.

3. If isolating the collectors, close the isolation valve on the feed & return lines after you are sure all the water has drained out of the collectors and plumbing.

4. Turn the pool pump on to filter the pool as needed.

AUTOMATIC SYSTEMS

1. Follow controller manufacturer operating instructions.

2. Set the desired temperature setpoint in the controller.

3. Turn the control mode to “auto”.

4. The controller will now control the operation of the solar pool heating system by turning the three-way diverter valve via the actuator motor depending on the temperature sensor readings.

   - ***The controller will send water to the solar loop when the roof sensor is some number of degree warmer than the pool water sensor and when the pool water is below the desire setpoint.***

   - ***The controller will cease sending water to the solar loop when the setpoint has been met or when the roof sensor reads a temperature lower than the pool water sensor.***

5. When the controller is in “auto” mode ensure that that all isolation valves are open. During service or winterization make sure the controller’s solar function is set to “off”, the system is drained,

TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
THERE ARE AIR BUBBLES IN THE POOL WHEN THE SOLAR HEATER IS OPERATING	**1.** If the pump is making more noise, there may be air coming into the pump through an air leak on the suction side of the pump due to the pump working harder to move the water through the solar system.	**A.** Be sure pump trap lid is on tight. **B.** Check the "O" ring on the pump trap lid. clean, lubricate, or replace as needed. **C.** If you have a suction type pool cleaner, remove it. If this improves the air bubbles, only use it when not operating the solar. **D.** If you have a clear lid on the pump and can see air bubbles in the trap, run water over the lid and each joint individually to see if the air bubbles will clear up using a garden hose. If there is not a clear lid, listen to pump noise for a smoother operation, repair any air leaks.
	2. If the vacuum breaker is installed on the roof, there is not enough water pressure in the solar system to keep the vacuum relief valve closed and it is allowing air to be drawn into the water as it flows by the valve.	**A.** Be sure filter is clean. Backwash to reduce pressure. **B.** If it's an older system, check for debris or scale in the mouth of the vacuum relief valve and clean if necessary. **C.** Use the (2-2015-019) on the return line to throttle the flow back to produce more back pressure on the system.

TROUBLESHOOTING (CONTINUED)

PROBLEM	CAUSE	SOLUTION
SOME OF THE SOLAR PANELS ARE WARM TO THE TOUCH WHILE OTHERS ARE COOL TO THE TOUCH	**1.** There is not equal flow through all of the panels. Warm panels indicate low water flow. Pump issue.	**A.** Be sure filter is clean. Backwash to reduce pressure. **B.** The pump may not be providing enough water to the solar system. Check water flow using a flow meter. Increase pump horsepower if needed to maintain recommended flow. **C.** If there is a suction type cleaner in the pool, remove it. If this eliminates the problem, use it only when the solar system is off.
	2. There is not equal flow through all of the panels. Warm panels indicate low water flow. Install issue.	**A.** If the system is a single row array and there is adequate flow, use the (HBV) on the return line to throttle the flow back to produce more back pressure on the system. This will even out the flow through the panels. If the array contains more panels than the maximum recommended on page 7 of this manual, change the array to a double row or single row split feed as show in Fig. 6.2 and 6.3. **B.** If the system is a double row or a single row split feed array and there is adequate flow, install a ball valve on the return side of the set of panels that are the coolest to the throttle. Back the flow through these panels and force more water through the warmer panels. If any section of the array contains more panels than the maximum recommended on page 9 of the manual, make changes as needed to correct this.

TROUBLESHOOTING (CONTINUED)

PROBLEM	CAUSE	SOLUTION
THE AREA LEAKS BETWEEN THE HEADERS AT THE PLASTIC PANEL CLAMPS	**1.** PPC latch is not tight enough to seal the joint.	Slide the latch farther across the connection between top and bottom half of the clamp.
	2. PPC is not seated squarely in grooves.	Disassemble PPC and verify that the gasket is seated properly.
THERE IS A PIN HOLE LEAK IN ONE OF THE RISER TUBES	**1.** If it's a new installation, it may be a manufacturing defect.	Contact your distributor for warranty repair information.
	2. Riser tubes are rubbing on roof surface.	Contact distributor for a repair kit and adjust the spacer bars to prevent future damage.
	3. Birds or squirrels have damaged the tubes.	Contact distributor for a repair kit and adjust the spacer bars to prevent future damage.
THE 3-WAY OR BALL VALVE WILL NOT TURN	Internal parts need to be lubricated or replaced.	If the valve has a grease fitting, turn it clockwise to inject grease into valve then turn the diverter past the grease fitting to spread the grease. If the grease fitting is dry, fill it with silicone grease. If there is not a fitting, disassemble valve and lubricate with silicone grease. Replace worn or broken parts.
THE AUTOMATIC CONTROL SYSTEM IS NOT WORKING	Various	Consult the manual for the automatic system you have.
THE WATER COMING FROM THE SOLAR SYSTEM IS NOT AS WARM AS IT SHOULD BE	**1.** The water is flowing too fast through the panels.	Test the water flow rate. Water flow through a single panel should be less than 10 gallons per minute. Adjust the 3-way valve to bypass some of the water.
	2. Seasonal normal operation.	In the cooler months of the year, or on cool, partly cloudy days, temperature rise through the panels may only be 2° or 3°. Use the back of your hand to feel the water temperature difference at the pool return inlet.

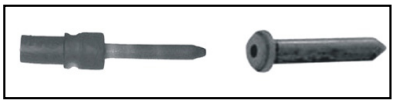
RISER TUBE REPAIR PROCEDURE

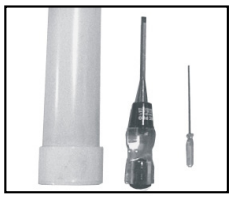
THE SUNSTAR SOLAR COLLECTOR IS A VERY DURABLE PRODUCT, BUT THERE ARE A FEW STEPS YOU SHOULD TAKE TO PROTECT ITS LONGEVITY.

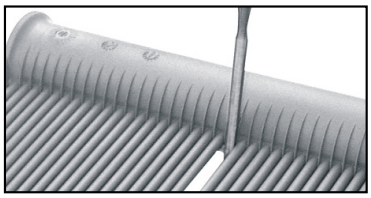
- ***Try to avoid walking on the collectors. If you cannot avoid it, always wear soft-soled shoes.***
- ***Do not install eco-SPARK collectors during temperatures lower than 35 degrees.***

If any of the riser tube in a eco-SPARK collector should become damaged for any reason, it can be repaired using the (RTK) repair tool kit and (138) repair plugs. The repair tool kit consists of a 1/4" repair chisel, an insert tool, and a PVC carrying case. Follow instructions for repair:

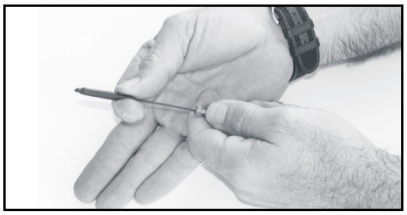
1. Utilizing the repair chisel, cut the damaged riser as close as possible to the header carefully avoiding damaging adjacent riser. (The sloped side of the chisel should face away from the header).

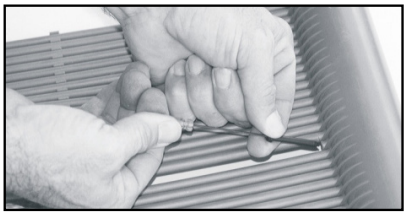






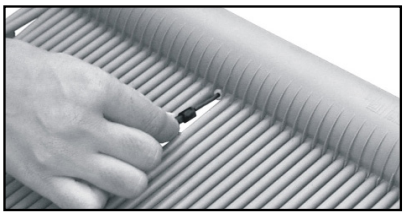
2. Spray the shaft of the insert tool and the rubber insert with silicone spray. Insert the insert tool into the rubber insert. While holding the rubber insert with one hand and the insert tool with the other, gently stretch the rubber insert. As you do, push the rubber insert all of the way into the header's opening. Stretching the rubber insert first allows for easier insertion into the header.

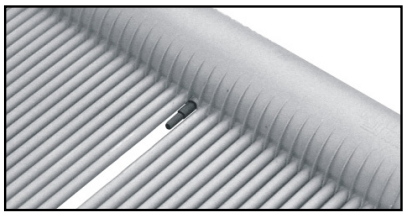




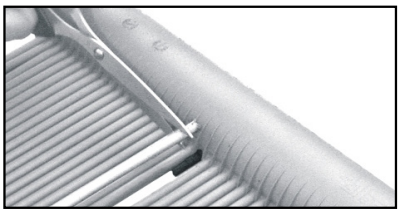
RISER TUBE REPAIR PROCEDURE (CONTINUED)

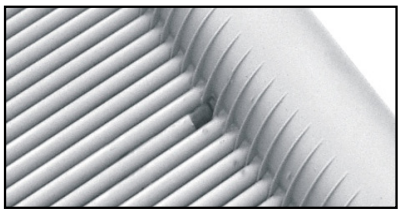
3. Pull out the rubber insert tool. Using your fingers or channel-lock pliers, push a poly-insert into the rubber insert as far as you can.





4. Cut the riser tube to the desired length and slide it over the stub of the poly-insert for a straight, eye-pleasing fit.





5. Repeat steps 1-4 for the other end of the riser tube. (At the opposite header.)

FOR ANY QUESTIONS OR ISSUES PLEASE CONTACT YOUR UMA SALES REPRESENTATIVE

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