Suncell SOLAR HEATING

DESIGN AND INSTALLATION

ROOF

GROUND

saving
energy
& *protecting the*
environment

SPECIFICATION

SYSTEM LAYOUT

TEMPERATURE PERFORMANCE

PANELS - HOW MANY/SITING

INSTALLATION
- **GROUND LEVEL**
- **ROOFS**
- **UNFRAMED PANELS**

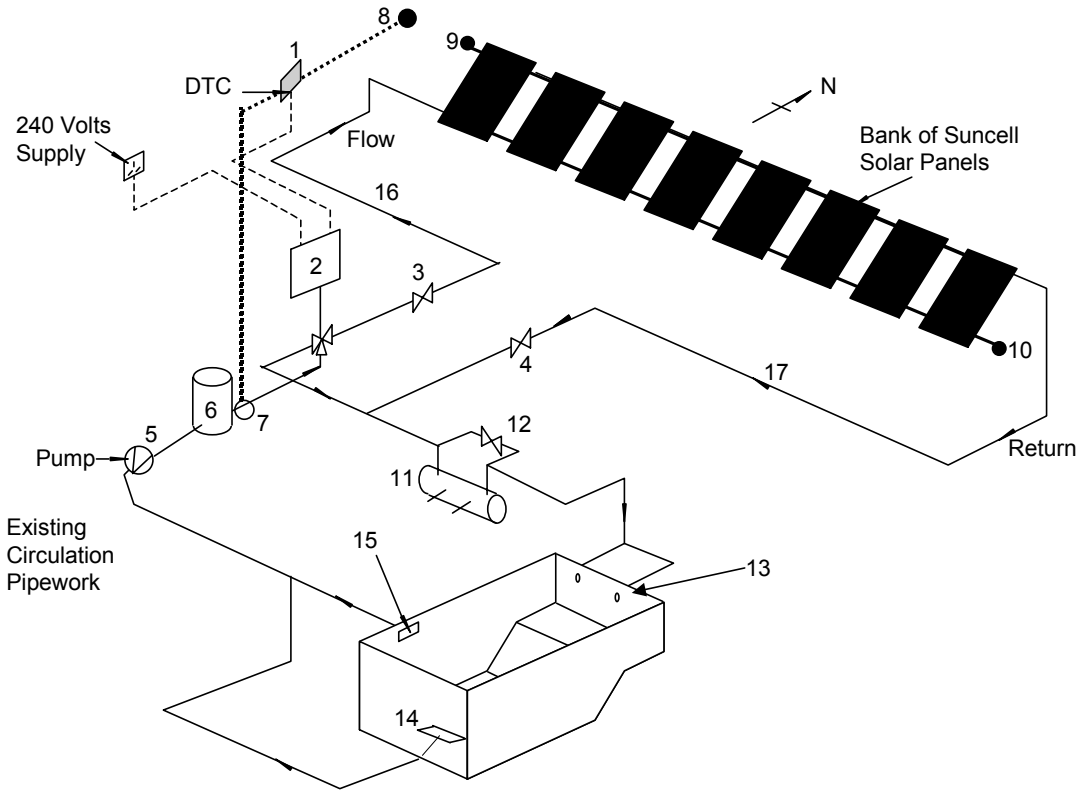
CONTROL SYSTEMS
- **3 WAY VALVE**
- **TEMPERATURE CONTROLLER**

OPERATION AND MAINTENANCE

BSI REGISTERED UKAS QUALITY MANAGEMENT 003

SYSTEM LAYOUT

TYPICAL DIAGRAMMATIC LAYOUT OF A MANUAL DRAIN-DOWN SYSTEM



1 Differential temperature controller (DTC)
2 3-Way Motorised valve
3 Double Union Ball Valve
4 Double Union Ball Valve
5 Pump
6 Filter
7 Water Sensor
8 Air Sensor
9 End Cap
10 End Cap
11 Auxiliary Heating (if provided) with by-pass
12 Double Union Ball Valve
13 Inlets
14 Sump Outlet
15 Skimmer
16 Flow to Panels
17 Return from Panels

Technical Specification

Applications

Suncell solar panels are intended for “low temperature” solar heating applications. The panels are especially suitable for heating swimming pools. This technical leaflet refers mainly to pool heating but the panels may also be used in other solar applications where it is appropriate to pre-heat cold water to temperatures up to 15 °C above the ambient temperature.

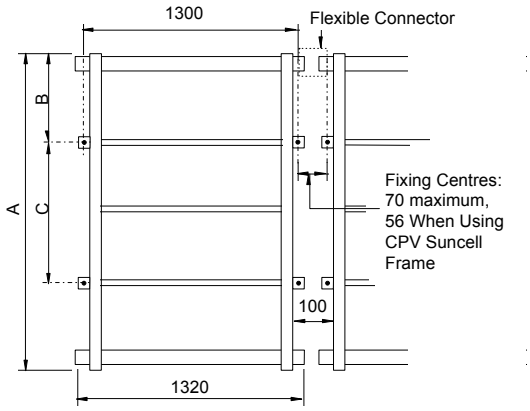
Specification

Suncell solar panels are flat plate solar collectors made from polypropylene. A cross section of the polypropylene collector plate is shown opposite. The diagram below shows the collector plate mounted in the standard aluminium frame.

The panels are made from a specially formulated grade of heat stabilised polypropylene. An extruded wafer section with a special profile has header pipes (manifolds) welded onto each end using a patented manufacturing process. A fluid can then be circulated through the wafer section via the header pipes. Heat from the sun’s rays, absorbed by the matt black surface of the panel, can thus be transferred to the circulating fluid.

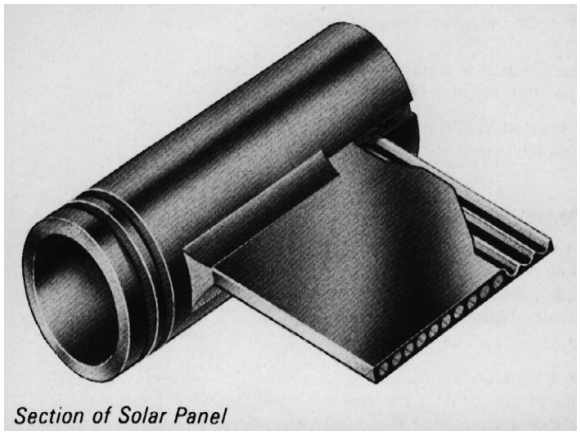
This grade of polypropylene is fully treated against ultra-violet (UV) degradation and is corrosion resistant. Swimming pool water, whether treated with chlorine or other pool chemicals, may be passed directly through the panels. This avoids the use of a heat exchanger. Sea water may also be used and there is no risk of scale deposits forming even in hard water areas, due to the low operating temperature of the panels.

The panels have been tested extensively in both laboratory and field trials. Each panel is pressure tested to 4 Bar (60 psi) and the maximum working pressure is 1.3 Bar (20 psi). The panels should be drained in winter, either manually or automatically, to provide protection against freezing.



Sizes and Weights

Suncell panels are manufactured in two standard sizes. The width of the panels is 1.2m and two lengths are available, 2m and 3m. Suncell CPF panels are supplied mounted in an aluminium frame and are referred to as models 020 and 030.



Section of Solar Panel

Suncell CPU panels comprise polypropylene collector plates only, supplied without any aluminium frame. Two sizes are available, models 020 and 030.

Suncell solar panels are very light and although it is of great importance to secure them against wind lift, the additional dead load on a roof is minimal. The weights, nominal dimensions and collector areas are tabulated below

Model	Weight empty	Weight full	Nominal Dimensions	Collector area
020 CPF	11 kg (24 lb)	22 kg (48 lb)	1.2 m wide x 2 m long (4' wide x 6'6" long)	2.4 m^2 (26 ft^2)
020 CPU	7 kg (16 lb)	17 kg (38 lb)		
030 CPF	15 kg (33lb)	29 kg (64 lb)	1.2 m wide x 3 m long (4' wide x 10' long)	3.6 m^2 (40 ft^2)
030 CPU	9 kg (20 lb)	23 kg (51 lb)		

Dimensions

Dimensions are given in the table below. Note that the fixing centres between panels can vary slightly but it is important to maintain an expansion gap between the ends of adjacent header pipes. The panel illustrated in the diagram is the model 020. The model 030 has four sets of tie rods across the front of the panel in place of the three shown.

Dimensions in mm

Model	A	B	C
020	2095	540	1000
030	3095	640	1800

The header pipes are 1½″ nominal bore with an ID of 38 mm and an OD of 48 mm CPV standard flexible connectors slip over the outside of the header pipes to join adjacent panels. They also fit over 1½″ uPVC or ABS swimming pool pipework for the connections at each end of a bank of panels.

As a quick guide to the over all length of a bank of panels, allow 1.4 m (4’6″) per panel and an extra 0.3 m (1’) at each end for pipework connections.

Operating Conditions

Required Panel Area

For swimming pool heating the following panel areas are recommended. These are appropriate for outdoor pools and will maintain the pool temperature up to 6°C (10°F) above the unheated equilibrium temperature during the months May to September (N. Europe). Advice on the correct panel area for indoor pools may be obtained from our Technical Department. Note that a translucent pool blanket floating on the water will further enhance the pool temperature.

Pool situated in a normally sheltered location:
Panel area to equal 50 % of pool surface area.

Pool situated in a particularly exposed location:
Panel area equal to 80% of pool surface area.

Mounting the Panels

The panels should be mounted in a completely unshaded location facing South (N. Hemisphere). Orientations up to 20° E of South and 40° W of South are acceptable. The panels should be inclined at an angle to the horizontal of between 15°-45°. The minimum slope is 15° to ensure that the panels can be drained.

The panels should be fixed securely, at ground level, on a bank, on a suitable roof or on a purpose designed structure. For installations on level ground and flat roofs CPV offer a range of prefabricated support frames in kit form.

Flow through the Panels

The solar panels are usually connected into the existing pool filtration circuit so that filtered pool water is passed through them to absorb heat.

Swimming pool solar panels work on the basis of a flow rate with a low temperature rise. Therefore it is important to maintain an adequate flow rate through the panels. The minimum flow rate is 2 gpm per panel (9.0 L/m). The preferred flow rate is 2-4 gpm (9.0 – 18.0 L/m).

No more than 8 panels should be mounted in one bank. If more than one bank of panels is installed it is important to ensure that an equal flow of water passes through each bank. This is best achieved by using a 'reverse return' pipework arrangement or by installing regulating valves to each bank. The banks should be spaced apart so that overshadowing does not occur. (For a more detailed consideration of these and other technical points, consult CPV Design and Installation Manual).

Additional Components

The panels are joined together (and also to the flow and return pipework) using Flexible Connectors. Two Connectors are required per panel. Two End Caps are required to blank off the spare top and bottom connections of each bank of panels.

For smaller installations with up to 3 banks of panels, flow diversion through the solar panels is normally achieved by installing a Suncell 3-way motorised valve in the filtration circuit. The 1½″ size is suitable for 1 bank of panels (max 8 panels) and the 2″ size is suitable for 2 or 3 banks (max 24 panels). The motorised valve is activated by a CPV Suncell Differential Temperature Controller (DTC) to ensure that pool water passes through the panel whenever there is potential heat gain and bypasses the panels at other times to avoid the possibility of heat dissipation.

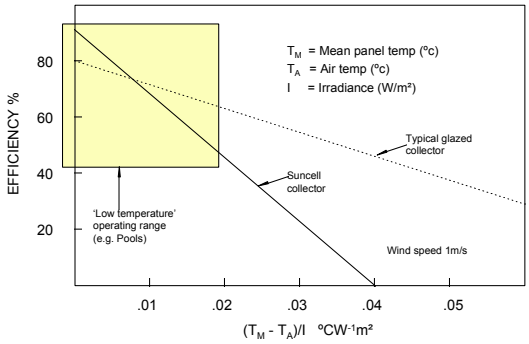
For larger installations, or in other cases where the filtration pump is either over or under-sized with respect to the solar panel flow rate requirement, a separate solar pump may be used in place of the motorised valve. This is positioned so as to draw filtered water from the filtration circuit and pass the water through the solar panels. The CPV Suncell DTC will provide the means of control but any pump drawing a current of more than 1.5A should be connected via a suitable starter/contactor.

Durability and Maintenance

Polypropylene is a tough plastic and the panels should have a life in excess of ten years. The panels require little maintenance but should be washed occasionally to keep the surface clean. The panels should be drained before the onset of freezing conditions at the end of the season (unless an automatic self-drain system is installed). Please refer to Owners Documentation supplied with the panels for full instructions.

5 Year Guarantee

CPV undertakes to replace any Suncell polypropylene solar collector which may become defective within five years of delivery to the consumer due to faulty materials or defective workmanship in manufacture. This guarantee is offered subject to the conditions on the guarantee Form supplied with the goods. In order to accept the Guarantee, the consumer must complete the Registration Card attached to the Guarantee Form and send it to the address shown thereon.



Performance Curve

The graph above shows the performance curve of the Suncell solar panel presented in the standard format. The Suncell solar panel is installed without front glazing and without rear insulation. For reference the performance curve of a typical non-selective single glazed solar panel is also shown. It can be seen that in the 'low temperature' operating range typical of swimming pools, the efficiency of the Suncell panel is generally equal to that of the considerably more expensive glazed panel.

The mean operating efficiency of the Suncell panel when used to heat an otherwise unheated open air pool during the months April to September may be taken as 50%. Seasonal outputs in excess of 300 kWh per m^2 of collector can be achieved in central UK. At higher pool temperatures there will be some reduction of heat output but even for pools maintained at 27^0 C (80^0F) for the summer season output should exceed 200 kWh/m^2 - or around 5kWh of free heat per model 030 panel per day.

BSI

CPV swimming pool solar heating systems comply fully with the requirements of BS 6785, 1986 (British Standard Code of Practice for Solar Heating Systems for Swimming Pools.) In line with our policy of continuous product development, we reserve the right to alter any specifications with prior notice.

GUIDE TO TEMPERATURE PERFORMANCE

Most prospective installers of solar heating equipment for swimming pools wish to have some idea of the performance to be expected and the information given here is intended for just that purpose.

It must always be realised, however, that solar heating engineers do not create the heat for the pool but only a method of collecting the heat available and transferring it to the pool water. Naturally the overall performance must depend primarily on the amount of radiation available and therefore is prone to large variations corresponding to weather conditions. The only way to present any meaningful data is to make some sensible basic assumptions and then to concentrate on average conditions that can be expected over a number of years.

Firstly it is reasonable to assume that an outdoor swimming pool is only really in use from the end of April to mid-October. Solar energy collected outside this period is of such a small magnitude that it is of no real use in heating the pool. Concentrating on this "swimming period" it is known that the average solar radiation will vary between approximately 3 kW hr/m^2 day and approximately 6 kW hr/m^2 day. It may be assumed that at the beginning of the swimming season there would be a bias towards the lower of these two values and that during the mid-Summer the bias will be toward the higher of the two figures.

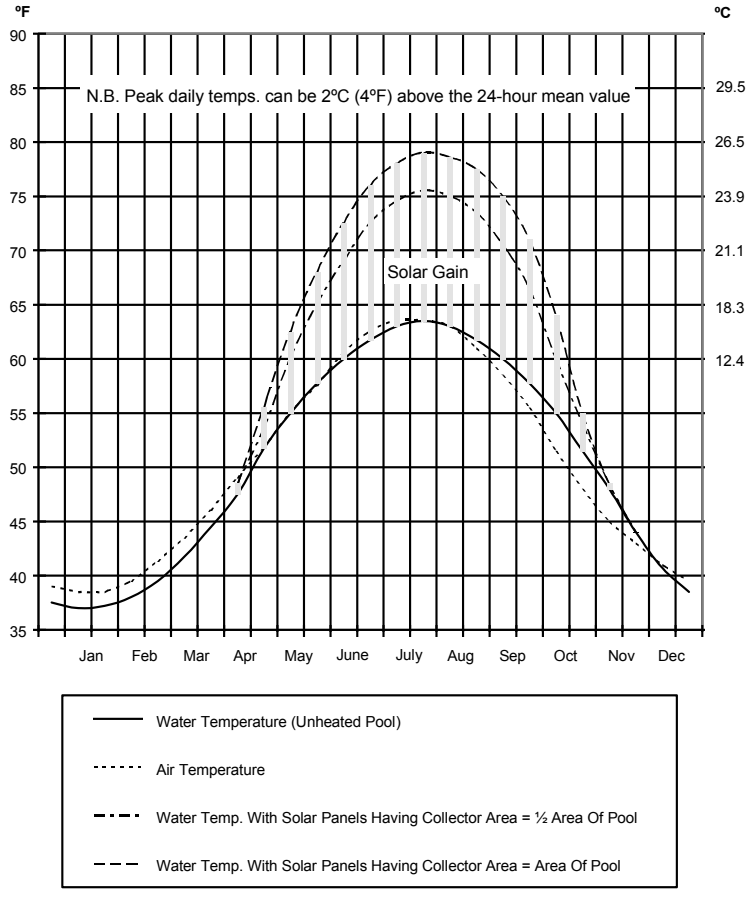
Now the mean 24 hour water temperature in an unheated outdoor pool follows very closely the mean day/night ambient air temperature throughout the year. The accompanying graph shows an average temperature curve for such unheated water. By assuming an area of solar collectors equal to half the surface area of the pool and allowing for accelerated heat loss as pool temperature rises above ambient a graphical extrapolation enables the projected water temperature for a typical pool to be plotted and this is shown on the accompanying figure. Also for comparison an additional curve is indicated to represent the expected performance is an area of panels equal to the full surface area of the pool were installed. It will be noticed that the increase in temperature is not proportional to the area of panels, mainly due to the higher rate of heat loss as the temperature of the water increases.

Thus the addition of solar heating to an unheated pool will considerably enhance the water temperature during the swimming season and it is clearly a question of economics as to how much collector area is installed. Generally speaking half the surface area of the pool should represent the best compromise for the area of collector surface, but obviously additional panels will have a beneficial effect. It will be observed that in the mid-Summer period with the recommended area of panels, the average 24 hour water temperature for a solar heated pool could be as much as 6°C (10°F) above an unheated pool, and furthermore the peak afternoon water temperatures can be as much as 2°C (4°F) above the average 24 hour temperature. However this performance is only as good as the weather prevailing and in no way is the accompanying graph supposed to represent a guarantee of water temperature for a given area of panels.

In order to combat heat losses from a pool a floating cover may be used and then there would be an overall gain in water temperature above the level indicated, or alternatively the same level of performance could be achieved with a smaller area of panels. Some 25% reduction in panel area could be accepted if a floating cover were to be used every night during the season.

Another factor influencing the efficiency of the heating system is the injection of the heated water into the pool and the subsequent mixing with the main body of the pool water. Introduction of the heated water at high velocity at a low level in the pool is to be preferred to a low velocity injection at high level. The reason for this is that a it is more efficient to produce the whole body of the pool at a more or less constant temperature rather than achieve stratification with a fairly thin layer of warm water at the top of the pool and a larger bulk of cooler water at the bottom.

Finally the provision of an efficient automatic control system is always to be recommended for use with solar collectors. This will ensure panels are never working in reverse and cooling the pool under adverse weather conditions or indeed at night. Only with such a system can the results indicated in the graph be sensibly achieved.



Above are mean 24 hour temperatures

SYSTEM DESIGN & INSTALLATION

HOW MANY PANELS?

There are two sizes of panel. Use the large size where space permits as it is more economical.

Area of each panel				Nominal size
Model 030	$3.6m^2$	$40ft^2$	3m x 1.2m	10ft x 4ft
Model 020	$2.4m^2$	$26ft^2$	2m x 1.2m	6ft 6in x 4ft

Heat loss from a pool occurs mainly from the surface and the amount of heat lost is dependent on the degree of exposure. Wherever possible night-time heat loss should be limited by the use of a floating pool cover.

The panel area is calculated as a percentage of the pool surface area for various types of pools

		Panel Area as % of Pool Area
A.	In sheltered location and with pool cover	40%
B.	In sheltered location without pool cover	50%
C.	In exposed location with pool cover	80%
D.	In exposed location without pool cover	100%

Example: Pool area 24ft x 12ft

1.	Pool surface area	24ft x 12ft	=	$288ft^2$
2.	Panel area required	50%	=	$144ft^2$
		80%	=	$230ft^2$
3.	Divide by area of panel (e.g. 030 = $40ft^2$)			
	To give number of panels	$144ft^2 \div 40ft^2$	=	3.7
		$230ft^2 \div 40ft^2$	=	5.75
4.	Round up or down according to space available, i.e.			
		3.7	=	4 panels
		5.75	=	6 panels

SITING THE PANELS

Solar panels need an unshaded south facing position. The position of trees, etc., should be considered when deciding on the best-unshaded site. They should be inclined in order to catch the most sun.

The direction the panels face (orientation) can vary from South - East to South - West without much affect on performance. Orientations slightly to the West of South are ideal. The slope of the panels (inclination) can also be varied without any noticeable affect on the performance within the range of 15 to 45 degrees to the horizontal.

Do not mount the panels flat, doing so will prevent them from being drained down fully in cold weather and lead to damage if it freezes.

The panels should not be installed vertically since this will greatly reduce their efficiency.

There needs to be a satisfactory route for the pipe runs between the panels and the filtration plant. Locations relatively close to the pool are ideal but long pipe runs do not present any particular problem.

Solar panels may be located at ground level (e.g. on support stands) or on a sloping roof. Sometimes a corner of the garden may be set aside for solar panels or else there may be a suitable outbuilding on to which the panels can be fixed.

NUMBER OF PANELS IN EACH BANK

A maximum of eight panels may be installed in one bank – and banks of six or seven panels are ideal. If more than eight panels are required they will need to be arranged in two or more banks with the same number of panels in each bank to ensure a balanced flow distribution.

When it is necessary to split the solar panels into more than one bank (e.g. larger installations) the method of pipework connection is important in order to ensure a balanced flow through each bank of panels.

The main flow and return pipes to the solar panels must be adequately sized according to the number of panels. To avoid the furthest banks of panels being starved of flow it is very important to respect the reverse-return method of connection of multi-bank systems. For further information please contact CPV Technical Services.

GROUND LEVEL INSTALLATION

There are two possibilities:

1. Mounting the panels on a bank
2. Mounting the panels on to a support frame constructed either of timber, aluminium or steel.

MOUNTING THE PANELS ON A BANK

Treated timber bearers or galvanised steel bearers are laid on the earth bank to provide a fixing for the panels and to maintain an air gap between the panels and the soil. If there is no air gap then moisture in the soil could conduct heat away from the back of the panel.

The bearers must run the overall length of the installation and must be firmly anchored into position using stakes, etc. Care must be taken if the bank is newly formed since subsidence could take place affecting the stability of the structure.

With framed panels installation work is relatively straight forward. The bearers are fixed to the bank so that they are the same distance apart as the top and bottom fixing brackets on the panel frame. The panels are then firmly fixed in position at the recommended fixing centres.

SUPPORT FRAMES

SUPPORT FRAMES

These can be constructed from treated timber or galvanised steel.

The requirements are:-

1. The framework must be strong enough to support the panels and any imposed loads (e.g. snow loads, or the weight of one person whilst carrying out maintenance inspection etc).

2. The framework must be firmly anchored into position either with concrete foundations at least 300mm (12") deep (more if the soil has been disturbed) or with large bulks of timber or concrete blocks.

3. If timber is used the size of the uprights should not be less than 100mm x 100mm (4" x 4") and the centres of these uprights should not exceed 2m (6'6")

Designing a support framework for the framed panels is relatively simple. Legs can support two rails (100mm x 50mm) which run the length of the installation. The centre to centre dimension of the two rails is the same as the centre to centre dimension between the top and bottom fixing brackets of the panel. The horizontal distance between the two rows of legs will depend upon the angle of inclination of the panels to the ground.

Alternatively, exterior grade plywood sheet may be laid on the support legs and the panel fixing bracket firmly attached to the plywood.

MOUNTING FRAMED PANELS ON TO A SLOPING ROOF

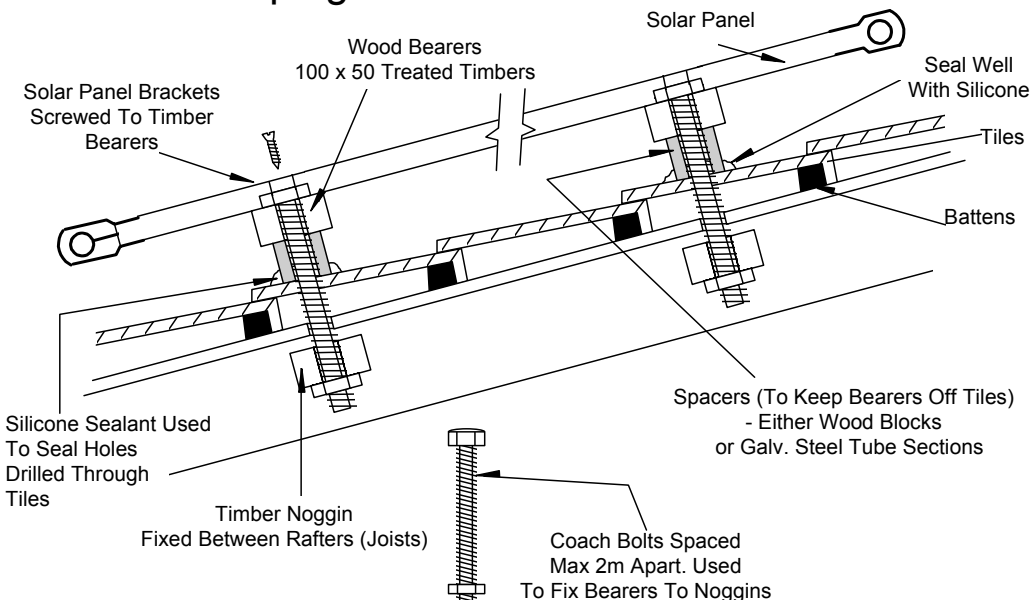
This is almost identical to mounting the panels on to a bank, i.e. instead of sloping earth we have sloping tiles or slates.

The treated timber bearers are placed on top of the tiles and must be securely fixed on to the roof timber and not just to the tile battens. In the case of a slate roof the bearers may need to be slightly proud of the slates so that the roof drainage is not affected.

The roof surface should be punctured in as few places as possible compatible with security against wind lift. A few really solid fixing points are preferable to a large number of poor fixings. It may be necessary to drill through the tiles or other cladding. Alternatively it may prove more satisfactory to remove sections of the cladding at the fixing points and replace with suitable flashings after securing the fixings. If holes are made, generous amounts of building mastic or suitable sealant should be placed in the holes before inserting and tightening the bolts and screws. Hanging straps passed up under the tiles may be used if adequate provision can be made to ensure that a suction wind force on the panels will not cause the tiles to lift. This may be achieved by running the straps down to the eaves if a suitable fixing can be found.

It may be possible to fix the panel bearers directly to the roof timbers beneath. If not it will be necessary to fix timber noggins (say 100mm x 50mm, 4″ x 2″) between the rafters and fix the panel bearers to the noggins. If in doubt always seek the advice of an architect or builder.

Typical method of fixing Framed Solar Panels to a Tiled Sloping Roof



Mounting the framed panels (Models 030 and 020) on the roof is relatively simple since the two bearers must be at the same distance apart as the top and bottom fixing brackets on the panels.

The procedure is as follows:

1. Mark out the positions for the bearers on the roof. The centre-to-centre dimension of the bearers will correspond to the centre-to-centre dimension between the top and bottom fixing brackets on the panels (1800mm for the model 030 and 1000mm for the model 020).

2. On the centre line of the bearers drill through the roof at intervals of 2 metres or less. The diameter of the hole need only be slightly larger than the diameter of the coach bolt or coach screws which are to be used. Too large a hole may result in leaks.

3. Inside the roof space, 100mm x 50mm (4″ x 2″) timber bearers or noggins are fixed to the roof joists and in such a way that they line up with the holes drilled through the roof covering.

4. The panel bearers on the outside of the roof are then fixed to the noggins using coach bolts or coach screws. A proprietary type of building mastic must be used around the holes so that no water can seep through into the roof space.

   NOTE On some roofs the panel bearers may have to be installed proud of the roof surface so that the roof drainage is not affected.

5. The panels are then fixed to the bearers in the normal way remembering that the distance between adjacent fixing brackets must not exceed 70mm.

For some types of roof (e.g. corrugated iron or asbestos) proprietary fixing bolts are available which incorporate a method of sealing the hole through the cladding without the use of mastic. Care should be taken when drilling through certain types of roof cladding which may be rather brittle. In some cases drilling may be impossible and it will be necessary to use metal straps passed under the tiles or alternatively a few tiles will have to be removed in order that a secure fixing can be obtained.

UNFRAMED PANELS

Unframed panels can be fixed to a suitable roof or earth bank providing that the following points are remembered:

1. The method of fixing must allow for the panel to expand and contract with changes in temperature. For example, if the top header pipe is held rigidly in position then the bottom header pipe must be allowed to move. Expansion across the width of the panel must also be allowed for and panels can contract longitudinally.

2. The panel must be supported clear of the roof surface or earth bank so that it is not damaged by abrasion. This is normally achieved by using timber strips or a backing sheet, (corrugated PVC sheet or similar can be used).

3. The roof on which the panels are to be mounted must be structurally sound and capable of supporting the extra loading. The table below gives the weights of Suncell panels, but generally this is insignificant compared with a normal snow load.

Suncell Panel	Weight empty	Weight full
Framed 3 metre panel	15kg	29kg
Framed 2 metre panel	11kg	22kg
Unframed 3 metre panel	9kg	23kg
Unframed 2 metre panel	7kg	17kg

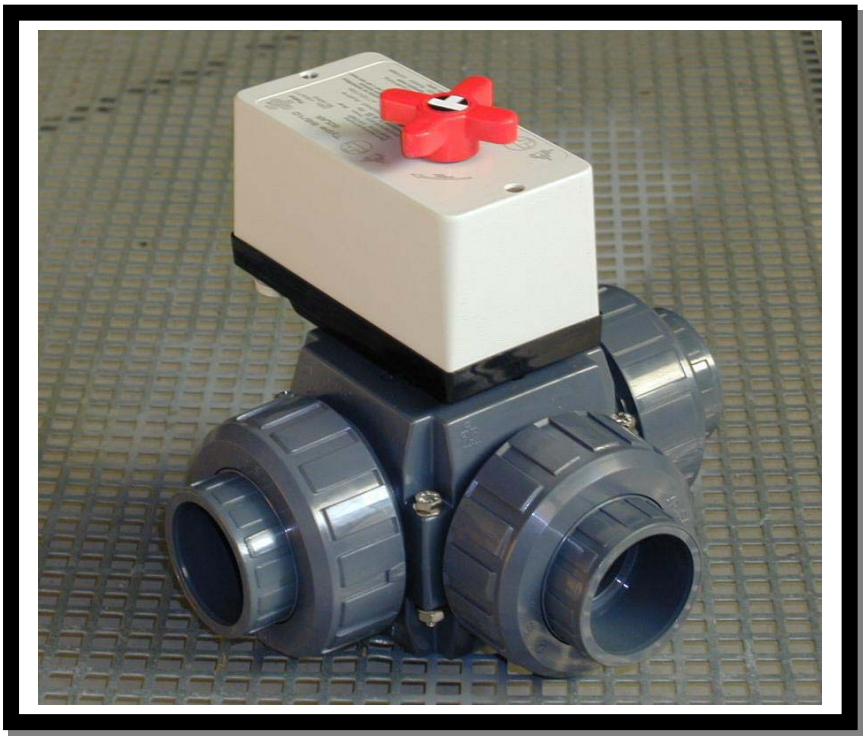
STRONG WIND WARNING

Collectors must be held down against wind lift and this can be achieved by using straps or ropes. However, consider:-

Using a factor of safety of 2 the likely suction pressure on the collectors will be approximately 50kg per m^2 this means that the 3m panel will require a weight of at least 180kg to hold it safely in position. Similarly the 2m panel will require at least 120kg.

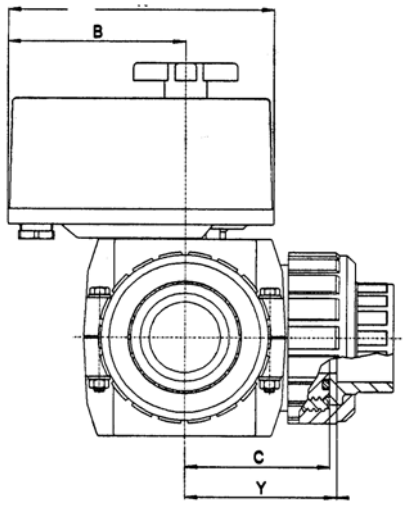
CAUTION
If in any doubt about ground or roof installation consult an Architect or Structural Engineer.

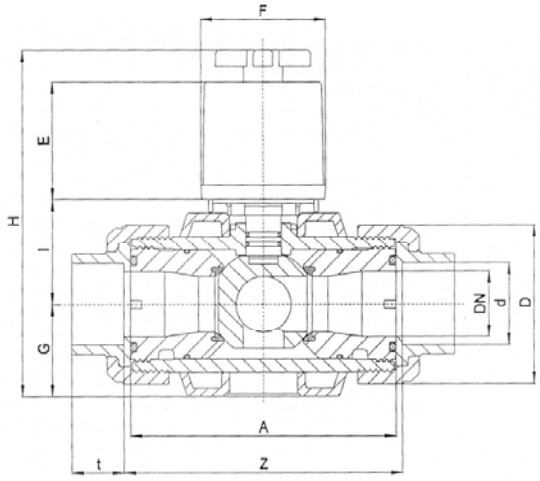
S5-10 3 WAY BALL VALVE WITH ELECTRIC ACTUATOR



Material	**PVC**
O Rings	EPDM
Ball Sealing Joints	TPE ‘Kraton’
Sizes	Standard valve supplied with 1½” or 2” plain sockets for solvent welding. Metric sockets 50mm and 63mm available to order
Actuator Voltage	230v AC
Duration of Switch on	60%/20mins

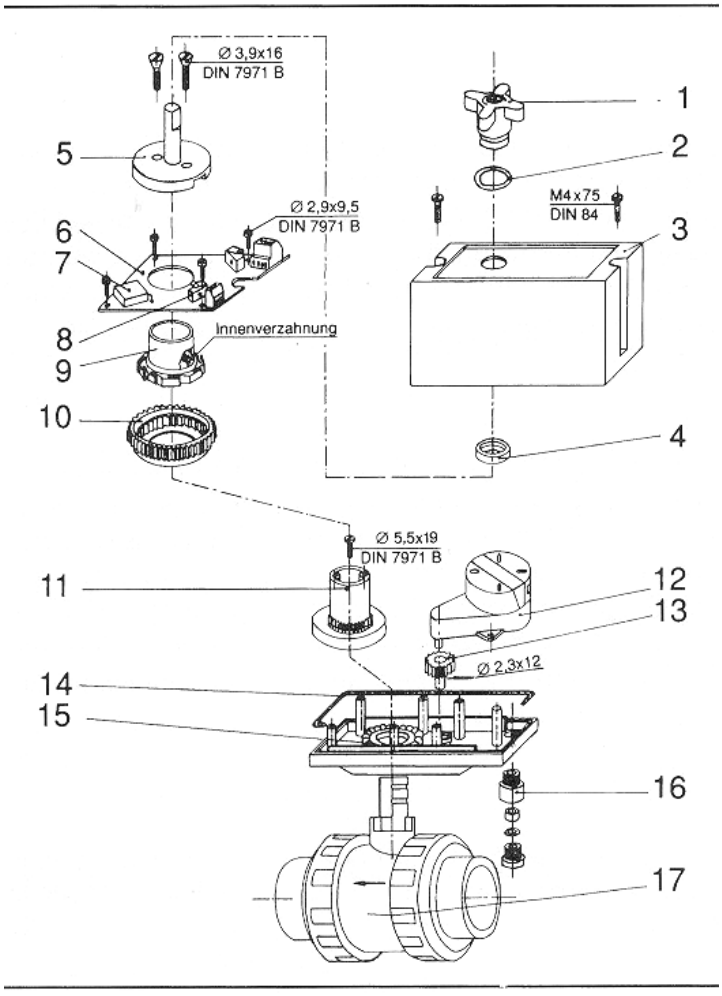
SAFETY FEATURE
The Solar Ball Valve has a pressure compensation system to avoid a rise in pressure during operation. If the operation is interrupted (e.g. failure of the power supply) it can be reset manually.





d	mm	40	50	63
DN	mm	32	40	50
G	Zoll	1¼"	1½"	2"
A	mm	162.0	162.0	181.0
B	mm	102.0	102.0	102.0
C	mm	81.0	81.0	90.5
D	mm	101.0	101.0	121.5
E	mm	78.5	78.5	78.5
F	mm	77.0	77.0	77.0
G	mm	56.0	56.0	64.0
H	mm	219.0	219.0	235.0
I	mm	64.50	64.5	72.5
K	mm	151.0	151.0	151.0
Y	mm	84.5	85.5	96.5
Z	mm	169.0	171.0	193.0
t	mm	27.5	31.5	38.5

1. Hand wheel
2. O-ring
3. Cover
4. Fixing for hand wheel
5. Disk cam
6. Plate bar with binding posts
7. Condenser
8. Main control (bundle-lever)
9. Coupler (ratchet)
10. Gearwheel z=64
11. Adaptor
12. Gear motor
13. Gearwheel z = 15 with tension dowel
14. Packing cord
15. Steel ball Ø 6mm
16. Screw connection
17. 2 and 3 way ball valve with base plate for electrical servo-motor
18. Set of fastening screws
19. Sealing set complete
    Consisting of: O-ring and thrust collar with ball seating joints
20. Electrical binding posts



SUNCELL 3-WAY MOTORISED BALL VALVE

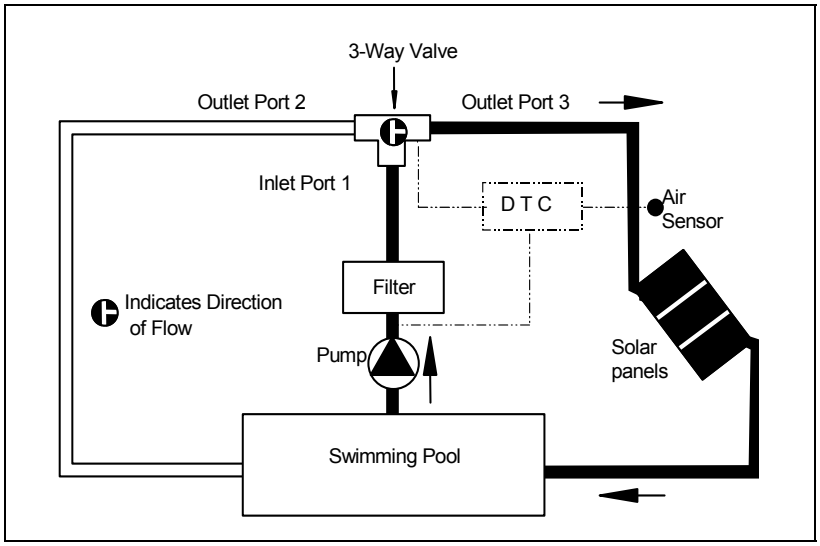
Models **SC.048.TMV- 1½ Inch Solvent Weld Sockets**
SC.060.TMV- 2 Inch Solvent Weld Sockets

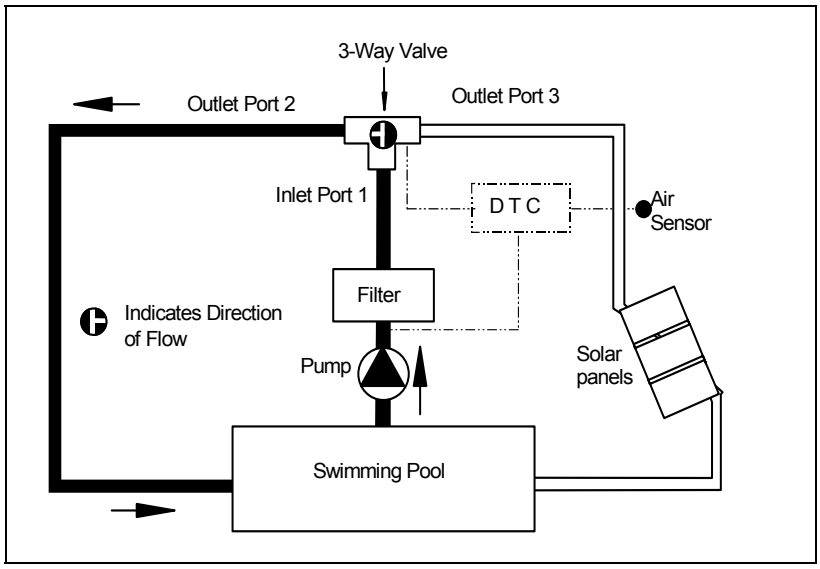
1. Inspection

The valve has been checked by the manufacturer before leaving the factory and is ready for operation.

2. Installation of the Valve

The valve may be mounted in any position except with the actuator underneath. Ensure that the pipework is fully supported by brackets on either side of valve.





The inlet from the pool must always be on the branch port (1) of the valve. The outlet ports (2 & 3) can be as shown in diagram above or reversed as detailed overleaf.

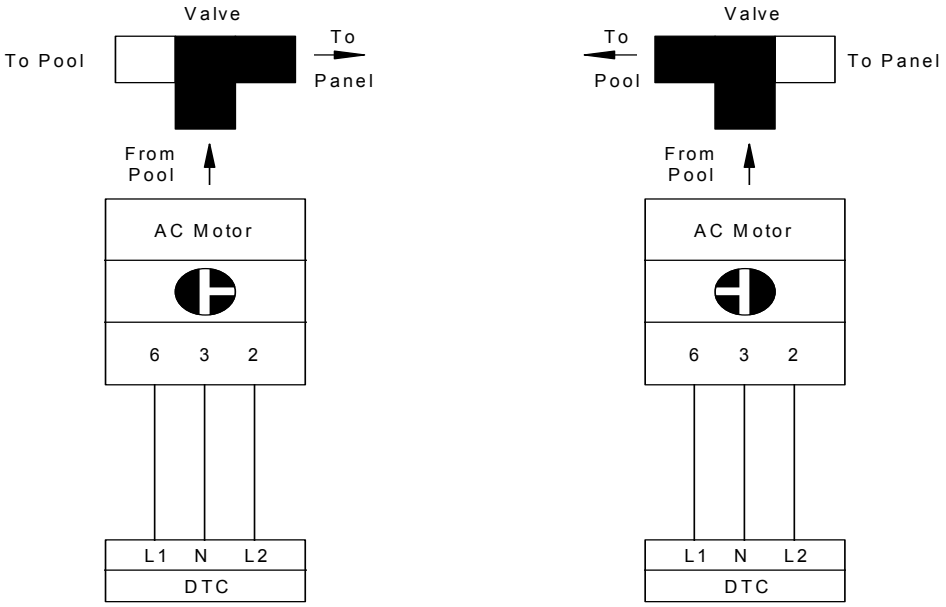
SUNCELL 3-WAY MOTORISED BALL VALVE

3. Electrical Connections
To be read in conjunction with DTC Installation Guide (Leaflet SUN E10/10a)

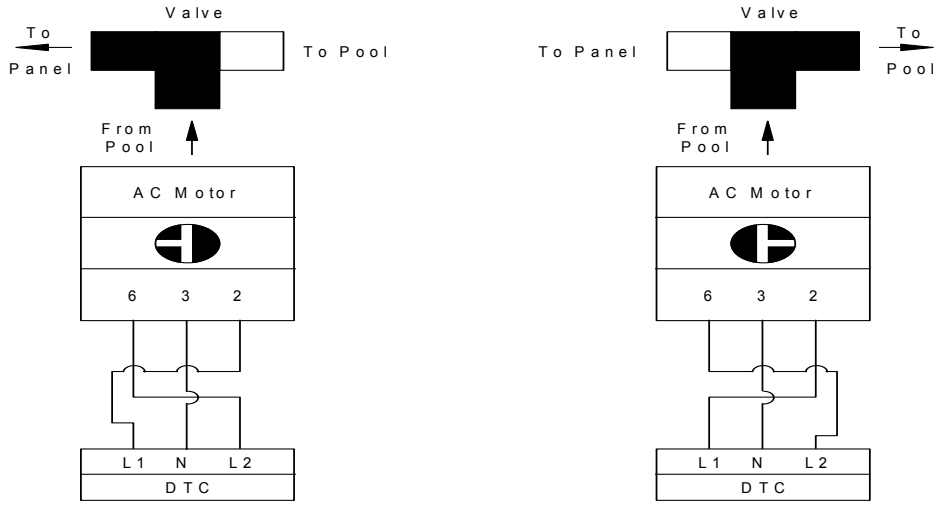
SAFETY WARNING

DO NOT CONNECT POWER LEAD UNTIL THE VALVE AND DTC INSTALLATION IS FINISHED

Solar heat gain L1 - 6 live No solar heat gain L2 - 2 live



When it is necessary to plumb the outlet pipes to pool and panels into opposite valve ports reverse L1 and L2 as follows:



Solar heat gain L1 - 2 live No solar heat gain L2 - 6 live

4. Change over times
The actuator takes approximately 65 seconds to change from one position to another. In the event of a mains supply failure a manual override is provided on top of the actuator. Turn only in a clockwise direction

If in doubt always contact a qualified electrician

DIFFERENTIAL TEMPERATURE CONTROLLER
FOR
SUNCELL SWIMMING POOL SOLAR HEATING SYSTEMS

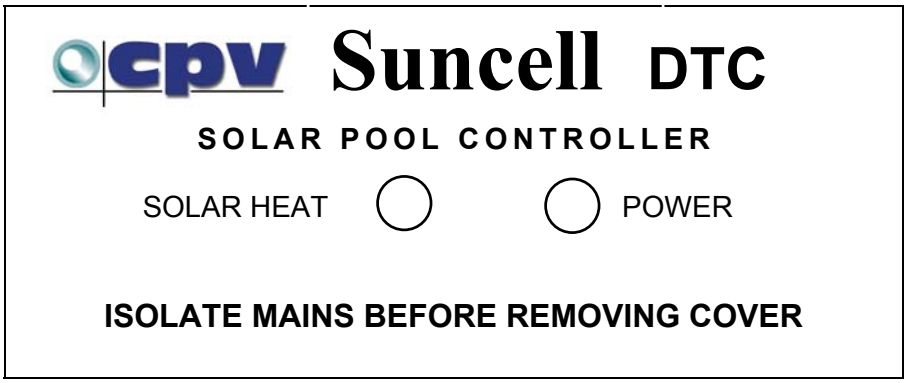
Provided that a control system has been fitted the operation of the solar heating is automatic. Pool water will circulate through the solar panels only when there is sufficient solar radiation to ensure a nett heat gain to the pool.

The Suncell DTC must be mounted in a position protected from the weather and away from a high temperature heat source such as a boiler.

It is normally mounted in the pool filter house and is supplied with a fixed differential temperature setting of 1°C. Further adjustment is not required.

The output of the Suncell DTC can be connected to a motorised valve or a pump. In the latter case ensure that the power of the pump is within the rating of the Controller (i.e. 300W, 1/3 h.p. max).

INSTALLATION



Fix the Suncell DTC to a wall using the two screw holes on the sides.

Now install the sensors. The panel sensor is incorporated into a small square section of solar panel material and should be mounted in a position which will receive precisely the same solar radiation and weather conditions as the solar panels. Often it is conveniently fixed on the roof of the pump house to face the same way as the solar panels and on an angled block of wood rather than a metal fixing which could affect its temperature response. Make sure that the cable insulation is not damaged in any way.

The pool temperature sensor (tubular) is placed in the pocket provided which should be located in the filtration pipework prior to the branch to the solar panels. A 10.5mm diameter hole should be drilled in the pipework to accept the stainless steel sensor pocket which is fitted with a PVC collar. The pocket should be inserted into the pipework and sealed by solvent welding the PVC collar to the pipework. Ensure that the sensor is correctly inserted into the pocket and avoid excessive pull on the sensor leads.

SUNCELL D.T.C.

SAFETY WARNING

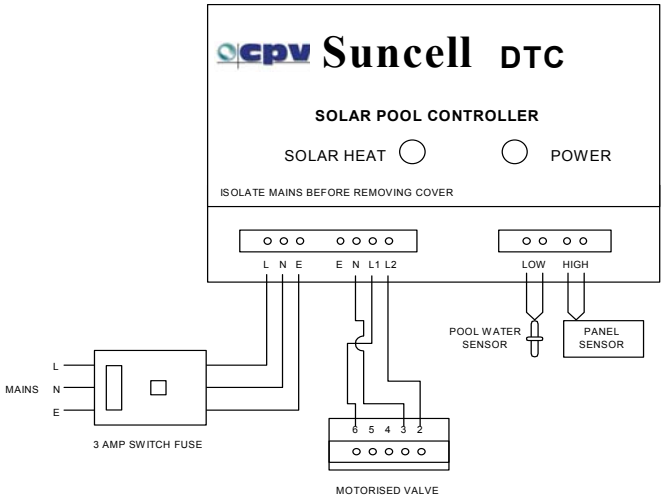
DO NOT CONNECT THE POWER LEAD BEFORE COMPLETING INSTALLATION AND WIRING OF PUMP OR MOTORISED VALVE. ALWAYS REPLACE THE CONTROLLER COVER BEFORE POWER IS SWITCHED ON.

ENSURE THAT ALL WIRING EXTERNAL TO THE CONTROLLER IS IN ACORDANCE WITH I.E.E. REGULATIONS. IF IN DOUBT ALWAYS CONSULT A QUALIFIED ELECTRICIAN.

ELECTRICAL CONNECTIONS

Remove the bottom cover exposing the terminal blocks. Connect the OUTPUT terminal block to the MOTORISED VALVE using 3 core mains cable. When connecting to a pump use 4 core mains cable.

Connect a suitable length of 3 core mains lead from the MAINS terminal block to the 220/240v AC mains supply via a switch fitted with a 3 amp fuse. **FAILURE TO CONNECT THE EARTH WIRE WILL RESULT IN A SERIOUS SAFETY HAZARD.**



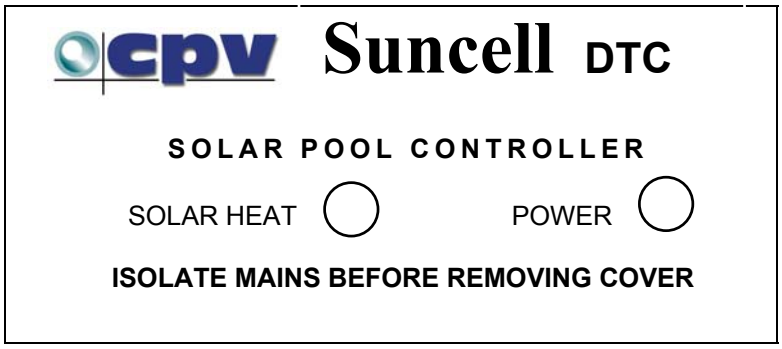
TO CONNECT TO A PUMP USE OUTPUT TERMINALS (L1 (LIVE), N (NEUTRAL) AND E (EARTH))

The panel sensor and pool sensor leads should be connected to the High and Low terminals respectively in the control box. Normally the sensor leads do not need to be extended. In the event that extension is essential the joint in the cable must be carried out to a high standard and be fully waterproofed. Before replacing cover remove the appropriate knock-out areas with a pair of pliers or a knife to allow space for the cables and check wiring.

The power may now be switched on. The POWER indicator should illuminate. The SOLAR HEAT indicator shows when solar energy is available to be collected. If you wish to test the pump or motorised valve, switch off power to the Controller, remove the cover and move the DIF TEST switch in the direction of the arrow. Replace the cover and switch on the power to the Controller. The solar circuit should now be activated irrespective of the sensor temperatures so that water flows through the solar panels. Do not forget to re-set the switch afterwards to its original position.
NB If water does not flow through the solar panels when the DIF TEST switch is activated then reverse connections 6 and 2 on motorised valve.

The control system may also be tested by cooling down the pool sensor (e.g. dip the tip in icy water) to circulate water through the panels. Warming the pool sensor should similarly cause the pool water to bypass the solar panels.

TROUBLE SHOOTING GUIDE FOR DTC AND SENSORS



DTC TEST SWITCH

Under the terminal cover of the differential temperature controller (DTC) there is a 'Diff. Test' switch that can be used to simulate an internal resistance/temperature difference and so manually switch on the solar system. To check this the following procedure is required:

i) Switch off the mains power and remove terminal cover.
ii) Activate the 'Diff Test' switch (right to left)
iii) Replace terminal cover and switch on the mains power.
iv) The solar heat light should glow and the motorised valve turn to allow water through the panels.

This test will indicate whether or not the basic functions of the DTC (relays etc) are working. Leave the switch in the OFF (right) position, which is the correct setting for automatic operation. Now test the operation of the DTC with the pool and water sensors connected using the procedure below.

HOT (Panel) AND COLD (Pool) SENSOR TEST

Take the pool sensor out of its pocket and dip the tip in a container of cold, preferably icy, water. The solar indicator light and solar system should come on. (Note: If already on, do the next step and come back to the icy water).

Then warm the pool sensor by dipping the tip in a container of hot water. The solar system should go off within a few seconds.

If these tests do NOT produce the correct result then there is a fault. The next steps will help in identifying whether a sensor, DTC control unit or wiring is to blame.

TROUBLE SHOOTING GUIDE FOR DTC AND SENSORS

Switch off the mains, remove the terminal cover from the DTC and disconnect the pool and panel sensors from LOW and HIGH terminals respectively.

Step 1 – Sensor Check

The pool and panel sensors are basically resistance thermometers whose resistances: a) decrease as the temperature rises.
b) increase as the temperature falls.
This resistance rise and fall is calibrated into degrees and used to drive the DTC, eg; when the pool temperature (sensor) is lower than the panel the DTC will select the appropriate solar valve position to pass pool water through the warmer solar panels.

Using a multimeter test the resistance of each disconnected sensor in turn.
Sensor Specification Range: 2000 to 10000 Ohms (depending on the temperature).
Sensors outside these limits are considered faulty and must not be used in Step 2.

Step 2 – DTC Check

Assuming that the sensors are found to be OK (Step 1) proceed as follows:

i) Connect up the **pool** sensor to the HIGH terminal, switch the mains back on and note whether or not the solar light comes on.
   Solar light on: DTC OK
   Solar light off: DTC not OK

ii) Repeat with the **panel** sensor.
   Solar light on: DTC OK
   Solar light off: DTC not OK

Note: Sensors with resistances above or below the range given in Step 1 may still operate the solar light and therefore should not be used.

The same result should be obtained in both i) and ii). If the solar light did not operate, then the DTC or the wiring is probably incorrect or faulty (see also the differential test previously mentioned). Check out the wiring, contacting your dealer or an electrician if necessary for technical support.

FURTHER OPTIONS

These simple tests will not identify every conceivable failure mode but they are often useful to make before other checks are made on the rest of the system, such as the external wiring, solar valve etc.

SPARES

CPV distributors and installers can supply individual sensors as spares. It is also possible to purchase a complete replacement DTC unit with sensors, to try the new sensors with the old controller and then return the new controller if not required. Provided it is received in new condition with factory packaging, an appropriate credit or refund will be made after deduction of a handling charge.

OPERATION AND MAINTENANCE

The components of your Suncell Solar Heating System have been manufactured following many years of research and development work, ensuring that only quality tested materials are used. Your new investment should give years of trouble-free service if the following guidelines are observed.

INTRODUCTION

Swimming pool water is circulated through the Suncell solar panels to transfer heat to the pool. Either the pool filtration pump or an additional pump is used to circulate water through the solar panels. Automatic control is achieved by means of a controller linked either to a motorised valve in the filtration circuit or to the pump as appropriate. The Component List will identify which type of system has been supplied.

Provided that a control system has been fitted the operation of the solar heating is automatic. Pool water will circulate through the solar panels only when there is sufficient solar radiation to ensure a nett heat gain to the pool.

Filtration circuit timeclock

If the solar heating system is integrated with the filtration circuit make sure that the filtration pump is operating during hours of possible solar heat gain. If the pump is operated by a timeclock this must be set to come on during daylight hours, i.e. from 9.00 am to 6 pm as a minimum, or install a relay switch to override .

Operating check

An adequate flow of pool water through the solar panels is necessary to ensure efficient operation. If their surface is cool to the touch when operating in bright sunshine this indicates that heat is being transferred quickly and efficiently to the pool.

Precautions

NO BONFIRES. Do not light bonfires near the solar panels since burning embers may fall on them causing damage.

While the panels are designed to be tough and will withstand minor impacts, care should be taken not to damage the solar panels by sharp objects such as screwdrivers or by airgun pellets.

The solar panels must be protected against frost damage by draining. It is also advisable to leave them drained if the solar heating system is to be left out of commission for an extended period during periods of hot sunny weather.

Insurance

Check that your Suncell Solar Heating System is included on your insurance policy or make separate arrangements to insure this valuable investment.

FROST PROTECTION

During periods when frosts may occur the solar panels and all exterior pipework must be drained of water to ensure that they are not damaged by freezing. Most systems have to be drained manually although some are designed to drain automatically - but we recommend that the system is checked at the end of each summer. For manual drain down systems ensure that the following winterisation procedure is carried out at the end of each September or when frosts are forecast.

Manual draining of Suncell Solar Panels

1. Switch off the circulating pump and Suncell DTC solar controller.
2. Close the isolating valve on the suction side of the filtration pump to ensure water returns to the pool via the pool inlets and not through the filter.
3. If a Suncell 3-port motorised valve is fitted this should be moved into the all open position. See below for further details of how to manually operate the valve.
4. Remove the top end caps from each bank of panels and allow a few minutes to drain. (Note: for panels mounted below pool level it is essential to first close isolating valves in the flow and return pipework). The bottom end caps can subsequently be removed so that any remaining water can drain out. Alternatively one or more drain cocks may be opened if these have been installed. It is recommended that end caps are left off and drain cocks left open through the winter. Although open ends must be protected against potential blockages.

OPERATION AND MAINTENANCE

5. The isolating valves in the flow and return pipework to the panels should then be closed to isolate the panels. The valve on the suction side of the pump must be re-opened.
6. If it is intended to run the filtration pump intermittently during the winter months it is important that the 3-port valve is moved back to the 'bypass' position in order to allow the circulation of pool water.

CONTROL SYSTEM

Automatic control can be provided by a Suncell differential temperature controller (DTC) connected to a Suncell 3-port motorised valve.

This controller automatically compares the temperature of the solar panel sensor with that of the pool water sensor and allows circulation through the solar panels whenever there is an available heat gain. No adjustment is required since the Suncell DTC is set at the factory.

A facility is provided to override the controller to allow circulation when there is no solar heat gain. The relevant switch, which is intended for test purposes only, is located beneath the removable terminal strip cover.

In the event that the 'power on' indicator does not light the relevant fuse or circuit breaker trip button should be checked. The operation of the DTC may be verified by warming the pool sensor (to check that it switches 'off') or by cooling it (to check that it switches 'on'). To carry out this test the sensor should be removed from its pocket and its lower half immersed in a cup of warm or icy cold water as appropriate.

MOTORISED VALVE

Unless you have a separate pump for the solar heating circuit, automatic control is normally achieved by means of a Suncell 3-port motorised valve. This comprises a valve body with three ports and an actuating motor. Filtered water enters through the central port and is deflected through either of the remaining ports according to the state of the weather detected by the controller. A manual override is provided so that the valve can be operated independently from the motor for test or maintenance purposes. The override knob (at the top of the actuator) is imprinted with arrowed port indicators, i.e. these arrows show the flow direction through the ball-valve. Hence it is immediately obvious which ports are open and which are not (there will always be at least two ports open, but be sure not to close the water supply port). Note that the override knob can only be turned clockwise.

CAUTION

Tighten the valve union nuts by hand only, otherwise the thrust collars push on the ball resulting in the valve being very stiff to turn.

MAINTENANCE

i) Suncell Solar Panels

AS REQUIRED

a) Suncell solar panels require minimal maintenance but a periodic check of the security of panel fixings is recommended. If dirt accumulates on the front of the panels this should be washed off. This can be accomplished easily with the aid of a garden hose, a soft brush and, if necessary, a household detergent.

ii) Suncell Valves

BEFORE EVERY SEASON

a) Turn the valve by hand (clockwise) with the manual override to check it is free to turn.

b) If found to be stiff, lubricate the ball with Silicone or PTFE spray. Access to the ball can be obtained by unscrewing the union nuts. Retighten the union nuts hand tight only.

If in doubt always consult a qualified electrician

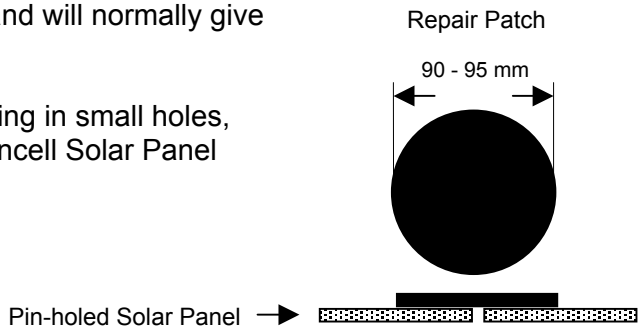
FOR SERVICE CALL:

Suncell SOLAR HEATING

Suncell Solar Panel Repair Kit

Suncell Solar Panels are very tough and will normally give many years of trouble free service.

However, if they suffer damage resulting in small holes, then they can be repaired with the Suncell Solar Panel repair kit.



Application Instructions

1. Ensure panel is drained of water before starting work.
2. Clean the area around the leak ensuring that any dirt and moisture is removed. Abrade the cleaned surface with coarse sand paper and wipe clean.
3. Cover the area surrounding the damage with any suitable insulating material such as wood or heat resistant cloth. Pre-heat the damaged area to a maximum of 65°C with a hot air gun (paint stripper) or a blowtorch. Extreme care must be taken to ensure that the solar panel is not overheated as this will cause it to soften and be further damaged.
4. Peel off the release liner on the repair patch, if present. If not present, then the ribbed side is the adhesive side.
5. Protect the hand with a heat resistant protective glove and hold the repair patch adhesive side up, either in the hand or on a suitable insulating surface. Heat the patch until the adhesive is slightly soft.
6. Position the patch over the panel heated area, adhesive side down, and press firmly onto the heated area with the gloved hand.
7. Heat the patch until adhesive is seen to extrude from the edges. Heat sensitive paint flecks may be present in the patch, if so they will change from green to grey.
8. Press the surface of the patch firmly with a gloved hand or a roller to ensure the removal of all air bubbles.
9. Finally finish off by applying heat from the hot air gun or blow torch to ensure a uniform bond. Allow the patch repair to cool for at least 30 minutes before refilling the panel with water.

CPV Ltd, Woodington Mill, East Wellow, Romsey, Hampshire, SO51 6DQ
Tel: ++ 44 (0) 1794 322884
Fax: ++ 44 (0) 1794 322885
E-mail: sales@cpv.co.uk
Web: www.cpv.co.uk