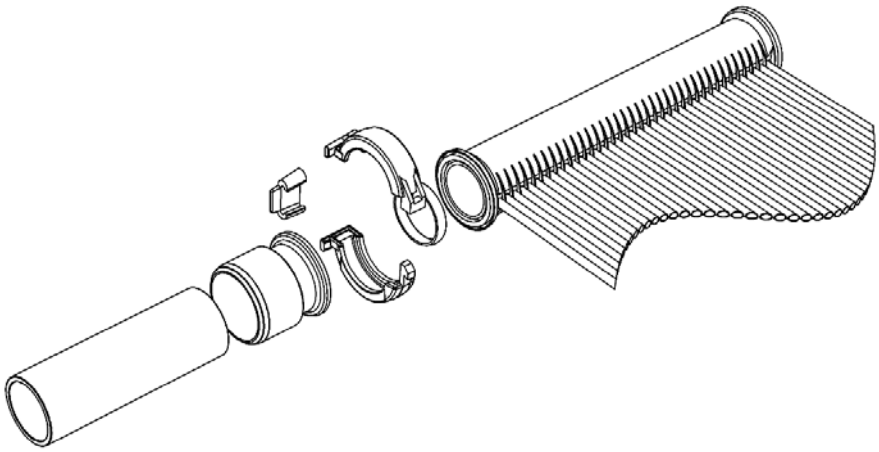
Heliocol®

Swimming Pool Solar Heating System

Installation Manual



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1 Introduction

Heliocol Solar Pool Panels are manufactured utilising state-of-the-art technology and production techniques. Heliocol collectors are sleek and simple, yet the ***patented over-moulded design*** *makes them durable enough to last a lifetime. Correct installation is essential to the overall success of the system. Installed correctly, a Heliocol System is practically maintenance free, as it taps solar heat year after year.*

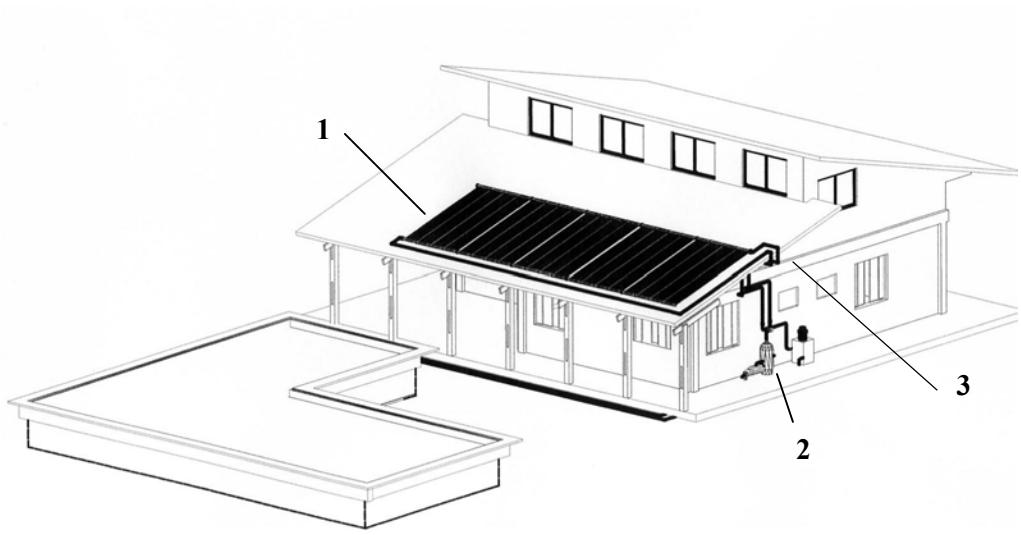
This manual contains easy, step-by-step instructions to help ensure that your installation meets our recommended standards. It also includes techniques and tips gathered from experienced Heliocol contractors, that will save you time and effort.

Overview

Heliocol solar heating systems can be either mounted on a roof or on the ground. In either case the collectors may lie directly on the mounting surface, or, if a change of angle is necessary, on a specially constructed rack.

The illustration below is of a typical roof mounted system, highlighting the three basic areas:

1. The solar collectors
2. The existing water filtration system
3. The feed-and-return plumbing that connects between the solar panels and the existing filtration system.



Conventions used in this Guide

Table 1: Icons used in this Guide

Icon	Meaning
	Safety warning
	Important note
	General note
	Practical tip

Important: While this manual explains how to install Heliocol Solar Panels properly in typical situations, it cannot address all the possible individual cases. If you have any installation questions, contact your Heliocol representative for assistance. As the installing contractor, you are responsible for fulfilling top quality standards when installing Heliocol panels.

Safety precautions

Warning: There is no substitute for safety. Do not take short cuts. Always exercise extreme caution, care and good judgement when working on or around a roof or pool area.

- Take care to avoid hazards such as **overhead electrical wires** or **loose tiles**.
- Do not allow **extension cords** to trail into the pool or other stagnated water.
- Disconnect the **power supply** to the pool when installing an automatic control system.
- When working on a steep roof, use a **safety rope**.
- Be sure to **secure ladders** so they do not slip or fall.
- Wear shoes with good tread to **avoid slipping** on the ladder or sloping roof areas.
- **Do not leave materials or equipment on a sloping roof** where they could fall off.
- When working outdoors in warm weather keep yourself adequately **protected from the sun** and make sure to **drink regularly**.

Important: Avoid treading on Heliocol collectors! Wherever possible, the system should be installed so that all parts of it are accessible.

2 Basic Heliocol terminology

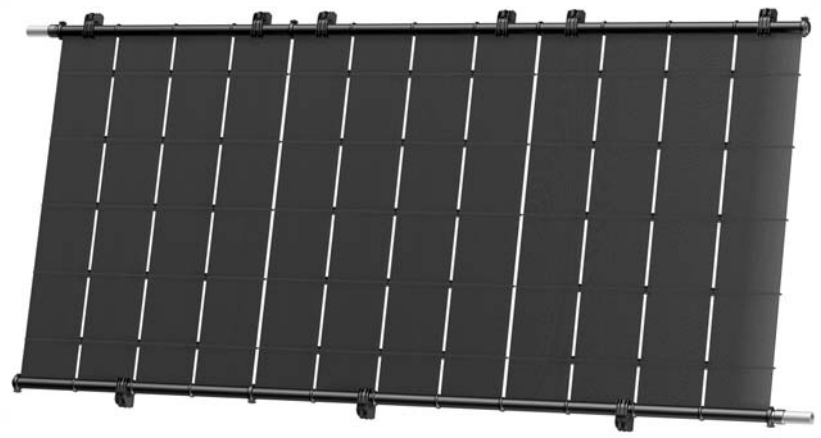
Modules /panels / banks/ arrays

Heliocol collectors are manufactured as individual “modules”, and connected together in the factory in groups of four modules to form “panels”. You connect the supplied panels together to form “banks” of various lengths, depending on the individual requirements at your site.

A Heliocol solar heating system consists of one or more banks of collectors, connected to the swimming pool filtration system.

Module – Modules come in a variety of four lengths, always 30cm wide.

Panel – 4 modules welded to one another at the factory.



Bank – a structure made of several panels joint together with specific PPC connectors.

3 Designing your system

This chapter describes the factors you need to take into account when designing your system, and the process of creating the plan of the system structure.

Important: At all stages of the design and construction keep in mind that you want to produce a system for the customer that will be as efficient and as *aesthetically pleasing* as possible.

Deciding on the location for the panels

The first thing to do is determine the location of your solar heating system. The following factors must be taken into account:

- **Collector area** – The total panel area must be large enough to heat the pool efficiently. The exact optimum size depends on many factors in addition to the pool surface area, including pool depth, climate, latitude, roof orientation and slope,winds, pool covered at night and the presence of local obstructions (such as overhanging branches) between the panels and the sun.

  An approximate "rule of thumb" is to allow for a collector area equal to the surface area of the pool.

- **Proximity to pool** – The panels need to be as close to the pool as possible, to reduce heat loss in the plumbing, and possibly the need for an additional pump.
- **Orientation** – Ideally the collectors should be mounted on a flat or south facing roof, or an elevated ground mounted rack, facing south. Where necessary, East facing or West facing roofs can be used (in that order of preference). If you have to mount collectors on an north facing slope, it is recommended to construct a reverse rack.
- **Tilt** – Be sure the planned position of the collector panels allows for them to drain naturally when the pool pump shuts off.

Tip: The "ideal" angle for maximum solar collection should be similar to the local latitude or up to 15° higher. However, any angle that allows for self-drainage of the panels is sufficient.

Important: Mounting the solar panels in certain locations, and/or constructing a support structures (if any) may require building permission. Consult with the appropriate authorities, or check with your local building department, about permit requirements and codes that may apply, before you start work.

Preparing a schematic diagram

Once you have decided on the location for the panels, prepare a schematic diagram of the system you wish to construct, taking into account the collectors sizes available.

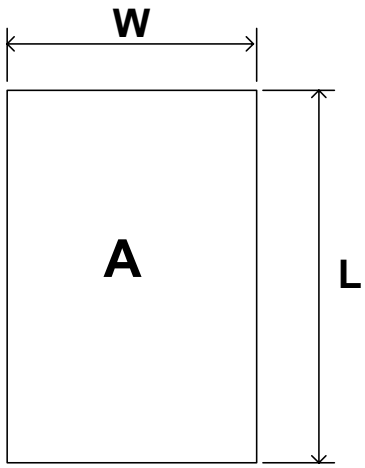
1. Fill in the "Site evaluation sheet" in Appendix A. This will help you decide on the best system for your site.
2. Prepare a schematic drawing of the installation area. Include the proposed location of the feed and return lines.
3. Use the panel dimensions in the table below to sketch the system you will construct.

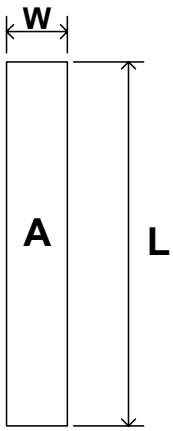
Tip: Roof areas often give the impression of being bigger than they really are, so be sure to actually *measure* the available area before making your drawing.

Note: Where possible construct your system using panels of the same length (if possible the largest length). Use individual *modules* only if essential.

Table 2: Module/panel area dimensions

Item	Width	Length	Area
Panel			
HC-30	120 cm	232 cm	2.77 m²
Cat No. 127108	4'	8'	30 ft²
HC-38	120 cm	292 cm	3.5 m²
Cat No. 127110	4'	9.5'	38 ft²
HC-40	120 cm	325 cm	3.85 m²
Cat No. 127111	4'	10.5'	40 ft²
HC-50	120 cm	385 cm	4.62 m²
Cat No. 127112	4'	12.5'	50 ft²
Module			
HC-8'	30 cm	232 cm	0.7 m²
Cat No. 124108	1'	8'	
HC-9.5'	30 cm	292 cm	0.9 m²
Cat No. 124110	1'	9.5'	
HC-10.5'	30 cm	325 cm	0.98 m²
Cat No. 124111	1'	10.5'	
HC-12.5'	30 cm	232 cm	1.15 m²
Cat No. 124112	1'	8'	





Note: In cases where space limitations do not allow for a complete panel, individual modules can also be ordered. Modules can then be connected to other modules or panels in exactly the same way that panels are connected to each other.

Sample collector system

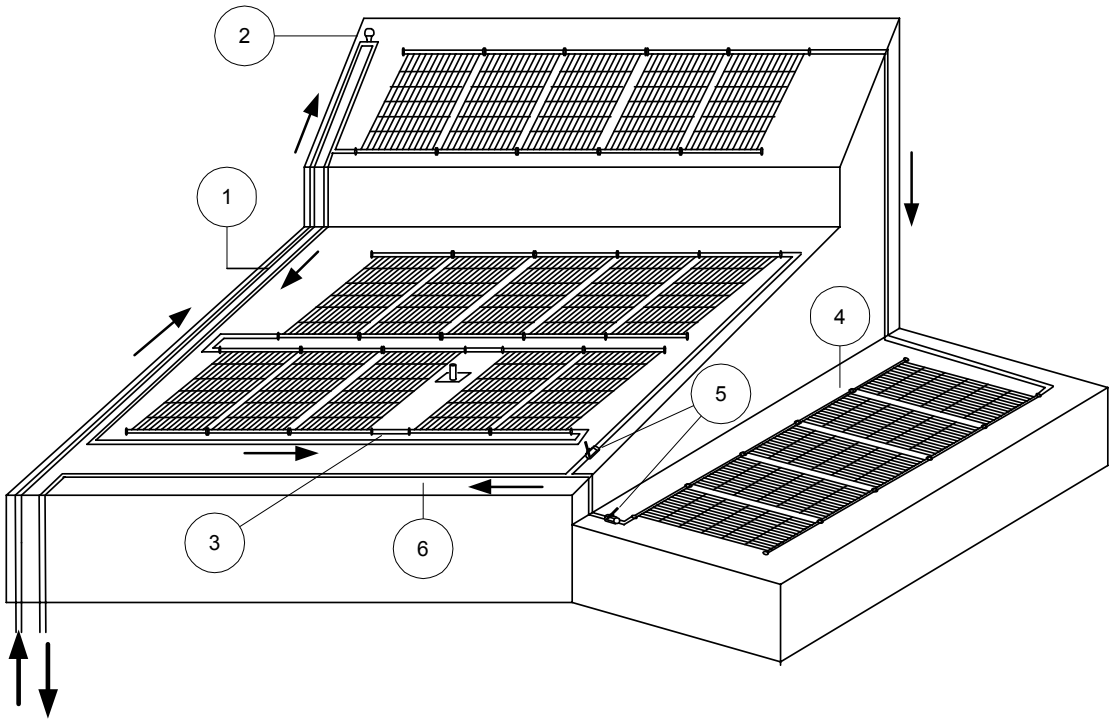


Figure 3.1: Sample collector system

1. Feed line climbing to the farest point from pump house.
2. Air release valve at highest point (optional).
3. PVC pipe connecting across a large obstruction
4. Flat roof
5. Balance valves in the return line.
6. Return line as short as possible.

Note: Full details of how to connect the supply and return pipes are given in Chapter 7.

Mounting racks

Where there is no roof space, or not enough for all the collectors, you may need to construct a rack to mount some or all of the Heliocol panels. The rack must provide a *stable* base for the panels to be secured to.

When designing a mounting rack the following considerations should be taken into account:

- The tilt of the rack should be as near as possible to the latitude of the location, to provide optimum solar collection.
- The tilt of the rack must be sufficient to allow the collectors to drain naturally when the pool pump shuts off.
- When calculating the area for the rack, take into account that collectors expand and contract due to temperature changes under normal working conditions. Allow 5cm extra length per collector.
- Allow room on the rack for the supply and return plumbing, and plumbing between collectors and banks.
- The mounting rack must be stable, and able to support the weight of the collectors when filled with water, which is up to 5kg/m^2.

Figure 3.2: Sample mounting rack

Note: Whenever unglazed solar collectors are installed on a rack , a substrate should be mounted on the rack prior to mounting the panel. This eliminates heat loss and stress created by wind blowing on the back side of the rack.

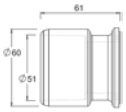
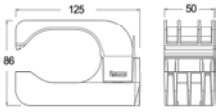
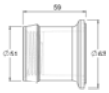
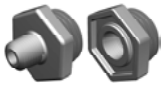
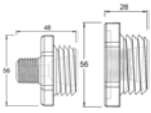
Sample installation photographs

4 Parts and tools

Once you know the layout of your solar collector system, and how many panels/ modules you require, this chapter will help you calculate which Heliocol and other fittings you will need to complete your installation.

This chapter deals with the following three categories:

- Heliocol fittings and accessories
- Other fittings
- Tools

Description	Cat. no	Picture	Dimensional Data	box
PPC Set Plastic Panel Connector	120210 T/B PPC T&B 1202110 locking clip 4202100 rubber seal			350 Each Part 1 set in 3 boxes
C.P.V.C Adaptor	420910 (2 inch) 420910E (50 mm)			80
End Cap	120260			280
Helio Roof Mounting Pad (Alligator)	120310			40
Flange	1202050			80
Vacuum End Cap	1202500 (M) 1202520 1202510(F)			125
A.R.I Vacuum breaker	4201312 4201315			24

Heliocol fittings and accessories

This section summarises the four basic types of connection to and between Heliocol panels, using Heliocol fittings.

Connecting between panels/modules

To connect a panel to a panel, or a panel to a module, you need a PPC connector set. This consists of a clamp top and bottom, a rubber gasket, and a latch.

When connecting two panels together you need two PPC sets (cat no. 120212), one to connect the upper manifolds and one to connect the lower manifolds.

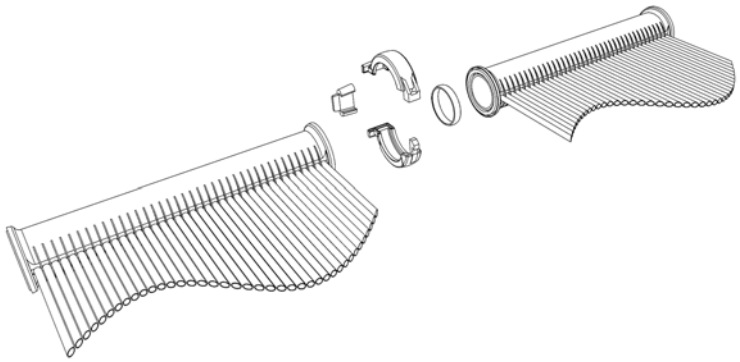
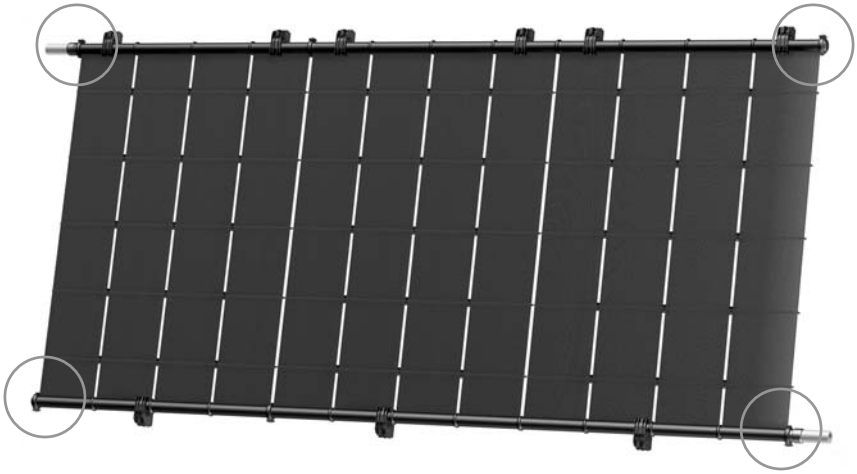


Figure 4.1: PPC (Plastic Panel Connector) set

Ends of a bank

When all the panels/modules in a row are connected together you will have four open ends. Two of these will be connected to the supply and return plumbing, and the other two will usually be blocked with end caps.



For each bank you will require:

2 end caps (120260), and

2 CPVC adapters (420910E)

Figure 4.2: Ends of a bank

Note: In some cases you might replace one of the end caps with an air release valve (4201312). See chapter 6 for more details.

Securing panels to the roof

Panels are secured to the roof using Heliocol mounting pads (Cat. 120320). In general allow 3 pads per panel, 2 at the upper end and one at the bottom. For steep roofs use 4 units per panel, 2 at the upper end and 2 at the lower end.

Heliocol fittings summary

Table 3: Summary of Heliocol fittings required

	Mounting Pads	PPC connectors	PVC adapters	End caps
For each panel	2-3	-	-	-
Between 2 panels	-	2	-	-
Between 2 panels across obstruction	-	4	2	-
For each bank ends	-	4	2	2

Pipes and other fittings

This section deals with pipes and other fittings you will need that are not supplied by Plastic Magen.

PVC pipe

Use only pressure rated Schedule 40/ PN16 PVC pipe.

Important: As black PVC pipe is sometimes difficult to obtain, customers sometimes inquire about the use of black ABS pipe instead. **Do not use ABS pipe**, as it does not have the UV inhibitors that PVC pipe does, and hence does not withstand exposure to the sun nearly as well. After several years of exposure it may become brittle and crack.

PVC fittings

Use only pressure rated Schedule 40/ PN16 PVC fittings to match your PVC pipe.

Important: Do not use “plumbers” fittings or DWV fittings (Drain, Waste and Vent).

Important: If you cannot obtain black pipes & fittings, and wish to spray paint the fittings black, be sure to use a high quality paint, preferably with UV inhibitors.

PVC cleaner and cement/ glue

Each PVC joint must be cleaned and glued with cement. Use a quality brand name product and follow the manufacturer’s directions for use on the product label.

Other fittings

Depending upon your specific job, you will need other plumbing items and materials such as: PVC valves, stainless steel lag bolts, silicone caulk, silicone spray, galvanised pipe straps, black electrical wire ties, electrical wire nuts, 18ga-22ga sensor wire, 14ga-16ga electrical wire with ground, Teflon tape, concrete anchors and screws, electrical conduit, etc. Be sure to use quality products that will withstand direct sun radiation for many years.

Additional parts you may need include:

- Vacuum breaker(s) (Recommended and supplied by Plastic Magen Cat. 4201311)
- Check valve
- Ball valve
- T-joint
- L-joint
- 3-way valve/ Automatic control
- Pipe reductions, bushings, sockets

Tools

Standard tools and materials that are useful to have when installing a Heliocol system are:

- Basic toolbox
- Chalk
- String
- Electric wire (to connect to automatic control)
- Coax (for sensor)
- Measuring tape
- Flat head and Phillips head screwdrivers
- Channel lock pliers
- Power drill with bits
- Caulking gun
- Pipe cutter or hacksaw
- Ladder
- Garden hose
- Hand saw
- Chisel

5 Hydraulics

This chapter deals with the hydraulics that need to be considered before installation.

Panel configurations

Before you can start constructing the system you have designed, you must consider how the banks will be connected together. You must also take into account the maximum number of panels allowed per bank, as shown below.

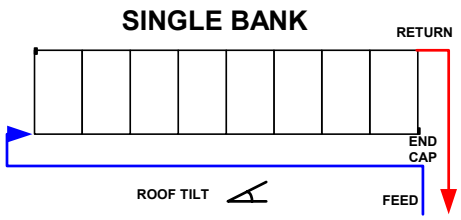
Table 4: Maximum number of panels allowed per bank

Panel type	Max. bank size
HC-30 (4'x8') Cat. 127108	**12**
HC-38 (4'x9.5') Cat. 127110	**10**
HC-40 (4'x10.5') Cat. 127111	**10**
HC-50 (4'x12.5') Cat. 127112	**8**

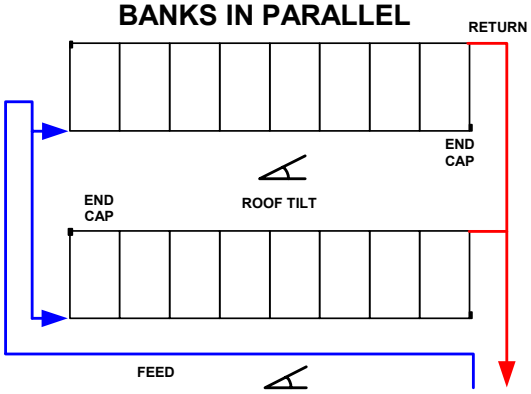
These maximums may be exceeded if there is high-pressure flow or substantial back pressure on the system that will force adequate flow through every panel. In other cases you should divide the bank into two using one of the other configurations.

Banks in parallel can also be used for smaller installations, when space is limited.

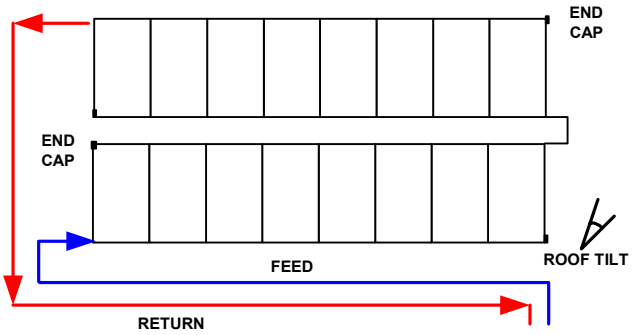
Basic plumbing & arrays layouts



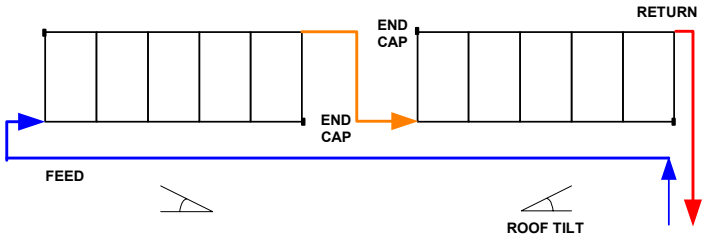
BANKS IN PARALLEL



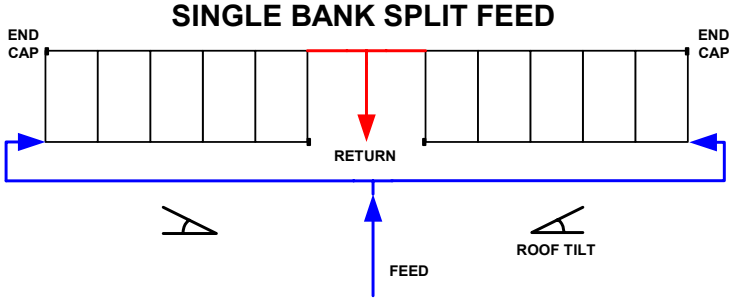
BANKS IN SERIES



BANKS IN SERIE



SINGLE BANK SPLIT FEED



Plumbing

Water inlet /outlet

- Inlets are always connected to a lower end of the bank; outlets to the upper corner diagonally opposite.
- It is best to connect the inlet to the corner farthest from the pool, so that the outlet can be as near the pool as possible, to reduce heat loss.
- Using the “Reverse return” (Tichelmann) method would ensure balanced flow in all collector banks.

Pipe diameter

It is important that all plumbing connected to the system uses a diameter of PVC pipe appropriate to the size of your solar array. Too narrow a pipe will unnecessarily restrict water flow to the panels. Use the following as a guide:

Table 5: Recommended pipe diameters

Flow Rate	Recommended pipe diameter
0-10 m^3/h	40 mm (1.5”)
10-18 m^3/h	50 mm (2”)
>18 m^3/h	63 mm (2.5”)

For larger flow rates you may need to operate alternative series-plumbing techniques.

Plumbing runs

- Plumbing runs should be as short as possible, especially the “Hot Return” pipe (to minimise heat loss).
- Pipes should be supported every metr or so, to prevent sagging and movement.

Tip: Since 90° elbow fittings greatly restrict water flow, use as few of these as possible. In some cases two 45° fittings can be used in place of a 90° fitting.

Tip: When clamping pipes that run across the roof use clamps that allow 1cm for expansion of the pipe in hot weather.

Tip: When clamping pipes on the side of a building use clamps with a diameter equal to the pipe diameter, to prevent vibration and to assure a professional looking installation.

Balanced flow

If you install a split system, such as one of those shown in former page , it is essential that the piping is connected exactly as shown, to ensure equal water flow through both banks of panels. Water follows the path of least resistance, so if one plumbing run is shorter, more water will flow through it than through the longer one. This should also be kept in mind when designing a panel layout different to those shown.

For larger, more complicated configurations “balancing valves” may be necessary to maintain equal water pressure in all parts of the system.

Pump power

The horsepower of the swimming pool filtration pump must be adequate to supply the Heliocol system with enough water to provide the recommended flow rate necessary for the panels being installed. These recommended rates in litres per minute are:

Table 6: Recommended flow rate trough the panels

Panel type	Minimum Flow
HC-30 127108 (4'x8')	720 lit/hr
HC-38 127111 (4'x9.5')	900 lit/hr
HC-40 127111 (4'x10.5')	900 lit/hr
HC-50 127112 (4'x12.5')	1200 lit/hr

For example: If you were installing ten HC-40 (4'x10.5') panels, your pump would have to be able to deliver 9000 liters/hr to the solar array. These recommended flow rates may be exceeded by as much as 100% without any detrimental impact on the performance of the system. The existing pool filtration pump is usually adequate for circulating the water through the solar system.

Generally, a 1 horsepower pump is sufficient for a standard private pool solar system, unless there is an unusually long pipe run, a high roof, or a large number of panels. If you are not sure what your pump flow rate is, consult your Heliocol Representative or Pump Manufacturer for the pump's flow characteristics.

Automatic drainage

The panels and the PVC pipe must be installed so that the water drains out of them when the pool pump shuts off. This is especially important in areas where freezing occurs.

To allow for drainage a vacuum breaker is installed on the solar feed line above the 3-way valve, as shown in the draw on page 31.

Important: Heliocol Solar Pool Panels are warranted against internal freezing on condition that they are installed to allow for automatic draining.

Compensating for lack of automatic drainage

If, due to unusual roof design or pool equipment location, it is not possible to achieve complete automatic drainage, manual drain down valves must be installed in appropriate places in the plumbing, or at the end of the bottom (feed) header.

Instead of installing an End Cap at the end of the header, place a Vac Cap (120252) along with a ball valve for manual drain. These valves should be opened when shutting down the system for the winter months or when outdoor temperatures approach freezing point.

6 Installation

This chapter describes four basic installation processes:

- Connecting panels together
- Connecting panels across an obstruction
- Securing panels to the roof (sloping or flat)
- Gluing PVC joints

Tip: It is highly recommended to visit the site *before* installation day. Looking around the site after you have planned the installation layout is of great help in foreseeing and solving possible problems.

Connecting panels together

1

Lay the two panels side by side with the panel spacer bars facing down. Place a PPC connector (top, bottom, gasket and latch) at both ends where the headers meet.

2

Clean the groove of both headers and dry them.

3

Insert the gasket (420211) into the groove of one of the headers.

4 Connect the two headers by inserting the rubber gasket (420211) into the opposite header groove and fitting the ends of both headers into the plastic panel clamp.

Important: Make sure that the gasket sits snugly in the grooves of both headers, and is not squashed or pinched between the headers, as this could result in leakings.

5

Place the bottom half of the plastic panel clamp under the header end with the larger, flat portion facing *away* from the panel.

6

Interlock the tab in the top half of the clamp with the hole in the bottom half (120210B), swing the top half (120210T) round over the headers, then lock the two halves of the clamp together using the latch (120211) (do this by sliding the large end of latch over small end of the PPC assembly.)

7+8 Use channel lock pliers to tighten the latch grip by squeezing it with moderate force until it seats flush so it cannot slide out of its position.

9 The headers are now connected.

10 Repeat the procedure to connect the headers at the other end of the panels.

Bypassing a small obstruction

Small obstructions can sometimes be bypassed simply by unclipping some risers from the spacer bars and spreading them to either side of the obstruction.

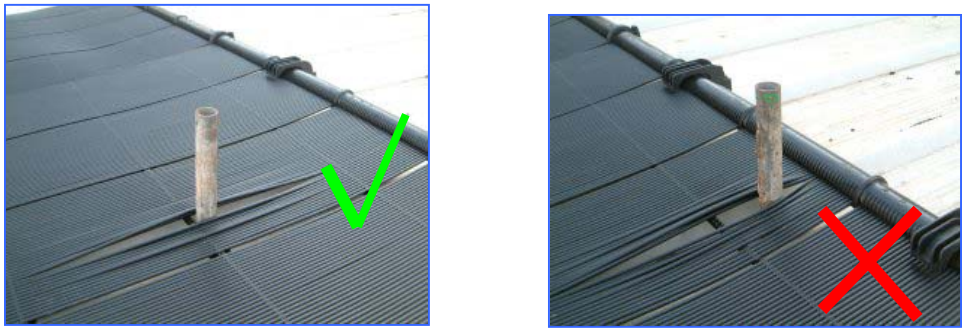


Figure 6.1: Bypassing a small obstruction

Important: If the obstruction is between one of the headers and the adjacent spacer bar this method must not be used, as it might cause a riser to become detached from the header. The Plastic Magen Warranty does not cover incorrect installation of this type.

Connecting across a large obstruction

For obstructions more than 15cm wide, or less than 30cm from one of the headers, you need to circumvent the obstacle using extension pipes between the manifolds.

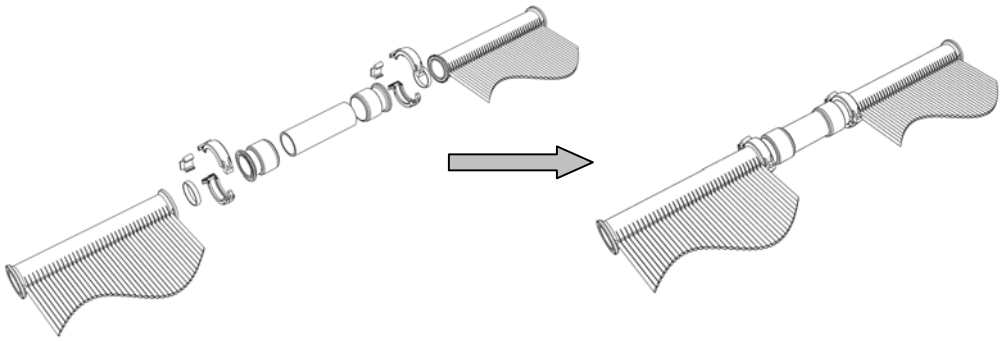


Figure 6.2: Connecting across an obstruction

Therefore, when connecting two panels/modules together across a large obstacle you need:

- 4 PPC sets
- 4 CPVC adaptors
- 2 lengths of PVC pipe cut to the required length.

Fixing panels to a sloping roof

Heliocol mounting pads ("Alligators") are used to secure panels to the roof or rack. The following considerations apply:

- Mounting pad 120320 can be fitted to the panel anywhere along the manifold header, except within 5cm of the ridges where two modules join (to allow for thermal expansion).

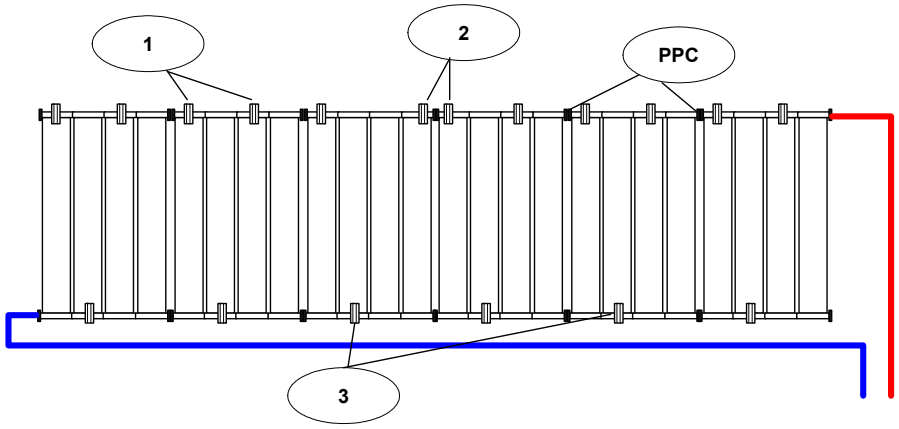


Figure 6.3: Mounting with a "Alligator" Mounting clamps

1. In general, allow two mounting pads on the upper header of each panel, and one for the lower header. (On roofs with a pitch greater than 10/12 you need more pads, and on flat installations you can use less.)
2. It is recommended to lock the centre of each bank in place, so as to spread thermal expansion and contraction evenly between both sides. To lock the centre panel of a bank, position the mounting pads on that panel adjacent to the left and right of *one* of the header ribs. These clamps should be attached using *two* lag bolts as opposed to one.
3. In a strong inclination roof it is recommended to fix one mounting clamp at the lower manifold, to support the panel and to avoid it from lifting due to strong winds.

- For barrel tile roofs, each mounting pad needs to be positioned so that it is centred on the upper ridge of a tile.

Important: Never "lock" more than one position on a bank, as this could result in damage to the system due to thermal expansion and contraction.

To mount panels with Heliocol "Alligator" mounting pad:

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

2 Position the first "Alligator" on the chalk line, about 15 cm from the top corner of the first panel..

Note: Since the panels should slope slightly down toward the feed end of the array, for proper drainage, the chalk line should also slope down in this direction, approximately 2cm per 5m.

3 Subsequent "Alligator" should be spaced out evenly along the chalk line, approximately every 60 cm (for roofs with a pitch up to 40°). Apply sealant generously to the lower hole on the bottom half of the clamp.

4 Position the bottom half of the mounting clamp perpendicular to the chalk line, on the highest part of the tile.

5 Lag the clamp to the roof, through the lower hole. For barrel tile roofs, place a rubber pad (420320) underneath each clamp, by inserting the four feet of the rubber pad into the four corners of the bottom of the clamp, before lagging to the roof.

Tip: The bottom of the clip is designed to grip the roof's surface to avoid twisting; however, if the roof surface is particularly hard or slippery you can use an additional lag bolt in either the top or lower hole.

Tip: To ensure correct spacing of the clamps, hang the upper headers of panels in the lower halves of the clamps that have been attached to the roof, as you go.

Once all "Alligators" are properly lagged to the rack or roof surface, and all the collectors are hung in place, join the upper headers together with PPC connectors.

6 Snap the top portion of each mounting clamp over the panel header and onto the bottom portion of each clamp, pushing down firmly.

7 Attach "Alligator" mounting clamps to the lower headers, allowing one clamp per panel..

8 Ensure that all four corners of the bank are securely fastened to the roof.

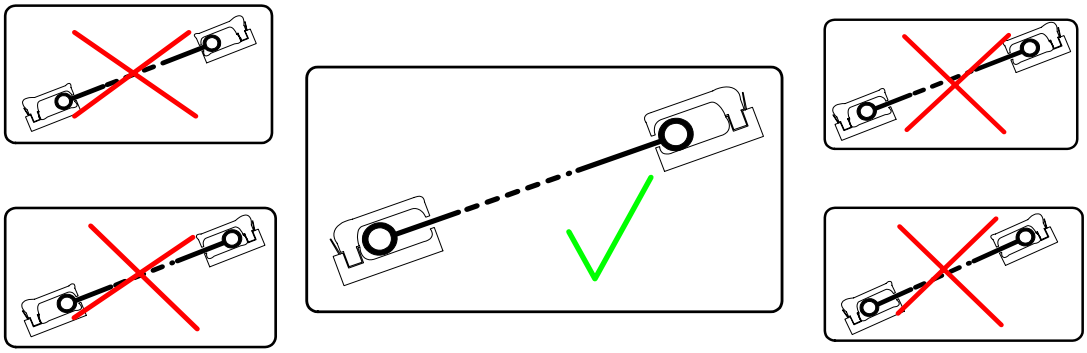


Fig 6.4: Correct installation of Heliocol mounting pad

Important: When fixing clamps to the lower headers, let the panel "hang down" in the upper mounting clamp, and then push the lower clamp up as far as it will go. Fastening the clamp in this position allows for thermal expansion and contraction.

Make sure that the Alligator mounting clamp is not installed over the welded joint between the modules.

Such an installation can "lock" the panels to the roof and a thermal distortion can occur

In a roof with pitch higher than 30º or in a high speed winds zones it is recommended to reinforce the alligator lock with two screws drilled to the back side of it.

(The alligator is produced with two special holes exactly for those occasions).

Tip: If you are installing the system on an inexpensive or soft asphalt shingle roof, it would be advisable to put some pads of aluminium roof flashing under the clamps holding the bottom headers, to prevent roof wear. The pads can be attached to the roof using silicone or other adhesive.

Fixing panels to a flat roof

If you are mounting your solar panels on a flat roof, it is recommended **not to penetrate** the surface with a lag bolt, to avoid rain/ water percolation through the roof.

Where there is a freezing danger in winter season- it is recommend to elevate the return manifold header using a piece of wood/ cement/ plastic in order to enable water draining from the system.

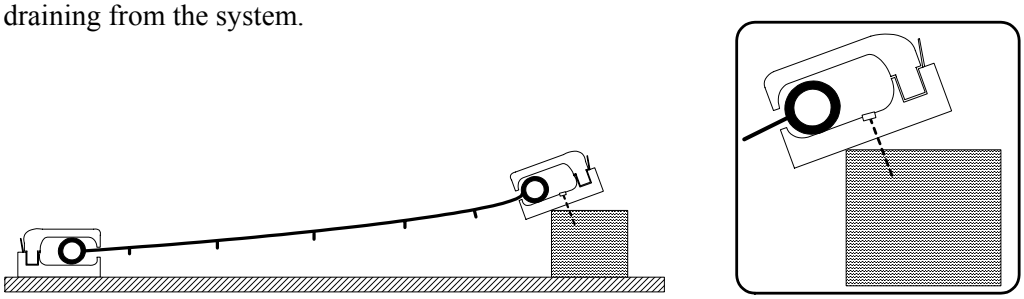


Fig 6.5: 4'x4' wooden rail section

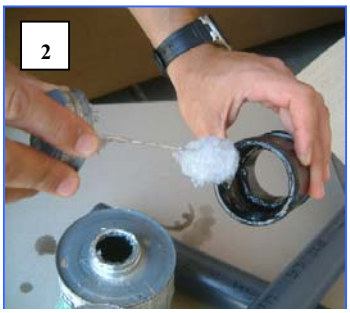
Public pool installation using 4'x4' wooden rails to lift the outlet manifold header.

In places where freezing problem do not exist the panel can just be laid flat on the roof – each bank of collectors should be fastened to the roof with four Alligator clamps, one in each corner.

Cementing PVC joints

Important: When gluing PVC fittings to PVC pipe, such as the Heliocol Pipe Connector, be sure to use a good quality PVC cement.

1 Before applying the cement, be sure to clean the contact areas with the PVC cleaner or “primer”.



2 Immediately after cleaning, apply cement first to the fitting and then to the pipe end. Immediately after cleaning, apply ample cement first to the fitting and then to the pipe end.

3 Insert the pipe end into the fitting with a slight twisting motion so as to spread the glue evenly, and seal the joint.

4 Hold it in position for 5–10 seconds to allow the cement to set slightly.

Wipe away any excess cement.

Tip: By taping the cans of PVC cleaner and PVC Cement together you can reduce the risk of them tipping over and spilling.

7

Connecting to the existing equipment

This chapter describes the standard (and most common) method of running the PVC pipe from the feed and return lines to existing ground level equipment. Some installations may require a more creative approach.

Whenever possible, the return line should have the shortest run and all pipes should run slightly "downhill" to allow for automatic drain-down of the plumbing and solar array. If this is not possible, manual drain valves must be installed as needed.

Note: If the existing pool machine room is near the house, you may prefer to complete the necessary plumbing there before connecting between roof and ground level. That way you will know exactly where the pipes should come down from the roof. However, if you will be trenching from the existing equipment to the Heliocol installation location this is not necessary.

Feed and return lines

Feed and return lines are connected using a PPC connector and a CPVC adaptor. The remaining two open corners of the bank are sealed using PPC connectors and end caps.

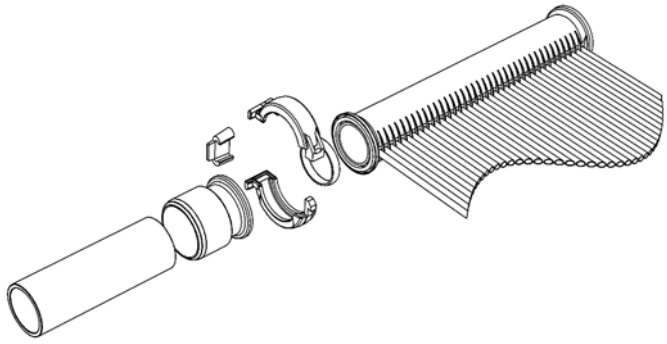
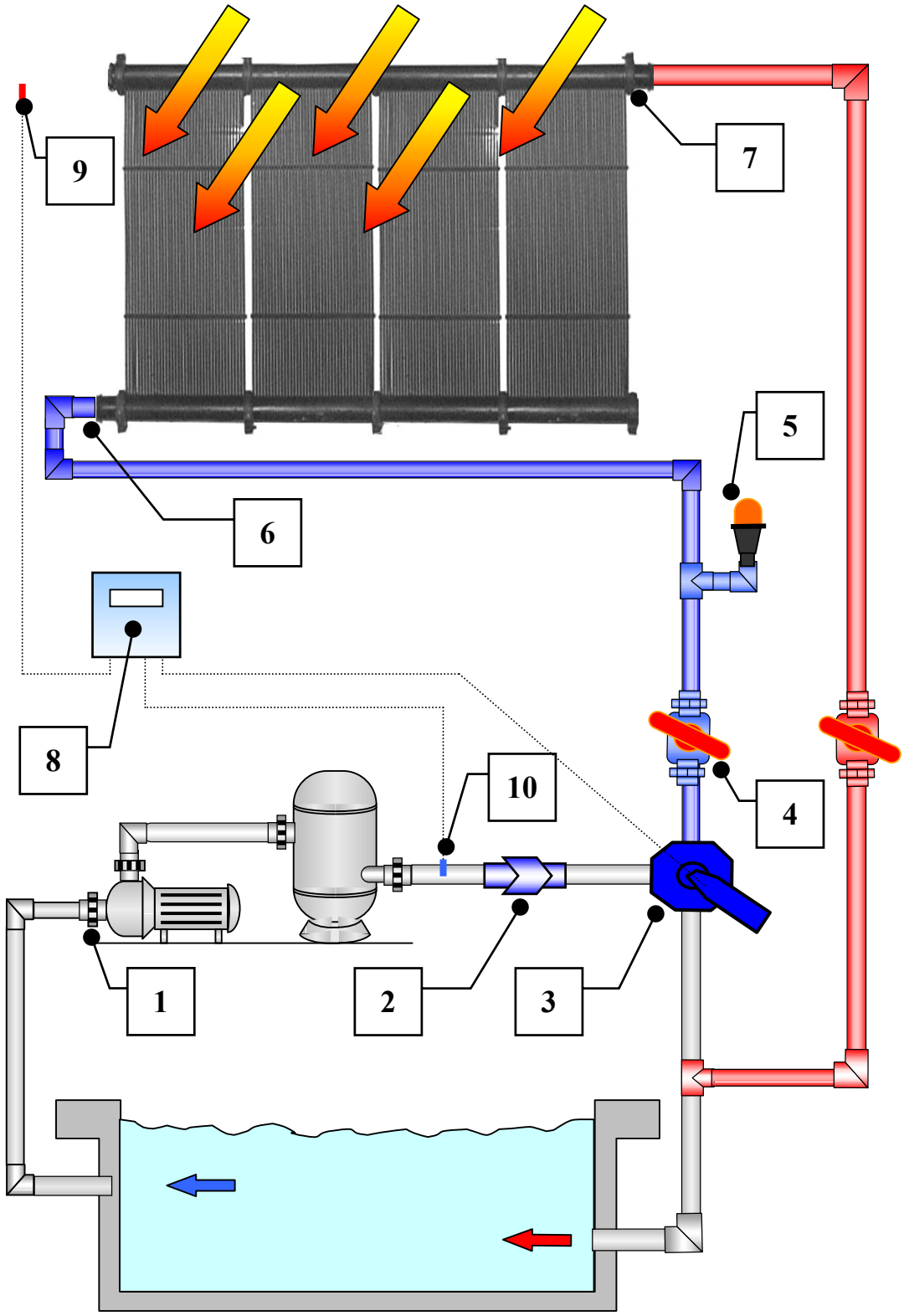


Fig 7.1: Connecting plumbing line to the collector

To connect the feed and return lines:

1. Connect the feed line to the low end of the bottom header, which should be the corner farthest from the pool pump, using a PPC connector and a CPVC adaptor.
2. Connect the return line to the top header on the opposite end of the bank. This gives the heated pool water the shortest route back to the pool.
3. Block the remaining two corners of the bank using **end caps** attached with PPC connectors.
4. Connect the feed and return pipes using reliable plumbing techniques.

Connecting with the existing filtration system



Plumbing guidelines

The figure above shows how a typical Heliocol Solar Pool Heating System is plumbed into existing pool plumbing. Even if your system is not identical to the one shown, the illustration can help you understand the flow of water from the pool, through the pump, filter, solar system and back to the pool.

Notice that the union check valve is plumbed in *after* the filter. This prevents the filter from being backwashed by the water draining down from the panels when the pump shuts off.

Notice also that the 3-way valve either diverts the water to the solar system or directly back to the pool. This 3-way valve should be a non-positive valve. This enables the water in the solar system to drain back to the pool when the pump shuts off. The ball valves on the solar feed and return lines allow you to completely isolate the Heliocol system.

1. Using the existing circulation pump the water flows through the filter and then directed to the collectors.
2. Check valve for preventing backwash of the filter when the collectors drain down.
3. 3 way valve that automatically directs the water to the collectors when there is efficient sun radiation.
4. 2 ball valves for disconnecting the solar panels from the filtration plumbing in different seasons or in cases of leakages. Guide the costumer never to shut off both of them without draining the collectors before!
5. Vacuum release valve for automatic draining of the panels after the solar system shuts off.
6. Inlet to the solar panels at the lowest side of the bank, using the “reverse return” method.
7. Outlet from the solar panels back to the pool.
8. Differential solar controller that commands the motorized 3 way valve, using two temperature sensors.
9. Radiation sensor, exposed to the sun at same hours the panels does.
10. Pool sensor, installed into the main filtering pipe for measuring correct pool temperature.

To connect with the filtration system:

1. Study the plumbing after the filter and decide where you are going to install the union check valve and the PVC "T" fitting. If you have auxiliary equipment, you may need to re-plumb a portion of your existing plumbing so this equipment is located after the Heliocol system.
2. Cut the pipe after the filter where you have decided to locate the union check valve and where your solar return pipe will attach to your existing pool return line.
3. As mentioned earlier, it is a good idea to assemble all pipe and fittings before cementing them just in case you make an error. Install a union check valve on the pipe coming out of the filter. Be sure that the arrow showing flow direction is pointed *away* from the filter.
4. The 3-way valve is installed next. Before installing this valve it is recommended to drill a 2mm hole inside the valve partition in order to enable water expansion due to stagnation pressure. It may come right next to the check valve, or you may have to use some pipe and fittings to locate it off of the main line. (As stated earlier, use as few 90° elbows as possible.)
5. Install the ball valve to the solar feed coming out of the 3-way valve.
6. Install the vacuum breaker about 2m up the feed line using a PVC T or saddle weld on and threaded ¾" elbow. Face the tee to the outside as shown. Wrap the threads of the vacuum Breaker with Teflon tape and screw it into the threaded reducer bushing.
7. Install the second ball valve to the solar return line.
8. Now determine where to locate the PVC T fitting. The T may be located right next to the 3-way valve or elsewhere depending on your system. Connect theT fitting first to the solar return line, then to the 3-way valve, and then to the pool return line.
9. Once you are satisfied with the plumbing arrangement, go back and cement together all unsealed joints.

Note: Use C-Clamps the same size as the outside diameter of your plumbing fittings to secure the pipe and fittings tightly to the wall.

Note: When cementing check valves, try to do so in a horizontal position to prevent cement from dripping into the spring loaded valve and cementing it closed! When this is not possible, use cement sparingly and allow it to dry slightly before inserting the pipe into the socket. When cementing two and three-way valves, either remove the diverter from the valve or cement with the diverter turned away from any open port to prevent the cement from running onto the diverter and cementing it in place! In cooler climates glue dries much slower.

Tip: For a professional finish, take time to clean light coloured PVC pipe. Use a clean rag, pour PVC cleaner on it and then wipe the dirt and identification marks off the pipe. Do this on all exposed pipe. This is also a good preparation if you plan on painting the pipe to match house colour.

Running feed and return lines to ground level

To run feed and return lines to ground level:

1. Cement the appropriate sized PVC 90° elbow to the return line stub, facing down towards the bottom header.
2. Repeat the process for the feed line header stub, again with the elbow facing down, away from the bank.

Tip: When working with cement, lay a rag on the roof or rack, under the joint, to avoid dripping cement on the mounting surface.

3. Determine the position on the edge of the roof that the feed and return pipes will pass over. If possible this should be perpendicular to the exact points where they will fasten into the existing system (or into pipes coming from another location). (See Fig. 11.2).
4. Measure the distance from the return elbow down to the spot that you want to go, across the roof, to the point established above. *Be sure to include the overlap of the socket into the elbow in your measurement.* Cut a piece of PVC pipe to this length. Repeat this process for the feed line.

Tip:: If you are not experienced at cutting and fitting pipes, it is a good idea to assemble all pipes and fittings before cementing them, just in case you make an error.

5. Measure across the roof from these pipes to the points established in step 3. Cut the pipes to these lengths, de-burr the ends, and assemble the corners with 90° elbows.
6. Continue this process around the edge of the roof and down to the existing plumbing, keeping pipes as short, straight and close to the building as possible.
7. Once you are satisfied with the plumbing structure, go back and cement all joints together.
8. Secure long pipe runs with clamps, one size larger than the pipe diameter, using stainless steel lag bolts and silicone caulk.
9. Secure vertical pipe runs on the side of buildings with clamps *the same size* as the pipe diameter, using screws and anchors as needed.

Important: All four corners of each bank of panels must be securely fastened to the roof, while enabling thermal expansion & distraction of the panels.

Important: All plumbing must be supported with clamps or pipe straps. The mounting pad clips are not designed to support the weight of the plumbing in addition to the weight of the collectors.

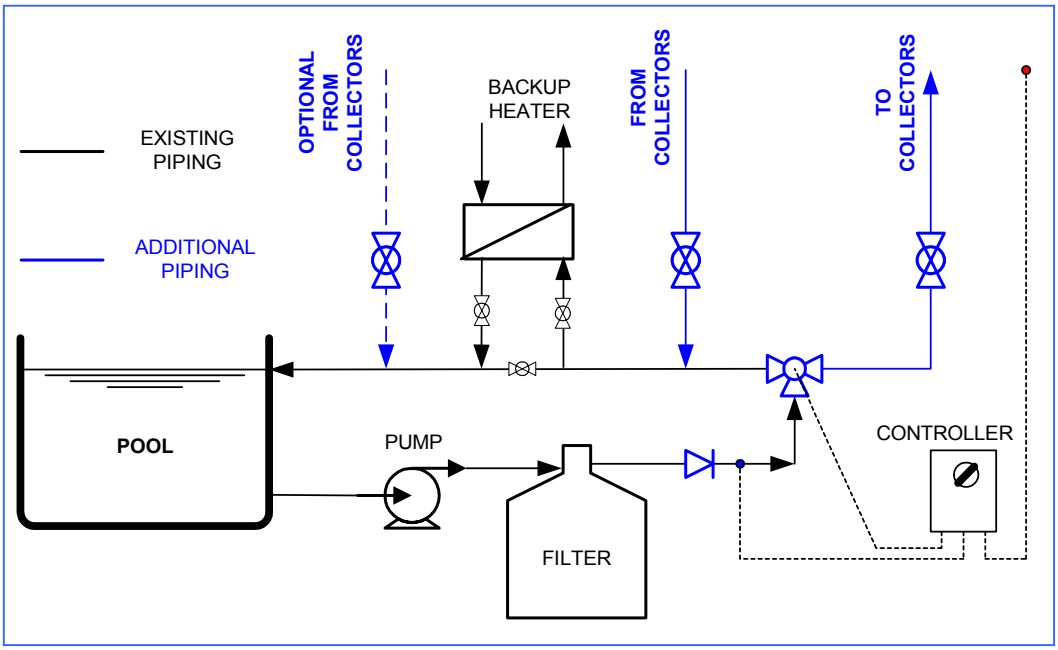
Automatic systems (Private & public pools)

The basic difference between the manual system just outlined and an automatic system is the use of a motorized 3-way valve, which is controlled by two sensors. In cloudy weather the connection with the pool is automatically shut off so as to maintain the warmest temperature possible. The two sensors will read: (1) temp of cool water coming from the pool and (2) the heat of available solar radiation.

Follow the directions included with the automatic system components for installing the differential control and sensors. The 3-way valve is installed as described in the previous section.

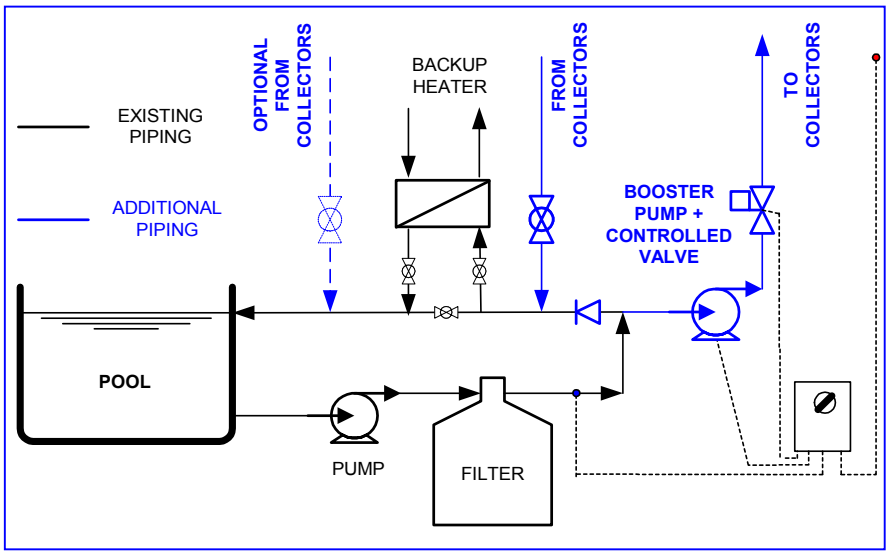
Important: Make sure that the radiation sensor which is located on the roof is exposed to the sun in the same way the collectors do. In a windy region a transparent plastic cover can be installed over the sensor.

Private pool basic plumbing



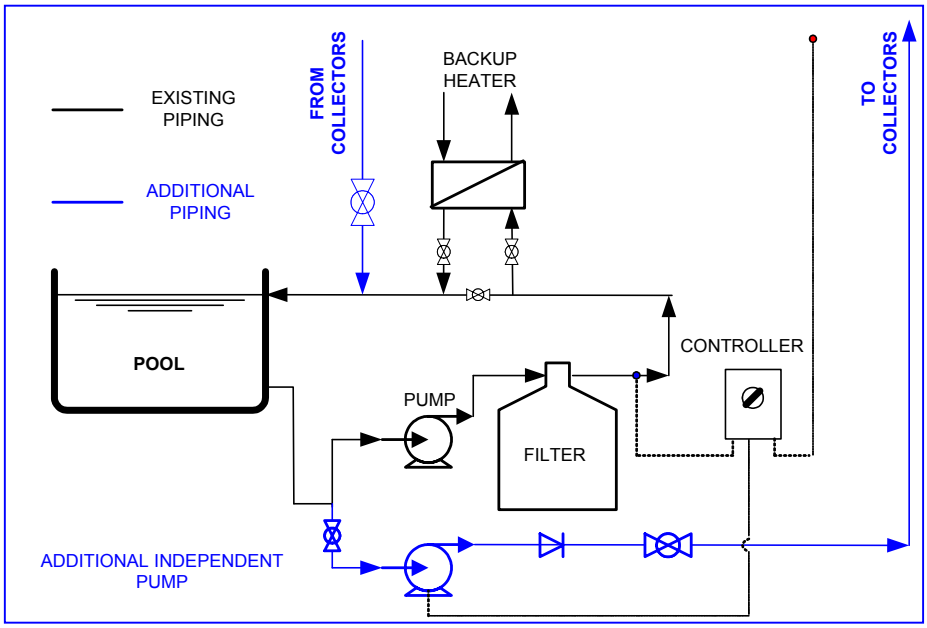
When the existing filtration pump is sufficient to deliver the desired discharge to the collectors and there is no need for additional booster pump, the system plumbing and control is based on the existing pump and a motorized 3 way valve that directs the pool water to the collector when there is sufficient sun radiation.

Public pool basic plumbing



The additional booster pump should be installed after the filter, using a “T” joint on the main filtration pipe. The automatic control commands both the booster pump and the 2 way valve after it. (The 2 way valve is installed in order to prevent undesired low water flow through the collectors caused by the main filtration pump).

Public pool basic plumbing 2



When there is a need for total separation between the solar piping and the filtration piping it is advisable to pump the water to the collectors by an independent pump that takes the water directly from the pool and returns the heated water directly to the pool.

8 Operation

If you have carefully followed the steps in this manual, you now have an efficient, professional looking Heliocol Solar Pool Heating System. This chapter deals with final checking before you let water into the system, high pressure testing of the system, and turning the system on and off.

Before letting water into the system

1. Allow the cemented fittings adequate time to dry as per the manufacturer's directions.
2. Verify that the check valves, control valves and vacuum breaker are installed properly.
3. Verify that all PPC connectors are tightly fastened.
4. Verify that all lag bolts are secured and that adequate silicone has been used to prevent any roof leaks where they are attached.
5. Be sure all panel riser tubes are snapped into the spacer bars.
6. Be sure that panel riser tubes do not sag onto the roof surface between spacer bars. If they do, adjust the spacer bars as needed to prevent this, otherwise a hole may develop in the riser tube.
7. Make sure that the system drains down automatically when the pump is shut off, or that manual drain valves have been included.
8. Verify that all pipe runs are properly supported.
9. Pressure test the system as described in the next section.

High pressure testing

High pressure testing the Heliocol system is recommended and takes only about fifteen minutes.

10. Allow ample time for all glue joints to dry completely.
11. Unscrew the vacuum breaker and replace it with the pressure testing assembly.
12. Connect one end of a hose to the water supply and the other end to the pressure testing assembly.
13. Turn on the water supply and wait for the pressure to reach 4–5 atmospheres.
14. Check all joints for leaks.
15. If there are leaks:
    a. Open the ball valve on the return line to relieve the pressure.
    b. Repair leaks.
    c. Repeat the pressure testing procedures as needed.
16. When pressure testing is complete replace the vacuum breaker.

Tip: Use this time to wrap up things and to clean up the job site.

Turning the system on (manual systems)

1. Turn the pool pump off.
2. Turn the 3-way valve so the “closed” indicator points toward the pool side of the valve.
3. Be sure that the ball valves on the feed and return lines are open.
4. Turn the pool pump on.
5. Set the pool pump timer, if used, so that the pump will run when sun is shining on the solar panels. Usually 10:00 AM to 4:00 PM, but this will vary with geographic location and time of year.
6. Wait 2-3 minutes and check in the pool inlets that slightly warmer water is entering the pool through the water inlet.

Important: During the cooler months of the year it is essential that the pool surface be covered at night with a “pool blanket” to minimize heat loss. Low night time temperatures may lower the water temperature more than the solar system can recover during the day.

Turning the system on (automatic systems)

1. Turn the pool pump off.
2. Switch the automatic control system on.

   If the valve was previously off, the 3-way valve will rotate to direct water into the system.
3. Verify that the ball valves on the feed and return lines are open.
4. Turn the pool pump on.
5. Set the pool pump timer, if used, so that the pump will run when sun is shining on the solar panels. (Usually 10:00 AM to 4:00 PM, but this will vary with geographic location and time of year.)
6. Wait 2-3 minutes and check that slightly warmer water is entering the pool through the water inlet, just like in the manual system.
7. After you have checked that the system is working sufficiently, turn the control switch to automatic position and set the required temperature on the control panel.

Turning the system off (manual systems)

1. Turn the pool pump off.
2. Turn the 3-way valve so the “closed” indicator points toward the “solar” side of the valve.
3. If isolating the panels, close the ball valves on the feed and return lines **after checking that all the water has drained out of the panels** and plumbing.
4. Turn the pool pump on to filter the pool as needed.

Turning the system off (automatic systems)

- Switch the automatic switch off.

9 Troubleshooting

This troubleshooting section will help you identify and solve any problems as quickly as possible.

There are air bubbles in the pool when the solar heater is operating

Diagnosis #1: 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.

Pump Answers:

1. Check that the pump trap lid is secured tightly.
2. Check the “O” ring on the pump trap lid. Clean, lubricate or replace as needed.
3. If you have a suction type pool cleaner, remove it. If this eliminates the air bubbles, use it only when the solar system is off.
4. If the pump has a clear lid and you can see air bubbles in the trap, use a garden hose to run water over the lid, and each joint individually, to see if the air bubbles will clear up. If the lid is opaque, listen to pump noise to check that it is operating smoothly. Repair any air leaks.

Diagnosis #2: If the vacuum breaker is installed on the roof, there may not be enough water pressure in the system to keep the vacuum relief valve closed, so air could be drawn into the water as it flows through the valve.

Install Answers:

1. Check that the filter is clean. Backwash to reduce pressure.
2. Locate the vacuum breaker on the feed line and put a solid end cap at the end of the upper header where the vacuum relief was located.
3. Using the ball valve on the return line, throttle back the flow to produce more back pressure on the system.

Some of the solar panels are warm to the touch while others are cool

Diagnosis: There is not equal flow through all of the panels. Warm panels indicate low water flow.

Pump Answers:

1. Check that the filter is clean. Backwash to reduce pressure.
2. The pump may not be providing enough water to the solar system. Check water flow using a flow meter. Increase pump horsepower to maintain recommended flow.
3. If there is a suction type cleaner in the pool, disconnect it. If this eliminates the problem, use it only when the solar system is off.

Install Answers:

1. If the system is a single row array and there is adequate flow, use the {HC-5210} Ball Valve on the return line to throttle the flow back to increase 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 9 of this manual, change the array to a double row or single row split feed as shown in Fig 4.2 and 4.3.
2. 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 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 this manual, make changes as needed to correct this.

Water coming from the system is not as warm as it should be

Diagnosis #1: The water is flowing too fast through the panels

Install Answer:

- Test water flow rate. Water flow through a single panel should be less than 2500 liters per hour. Adjust the Three-Way Valve to by-pass some of the water.

Diagnosis #2: Seasonal normal operation

Answer:

- In the cooler months of the year, or on cool or partly cloudy days, the temperature rise through the panels may only be 2° or 3° C. Use the back of your hand to feel the water temperature difference at the pool return inlet.

A Site evaluation sheet

Client contact info

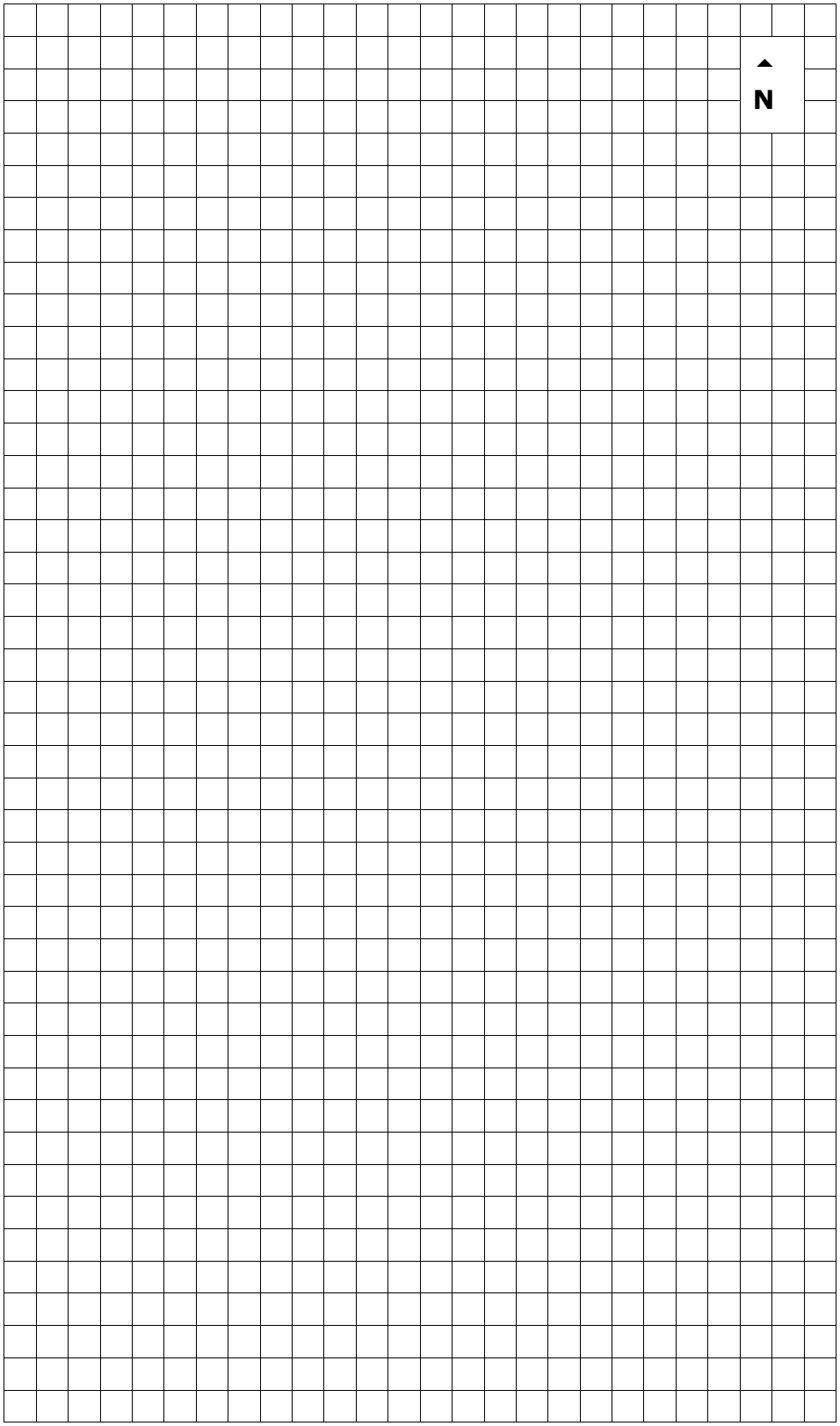
Client Name:	
Tel:	Mobile:
Fax:	Date:
Address:	

Site info

Pool length (m)	Width:	Surface area:
Is pool covered at night? **Y / N**		
Is pool directly exposed to sunlight? **Y / N**		
When is pool used? **All year round / Summer only**		
Evaluated ideal collector area? (m^2):		
Diameter of supply and return pipes to be used (mm):		
Distance from collectors to pump (m):		
Roof hight? (m)		
Current pump:		
Does pump need to be replaced? **Y / N**		
Specifications for new pump (if required):		
Supply:	Pressure:	Capacity:
Roof area available *and suitable* for collector installation (m^2):		
Roof orientation: Roof tilt (degrees):		
Roof type: **Tiles / Cement / Wood / Other** (please specify):		
Special considerations:		

Basic system layout

Using the grid below to sketch the layout of your system will help you plan the best system, and work out exactly what Heliocol parts and extra PVC piping you need.



B

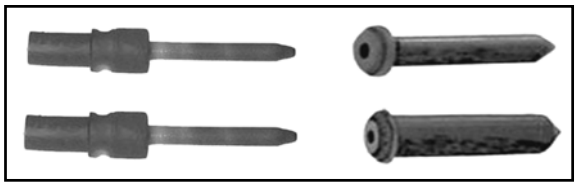
Replacing a damaged riser tube

In the event of a riser getting damaged and leaking, one of the advantages of Heliocol collectors is the ease with which the leaking riser can be removed, the leak repaired, and a replacement riser attached to maintain the uniform appearance of the panel.

A damaged riser is replaced using a Heliocol riser repair kit (consisting of two rubber sleeves and two plastic plugs), and the broken riser itself.

Note: Water does not run through the replacement riser. The purpose of the replacement is only to maintain the uniform appearance of the panel.

Figure B1: Heliocol riser repair plug (left) and sleeve (right)



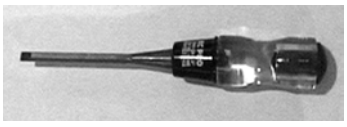
Cat. No.1202910 for panel **with** header **ribs**

Cat. No.1203910 for panel **without** header **ribs**

Figure B2: Heliocol riser repair tools:

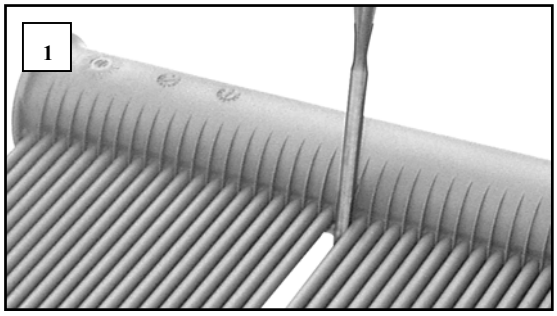
Specific Heliocol repair handle

Cat. No. 1202880



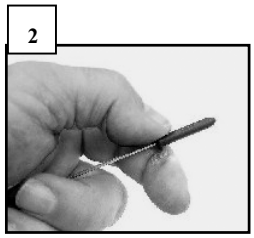
7 mm Chisel

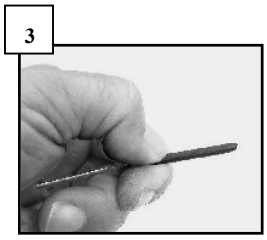
Important: Do not use a chisel more than 7mm wide, as you might damage the adjacent risers as you remove the broken riser.



1 Using a 7 mm chisel, and holding the flat side of the chisel towards the header, cut through the damaged riser, flush against the header.a round hole is created in the manifold header.

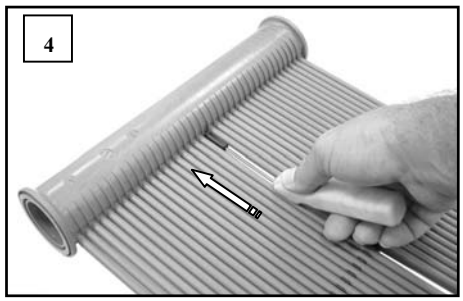
Repeat at other end of riser and save the removed riser for use in the repair.



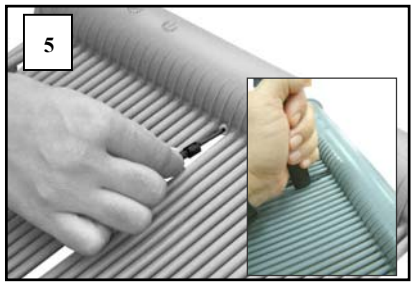


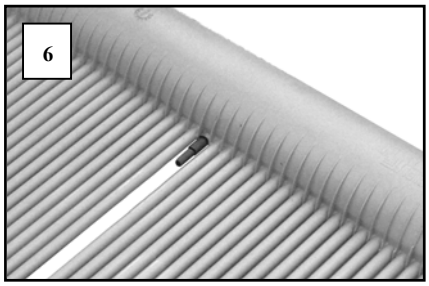
2 Spray the rubber sleeve with silicon spray and pull it over the small metal pin of the Heliocol repair handle.

3 Stretch and relax the rubber sleeve couple of times over the metal pin.



4 Using the repair handle gently push the rubber sleeve into one of the holes created by the removal of the riser, until only the head is showing.

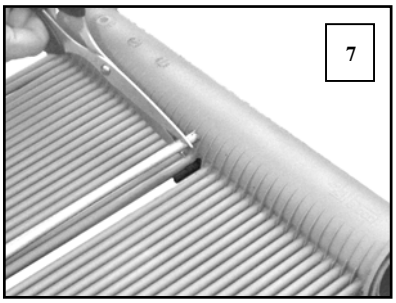


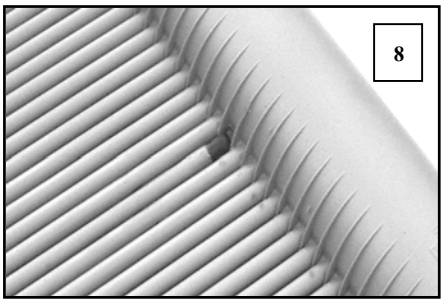


5 Push a plastic repair plug all the way down into the repair sleeve. You may use the rare part of the handle to do push it firmly into the sleeve.

6 The hole is plugged and will not leak.

Repeat steps 4 and 5 for the hole in the header at the other end of the panel.





7 Cut the removed riser so it fits exactly between the broad heads of the plastic pins.

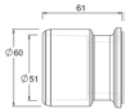
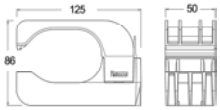
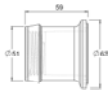
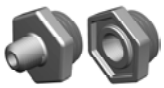
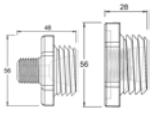
8 Fit the riser onto the stubs of the two repair plugs.

The panel is now leak free while its uniform appearance is restored.

C Parts list

The following sections illustrate the Heliocol and other parts needed for a typical installation, to help you compile your own order.

Heliocol parts

Description	Cat. no	Picture	Dimensional Data	box
PPC Set Plastic Panel Connector	120210 T/B PPC T&B 1202110 locking clip 4202100 rubber seal			350 Each Part 1 set in 3 boxes
C.P.V.C Adaptor	420910 (2 inch) 420910E (50 mm)			80
End Cap	120260			280
Helio Roof Mounting Pad (Alligator)	120310			40
Flange	1202050			80
Vacuum End Cap	1202500 (M) 1202520 1202510(F)			125
A.R.I Vacuum breaker	4201312 4201315			24

Other parts

In order to install a complete solar heating system it is necessary to use some standard accessories like pumps, valves and control unit.

PLASTIC MAGEN enable its clients to order a whole set of accessories in order to install the perfect heating system.

PARTS THAT CAN BE ORDERED DIRECTLY FROM PLASTIC MAGEN:

1. Vacum relief valve
2. Control unit combined from 2 temperature sensors and a motorized 3 way valve.
3. Ball valve
4. Check valve

Standards & Certifications

Plastic Magen Ind.

Since its establishment in 1973, **Plastic Magen Group** has evolved from a small engineering plastics factory on Kibbutz Magen. Israel, to the world's leading manufacturer of solar collectors and other sophisticated plastic heat-transfer systems.

The core technology of **Plastic Magen** products is a unique, *injection overmolding* technology. The technology is used to create seamless joins between a multitude of small tubes and a manifold header, ensuring lifelong, leak-free functioning, even under the most extreme weather conditions.

The all-plastic, overmolded structure of **Plastic Magen** products makes them ideal for five main groups of product:

Solar Collectors- used mainly as swimming pool heaters and pre-heaters for industrial or community central hot water supply systems.

Industrial Polymer Heat Exchangers- for heating/cooling of corrosive media.

Climatisaton Mats- for Hydronic Radiant Cooling systems integrated into ceilings.

Root zone Heating Panels (AGRIMAT^{TM})-for bench heating in nursery greenhouses.

Salt Chlorinators- for natural & safe disinfection of private swimming pools.

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