RVR Solar Systems

Installation Instructions

TiSUN®

Calpak

RVR.ie

Ireland's Online Heating Suppliers

Version 16052007

Table of Contents

System Schematics and Circuits

Detailed information on the design of solar systems is available in the RVR publication, Solar System Design Guide. This may be downloaded from www.RVR.ie and should be read carefully before designing a system.

Four basic system types are described below:

Twin Coil Thermal Store System

This type of system is suited to new or replacement installations where the water heater is to be replaced. A dual coil water heating tank is used as a solar store with the solar circuit connected to the lower coil. The tank used should be tall and narrow to ensure good stratification of the heated water. An oil or gas boiler is usually connected to the upper coil. In this type of system the solar system will be able to provide a large percentage of the domestic hot water needs of the household. Vacuum or flat panel type solar collectors may be used.

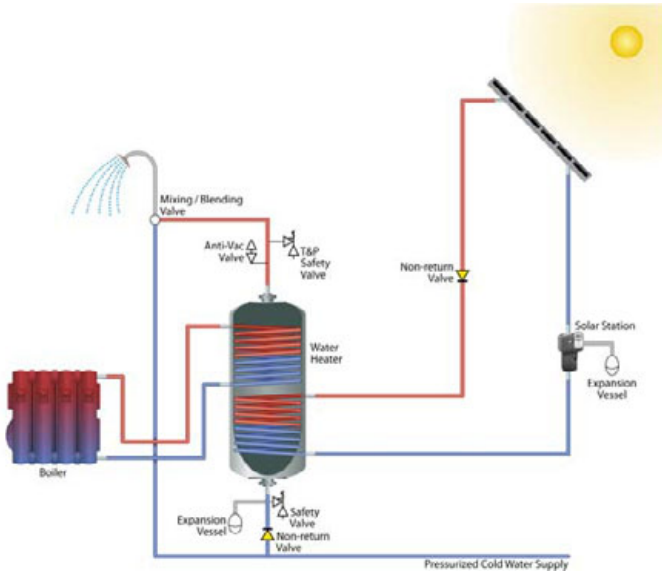

Fig. 1 – Twin Coil Thermal Store System

Single Coil Preheat Cylinder

This can be easier to install alongside existing installations and it is not necessary to replace the existing water heater. In this type of system the solar system will be able to provide a large percentage of the domestic hot water needs of the household. Vacuum or flat panel type solar collectors may be used.

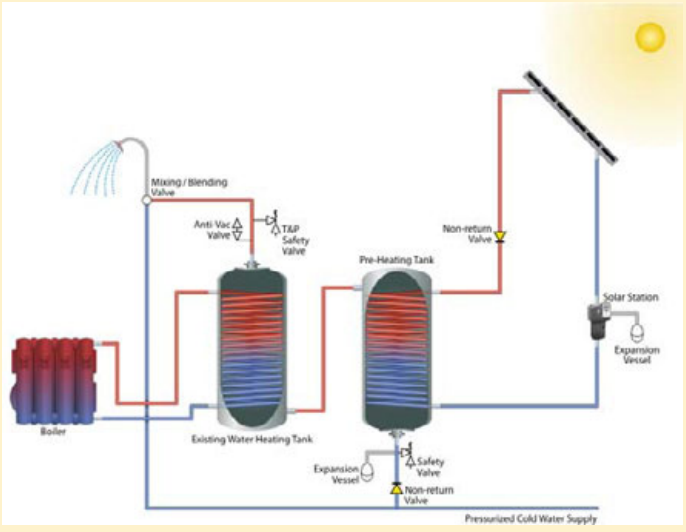

Fig. 2 – Single Coil Preheat Cylinder

System 3 – Thermal Store with External Heat Exchanger

The heat from the solar panels is fed to a plate heat exchanger which in turn is used to heat the domestic hot water. It may be a good choice where it can be retro-fitted to an existing water heating tank. Vacuum or flat panel type solar collectors may be used.

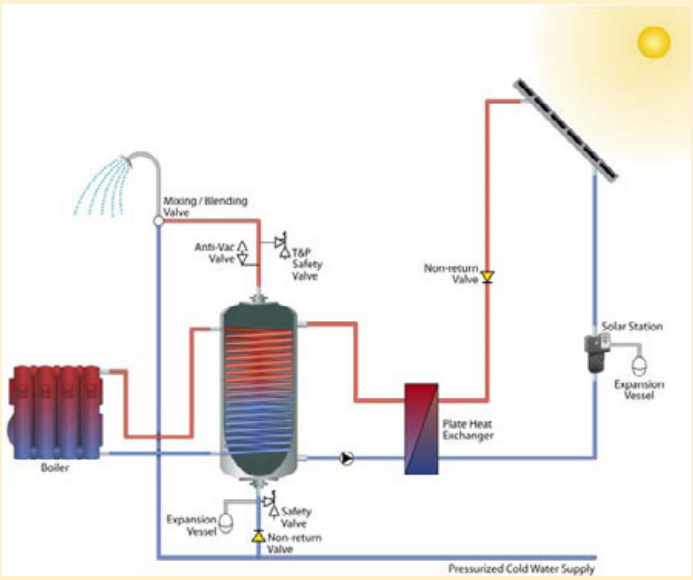

Fig 3 – Thermal Store with External Heat Exchanger

System 4 – PROCLEAN tank system

The solar system is connected to the lower coil in the PROCLEAN tank. The PROCLEAN tank allows the output of the solar system to make a contribution to central heating as well as providing hot water heating. Vacuum or flat panel type solar collectors may be used.

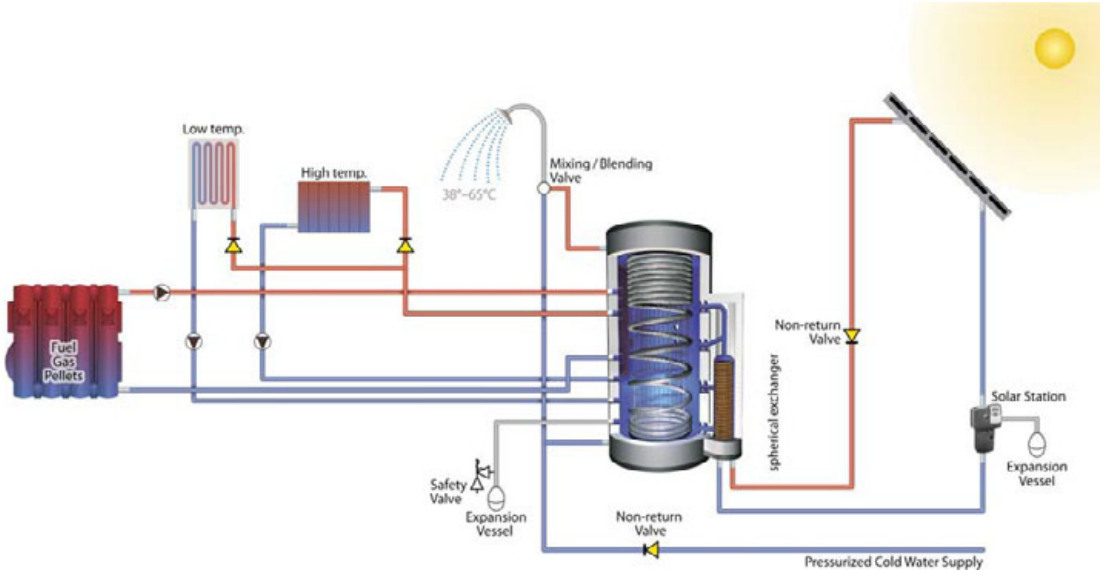

Fig 4 – PROCLEAN tank system

Equipment Specifications

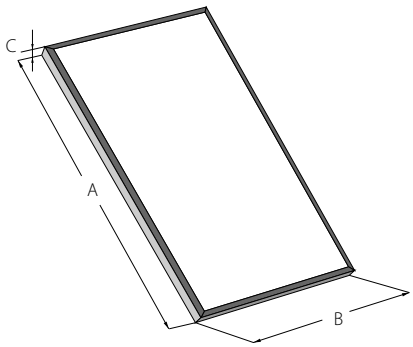

Fig 5 – GS Type Collector

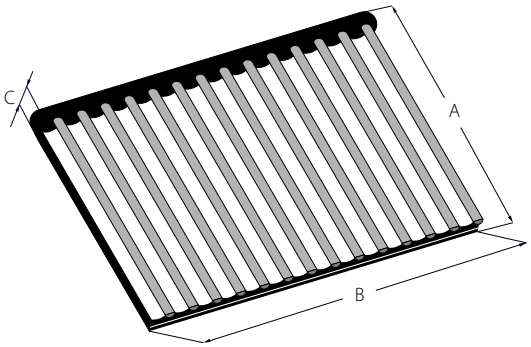

Fig 6 – VTN Type Collector

Model	Dimensions A × B × C (mm)	Area (m2)	Empty Weight (Kg)	Full Weight (Kg)	Maximum Working Pressure (Bar)	Flat Surface Support Bracket Kit	Sloped Roof Support Bracket Kit
FM-S	2160 × 1180 × 100	2.55	49	51	15	334401	334511
FM-W	1180 × 2160 × 100	2.55	49	51	15	335401	335511
240GS	2350 × 1070 × 95	2.5	38	40	13	SOL230	ASB015 (single) ASB020 (double)
12 VTN	1600 × 1330 × 100	2.13	35	38	13	SOL225	ASB005 (single) ASB010 (double)

Table 1

The TISUN FM models are flat plate collectors with a selective type absorber, tempered glass, rockwool insulation and an aluminium casing.

The CALPAK GS are flat plate collectors with a selective type absorber, tempered glass, expanded polyurethane insulation and an aluminium casing.

CALPAK VTN vacuum collector consists of vacuum tubes, 1.5 m long, with external diameter of 47 mm. A special CPC reflector is used to concentrate all solar rays onto the tubes thus minimising the number of tubes required.

Vacuum tube collectors have higher efficiency in diffuse radiation (cloudy weather and winter), compared to flat plate collectors. The vacuum produced between the two glass tubes provides excellent insulation which protects the collector from freezing when ambient temperatures are as low as -18 °C (without anti-freeze).

Standards and Codes

The installation of the solar system should only be carried out by suitably qualified and certified personnel.

All applicable standards and codes of practice should be complied with. These include but are not limited to :

- Safety, Health and Welfare at Work Act 2005
- Any requirements of the Health and Safety Authority
- The Building Regulations
- Local Authority Requirements
- EN 12975 and EN 12976 which deal with Solar Systems and Collectors
- IEE Regulations
- Any other applicable local national or European codes or standards

All solar panel should be certified and carry the Solar Keymark which is the official quality mark of the European Committee for Standardization (CEN). It guarantees the quality of solar heating products, both panels and complete systems.

Safety information

- Use safe access methods and install anti-fall protection. Do not use damaged ladders or equipment and ensure that they are placed safely and secured against falls and slippage.
- Use safety harnesses and belts.
- When working near electrical wires or cables, disconnect the electrical supply or maintain a safety distance of:
  1 m with voltages up to 1000 V
  more than 5 m when the voltage is not known.
- Wear protective goggles, safety shoes, gloves and helmet of approved quality.

Locating Solar Panels

The following five important factors should be considered when locating the panels:

Orientation

The collectors ideally should be oriented to face South (use compass to find South). However a variation of up to 15° from South does not have a significant effect on the efficiency. Orientation between SE and SW will typically affect efficiency by less than 5%.

By compensating with more collector area, it is possible to orient the collectors anywhere between east and west as the loss of efficiency at these extreme orientations is about 25%.

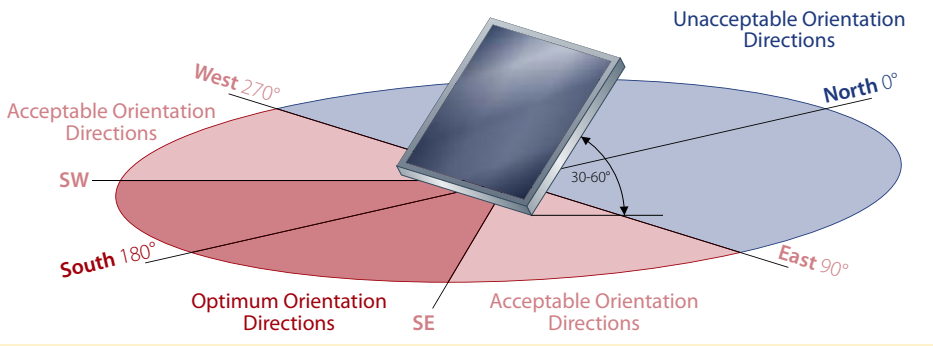

Fig 7 – Collector orientation and tilt

Tilt Angle

The tilt angle at which you mount the collector should roughly correspond to the latitude of the location. The optimum tilt angle is about 50° for installations in Ireland or the UK although any angle between 30° and 60° will give good results. Angles greater than 60° result in a significant loss of efficiency in summer. The loss of efficiency at a tilt angle of 80° will be about 20%. This may be compensated for by installing additional collector area.

Shade

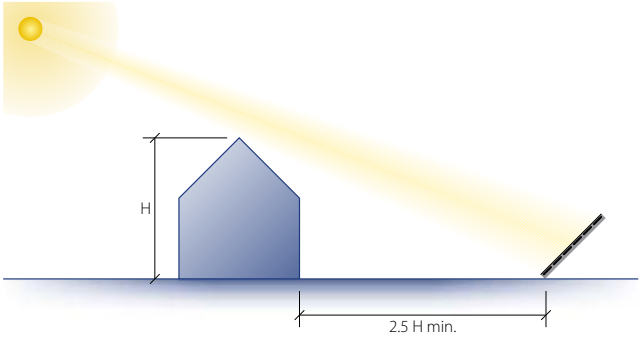

Fig 8 – Collector shading

Try to avoid significant shading of more than 2 hours per spring or autumn day. Ideally, the distance from an obstacle to the East, South or West should be at least 2.5 times the height of the obstacle.

Distance from Solar Store

The collectors should be as close to the solar store tank as possible in order to minimise heat and pressure loss.

Access for Maintenance

The area where the collectors are installed should have easy and safe access for maintenance.

Handling of Panels

During installation, keep the upper carton or plastic film in place up to the moment the circuit is filled with thermal fluid. Glass is better protected in this way from thermal or mechanical shocks.

The VTN collectors are packed in wooden or cardboard crates and must always be transported in a vertical position with big warnings that the tubes are made of glass (FRAGILE – GLASS TUBES). When quantities of more than one are transported, use pallets and use strapping and stretch film to ensure quality of packaging and protect against damage.

When mounting on the roof, remove the packing crate, and use appropriate straps and handling equipment to place the panels in position.

Do not remove the plastic cover before filling up the system with solar liquid.

Mounting of Panels

Support bracket kits are available to allow mounting of collectors on flat surfaces and sloped roofs. Before commencing installation on any roof or surface, obtain written confirmation from the designer, builder or owner that the roof is strong enough to support the weight of the solar installation.

Flat Surface Installation

A support bracket kit is available for each model of collector. Please see table 1 for bracket models.

Fig 9

- The components of the bracket kit are shown in the picture above. The angle pieces must be screwed together to form two triangles. The vertical angle is marked 45Y2, the horizontal one 45L2 and the sloped one 45K2.
- Once the triangles have been formed, assemble the two reinforcing pieces to form the X configuration. These are attached to the two vertical angles 45Y2. Finally screw the two blades together at the crossing point.

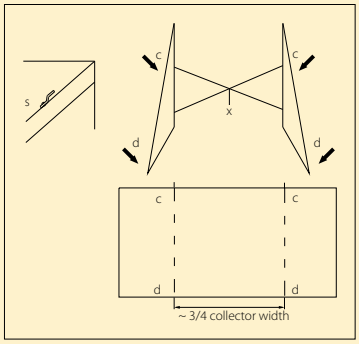

Fig 10

Fig 11

- Fasten the triangles on the flat surface parallel to each other using special fixing bolts and check stability. Ensure that the installation has sufficient stability to endure wind pressure.
- Mount the fixing pads "s" loosely on the sloped angle at points "c" and "d" by selecting one of the three available holes at each point so that the collector will have an inclination upwards to the left as seen from the front.

- Mount the collectors on the sloped angles and slide the fixing pad "s" at point "d" into the groove of the collector' s frame, then do the same with pads "s" at point "c" and finally screw it firmly.
- Verify that an inclination towards the outlet on the left of about 1-2° exists. This is imperative for air purging of the solar circuit.

Sloped Roof Installation

Before mounting solar panels on a roof, check with a qualified person that the roof is strong enough to support the additional weight and wind loading.

Brackets for mounting Calpak solar panels on-roof

These brackets have been designed specifically for Irish roof systems and the harsh Irish weather.

They are professionally manufactured from high quality 304 grade stainless steel. They will have an almost unlimited life in all normal environments. When installing solar panels in areas exposed to salt water spray or in heavily polluted atmospheric conditions, some corrosion may be experienced. If this is not acceptable, please contact RVR for technical advice prior to installation.

All roof kits are mounted using hanger bolts as shown in the photograph below. This type of fastener has a wood screw at one end and a threaded machine screw at the other end. All kits are complete with stainless steel hanger bolts and all other fasteners required to assemble the brackets.

An installed roof bracket for a single solar panel is shown in figure 13.

Figure 12 – Hanger Bolt

Installation Procedure

Figure 13 – Installed Roof Bracket

First determine the approximate location of the roof bracket.

If the inside of the roof can be accessed, then go into the attic and mark the location of the lower mounting holes for the bracket.

Figure 14

Now drill out through the rafter and slate with a long 6mm masonry bit making sure that the drill is perpendicular to the rafter.

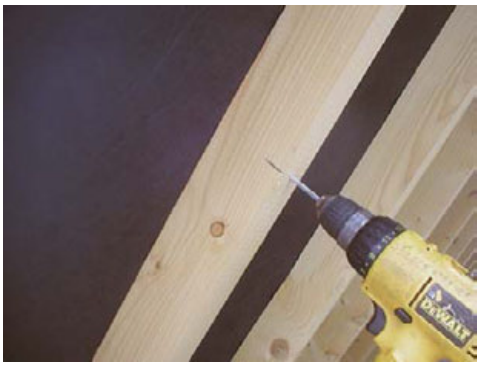

Figure 15

Leave the drill bit protruding through the slate, to the outside, and place the bracket upright over it. Take a measurement to determine a good location for the upper hanger bolt.

Figure 16

Figure 17

Now transfer the measurements which you have taken onto the inside of the rafters and drill out again.

If the attic has been converted the location of the exact centre of the rafter can be difficult to find. You can use an electronic stud finder to locate the rafters internally.

Then drill out through the center of the rafters and repair the holes inside.

Alternatively reference your location from a window and triangulate your measurements. Then transfer them to the outside and drill in through the slate.

See the following diagrams for spacing of rafter and hanger bolts in relation to the different types of mounting brackets.

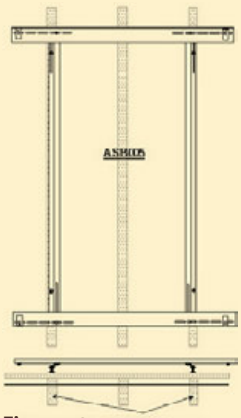

Figure 18a – Drill the centre in these locations for 1-12VTN bracket

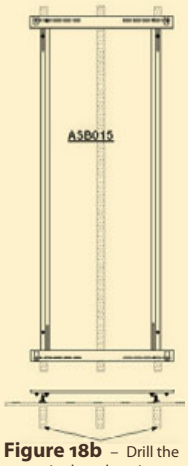

Figure 18b – Drill the centre in these locations for 1-240GS bracket

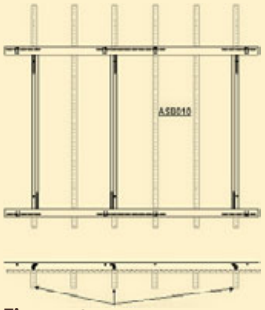

Figure 18c – Drill the centre in these locations for 2-12VTN bracket

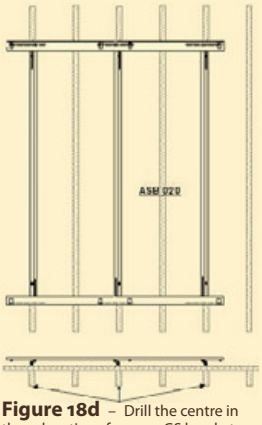

Figure 18d – Drill the centre in these locations for 2-240GS bracket

When all the holes are drilled, you now drill an 11mm clearance hole in the slate.

Next lock two SS nuts together as shown and twist in the hanger bolt until 50mm of threaded bolt protrudes above the slate or flat tile.

Figure 19a

Figure 19b

Apply some of the special purpose sealant (supplied) to the surface around the bolt. Fit the 5mm thick neoprene washer followed by the 40mm SS washer and SS nut. Tighten the nut by hand until you cannot turn it any more and then give it one full turn to form a watertight seal. **Do not over tighten or you may break the slate!**

We recommend the application of some more adhesive sealant around the washer to give extra protection against the Irish weather.

Figure 20

Figure 21

Now put on another SS nut on the protruding bolts and leave an even space between the first and second nut to ensure the bracket sits evenly off the roof. Don't forget to put on the 25mm SS washer which gives support to the SS bracket.

Next you fit the SS uprights making sure you put on the 25mm SS washer and the M10 SS nyloc nuts provided.

Figure 22

Figure 23

See completed mounting in figure 24.

Figure 24

Proceed to fit the crossmembers using the M8 bolts and nuts.

Figure 25

You can rest one side of the upper crossmember inside the upright temporarily while you move to the other side

Figure 26

Loosely fit the clamps to the lower crossmember.

Figure 27

Then slide down the solar panel into the clamps.

Fit the upper clamps and tighten them ensuring the solar panel has a 1 to 2 degree rise towards the outlet connection.

Brackets for mounting TiSUN solar panels on-roof

Follow the same procedure for installation of hangar bolts as described for the vacuum collector installation. The TiSUN panel has an extruded aluminium type mounting bracket.

There are two kits available, these are:

- Mounting kit for 1 panel and
- Mounting kit for each additional panel.

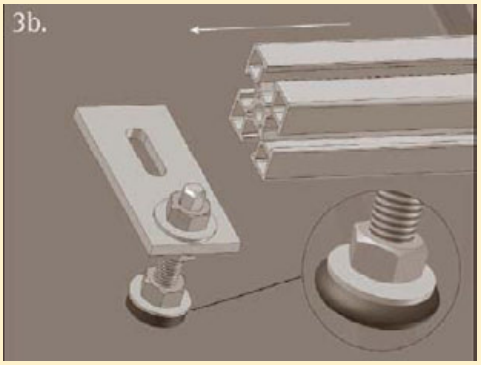

Figure 28

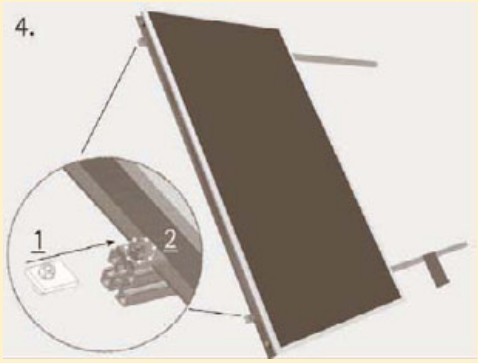

Figure 29

For more detailed installation instructions, please see the document supplied with the mounting kit or download it from **www.rvr.ie.**

Brackets for mounting TiSUN solar panels in-roof

There are flashing kits available for tile roofs and slate roofs. These are not interchangeable as the bottom part of the flashing for tiled roofs has a greater offset angle and a flexible skirt.. There is also a triangular adhesive foam backed strip provided for tiles. These foam strips are not used on slate roof installations.

There are 3 different kits available for each roof type, they are:

- Flashing kit for 1 panel.
- Flashing kit for 2 panels
- Flashing kit for each additional panel

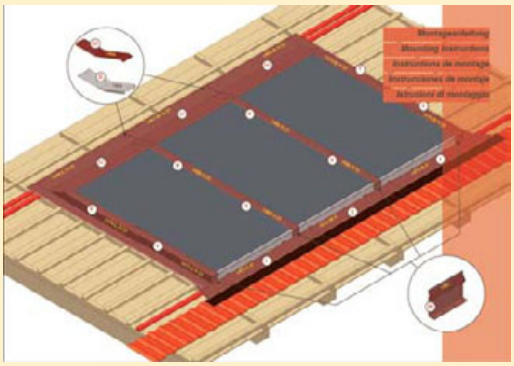

Figure 30

It is also necessary to modify the roof by fitting three extra battens under the flashing for support.

The minimum unfinished roof area (mm) for installing the flashing is provided in table 2.

Panel quantity											
1		2		3		4		5		6	
W	H	W	H	W	H	W	H	W	H	W	H
1750	2850	3000	2850	4250	2850	5500	2850	6750	2850	8000	2850

Table 2 – minimum unfinished roof area (mm)

The flashing kits contain all the components required to install the panels. When the installation is completed, two insulated flexible pipes with 18mm copper pipe ends are inside the attic. Take care when fitting compression fittings to these and to the panels. Use a 24mm and a 27mm open spanner to tighten the fittings. Do not use large adjustable spanners.

WARNING!

Be careful not to turn the pipe in the panel because it may create a leak internally.
When installing the fittings be sure to fit the brass inserts provided.
It is not necessary to apply sealant to the fittings because compression fittings create their own tapered seal.

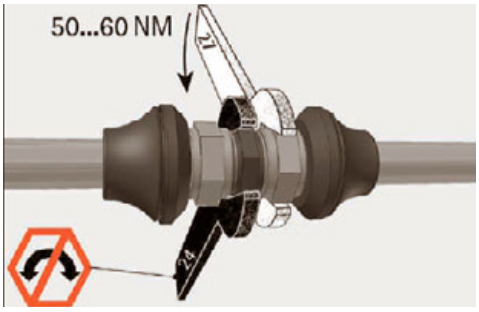

Figure 31

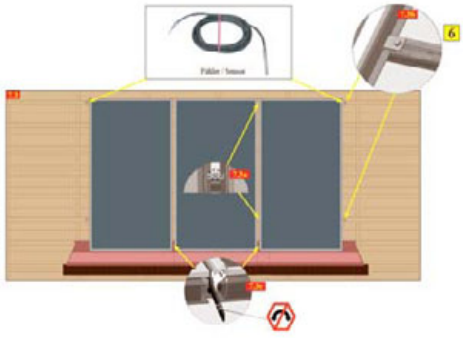

Figure 32

For more detailed installation instructions, please see the document supplied with the mounting kit or download it from **www.rvr.ie.**

Installation instructions for pipe flashing on flat tile or slate roof

A specially designed sloped roof flashing is available for sealing the insulated solar pipe, providing a watertight seal. This flashing will seal a 1 ½" pipe, it can also be modified to 3" by tearing off the inner sealing ring.

Determine the position of the pipe location, ensuring that the hole is clear of the rafters and battens. Drill a pilot hole in the position shown in the picture (fig. 33)

Figure 33

Now bore a hole with a core bit of approximately 65mm to provide clearance for the insulated pipe (fig. 34)

Figure 34

On slate roofs there may be copper retaining pins installed. Remove the pin which is located immediately above the hole as shown (fig. 35)

Figure 35

Pre fit the roof flashing and measure the distance which protrudes below the slate lip, then cut off the excess as shown (fig. 36)

Figure 36

If required install some copper pins on the upper corners and on the centre bottom, liberally apply the mastic (which is provided with the roof bracket kit) onto the area of slate which will be covered (fig. 37)

Figure 37

Drill a small hole for the pin on the bottom centre of the flashing, then slide the flashing upwards and under the slate located above the 65mm hole. Push down firmly and bend the copper pins over.

Extra mastic may be applied around the flashing for a watertight seal (fig. 38)

Figure 38

Installation instructions for 2 in 1 piping

It will be necessary to drill a larger hole in the slate.(fig. 39)

Figure 39

The hole in the flashing can be enlarged by tearing off the inner ring of rubber. (fig. 40)

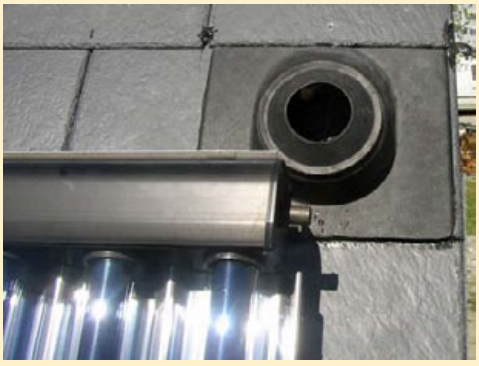

Figure 40

Push the piping through the flashing and ensure that there is enough to reach the furthest away connection, then notch the insulation and cut the pipe closest to the panel connection. (fig. 41)

Figure 41

Install the fittings and secure the pipe along the top of the mounting brackets. Cover the fittings with high temperature adhesive tape. (fig. 42)

Figure 42

Secure the pipe internally to the roof battens so there is no movement in the pipe.

Expanding foam can be applied inside the flashing; this will also provide rigidity and a good seal.

Installation instructions for pipe flashing on corrugated / profiled roof

A specially designed sloped roof flashing is available for sealing the insulated solar pipe, providing a watertight seal. The base of these flashings has a soft aluminium base molded onto an EPDM rubber grommet, which can be cut for pipe sizes from ¼" to 4" in diameter.

Determine the position of the pipe location, ensuring that the hole is clear of the rafters and battens. Drill a 65mm (approx.) hole in the position shown in the picture (fig. 43)

Figure 43

The flexible base can be shaped to match the profile shape. Liberally apply the mastic on the base and fit the top part under the upper tile (if applicable). Screws or rivets can be used to secure the flashing while the mastic is curing, see (fig. 44)

Figure 44

Method for connecting solar metalflex pipe

1. Cut the pipe with a tube cutter as shown in figure 42 (Warning: the pipe end can be very sharp!)

Figure 45

2. Put the backnut on the pipe, then place the segment ring in the first groove back from the end and squeeze it tightly around the pipe as shown in figure 43.

Figure 46

3. Tighten the connection using the threaded nipple and nut to create a flat end on the pipe as shown in figure 44.

Figure 47

4. Finally insert the fiber washer to create a leak proof seal as shown in figure 45 (Do not use for any type of sealant.)

Figure 48

Procedure for Tiled Roofs

The mounting procedure for flat tiled roofs is very similar to that described above except that it will usually be possible to directly access the rafters from outside by pushing up the tiles as only every third row is fastened on a typical roof. In this case, it will be easy to locate the rafter and drill through the tile from outside if desired.

When installing on curved tiles, it is important that the hangar bolt is located at the high point of the tile corrugation. This may not coincide with a rafter position. In this case, it will be necessary to install an extra wooden batten between adjacent rafters and screw the hangar bolt through this. Suitable treated batten kits are available from RVR Energy Technology Limited.

Mounting of FlowCon Solar Station

The Flowcon Solar station contains the system pump, safety valve, flowmeter, service valves, expansion valve connection and connections for filling and topping up the system.

Figure 49 – Solar Station

- Select a suitable position for mounting the solar station.
- Unpack the solar station and remove the front insulation jacket.
- Let the solar station screwed to the back part of the insulation jacket.
- Mark the mounting hole positions through the insulation and drill with an 8 mm drill. Insert the plugs into the holes.
- Mount the solar station with the screws provided.

Piping and Pipe Sizing

Arrangement of Collectors

Tisun FM-S and FM-W Flat panel collectors

No more than seven Tisun flat panel collectors should be connected in series.

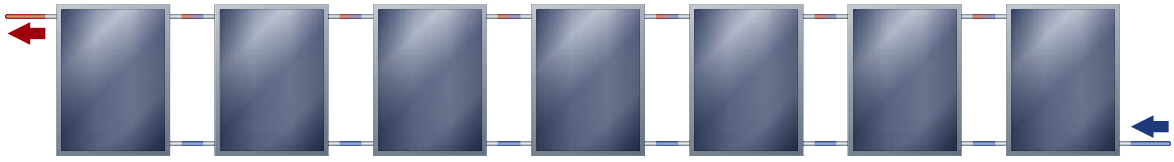

Figure 50 – Max seven Tisun collectors connected in series

Calpak GS Flat panel collectors

No more than three Calpak flat panel collectors should be connected in series.

Calpak VTN Vacuum tube collectors

When using vacuum tube collectors, the maximum number of tubes which should be connected in series is 36. ie 3 × 12 VTN collectors.

Figure 51 – Max three GS collectors connected in series

Figure 52 – Max three vacuum collectors connected in series

Connection of collectors in parallel

When larger numbers of collectors are installed, additional units should be piped in parallel.

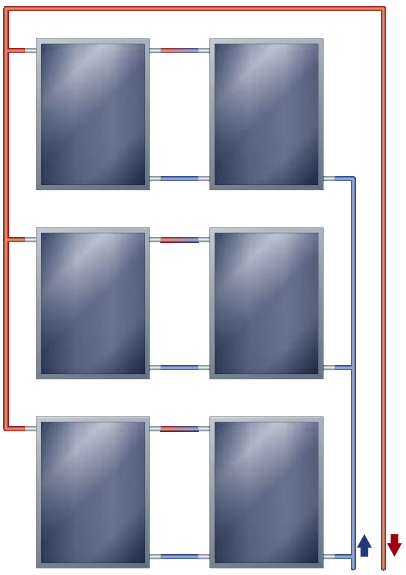

Figure 53 – Collectors connected in parallel

Pipe Materials

The temperatures encountered in solar systems are far higher than those encountered in conventional heating systems. For this reason metal pipe and tubing is used for the piping between collectors and the thermal store. Plastic tubing must not be used.

Copper is normally used and flexible corrugated stainless steel pipes are often used. Steel pipes may be used in larger systems. Galvanised pipes should not be used as they are not compatible with antifreeze fluids.

Suitable joining methods include releasable compression fittings using a metal clamping ring, hard soldering and non releasable press fittings. Soft soldering has a usage limit of 110°C and is not recommended.

Thermal Insulation of Pipes

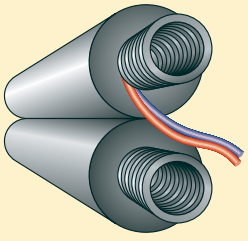

Figure 54 – Pre-insulated Solar Pipe System

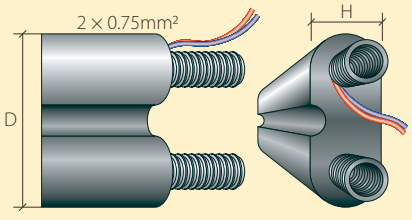

Figure 55a – Pipe Section (2 in 1)

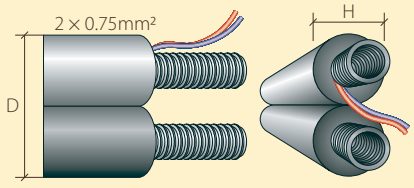

Figure 55b – Pipe Section (2 in 2 "Break Apart")

Stock №	Type	mm	inch	Coil length	Insulation type	Cross sectional dimensions
SOL359	DN12	12	5/16"	10m	2 in 1	75 × 45
SOL360	DN16	16	5/8"	15m	2 in 2 "Break Apart"	96 × 48
SOL363	DN16	16	5/8"	25m	2 in 2 "Break Apart"	96 × 48
SOL365	DN20	20	3/4"	15m	2 in 2 "Break Apart"	104 × 52
SOL368	DN20	20	3/4"	25m	2 in 2 "Break Apart"	104 × 52
SOL369	DN25	25	1"	25m	2 in 1	105 × 55

Table 3 – Pipe sizes for RVR solar pipe system

The solar heat has to be delivered to the thermal store with the lowest possible losses. An insulation thickness of at least 12mm should be used for pipes up to 22mm diameter. For larger diameters the insulation thickness should equal the pipe diameter.

There should be no gaps in the insulation. All fittings and connections should be insulated. The pipe insulation should be resistant to the temperatures found in solar systems. It should also be UV and weather resistant.

Pre-insulated solar pipe system

A special flexible pre-insulated solar piping system is available from RVR Energy Technology Limited. It is coated with a UV resistant film and greatly simplifies the installation of solar system piping. It is available in several sizes and also incorporates a sensor cable.

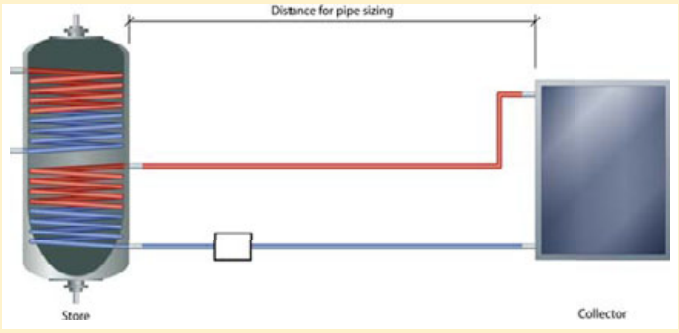

Figure 56 – Pipe Sizing distance

Number of Solar panels (up to)	Distance (m)				
	10	15	20	25	30
3	DN12	DN12	DN12	DN16	DN16
6	DN16	DN20	DN20	DN20	DN20
9	DN20	DN20	DN20	DN20	DN20
12	DN20	DN20	DN20	DN25	DN25
15	DN25	DN25	DN25	DN25	DN25
18	DN25	DN25	DN25	DN25	DN25
21	DN25	DN25	DN25	DN25	DN25
24	DN25	DN25	DN25	DN25	•
27	DN25	•	•	•	•

Table 4 – Pipe sizes for RVR solar pipe system

Pipe Sizing

The pipe diameters required for the solar circuit may calculated once the collector surface area and the length of the pipes is known. The table above gives recommended pipe sizes for the RVR pre-insulated flexible solar piping system. Note: the distances are the total pipe route distance between the collectors and store. For more complex systems, please consult RVR.

Installation of pipework

Select the correct pipe size and install the piping between the collectors and solar station and between the solar station and the thermal store.

System Expansion and Safety

Overheat Protection

European Standard EN 12976 requires that solar heating systems are safe and do not require any special measures on the part of the user when exposed to prolonged high levels of solar radiation without heat consumption.

The worst case situation will occur when the electrical supply is interrupted or the system circulation pump fails. In this case, the collector, which is filled with antifreeze fluid will boil dry and heat up to it's stagnation temperature. The pressure in the system will rise.

Collector Area	Approx System Volume	Expansion Vessel Size
5	18.50	19.00
7.5	23.25	40.00
10	28.00	40.00
12.5	32.75	60.00
15	37.50	60.00
17.5	42.25	80.00
20	48.00	80.00
25	58.50	100.00
30	69.00	**120.00**

Table 5 – Recommended Expansion Vessel Sizes (based on an expansion vessel pre-charge of 2.5 bar and a maximum system pressure of 5.75 bar) – commercially available sizes

An expansion vessel of sufficient size is required to contain the displaced collector fluid. The volume of the expansion vessel can be obtained from the table above and depends on the collector surface area and the system height between the expansion vessel and the bottom of the collector. A special expansion vessel suitable for solar applications is required. Suitable expansion vessels are available from RVR Limited.

It is important that the evaporated solar fluid cannot escape from any automatic air vents. If automatic air vents are installed close to the collectors, they should be fitted with ball valves to allow shut off after commissioning.

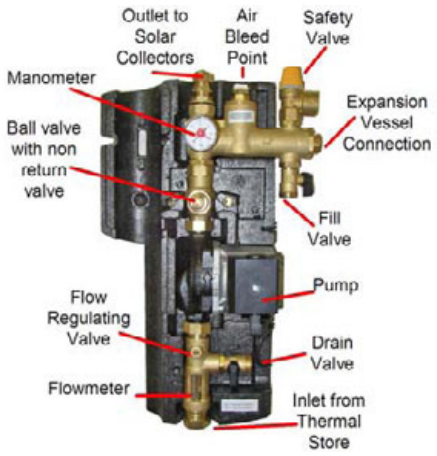

Fig. 57 – Solar Station Components

Safety valve

A safety valve is required by law to be fitted in each section of the collector system which can be shut off. The safety valve must be carefully chosen to cater for the temperature to which it will be exposed. The Safety valve should be piped to a drain. The safety valve is incorporated into the Flocon S solar station.

Installation of Expansion Vessel

The expansion vessel is connected to the expansion vessel connection on the Flocon S solar station. A flexible metal hose is supplied for this purpose, and comes with a wall bracket and connector for ease of servicing.

Setting of Expansion Vessel Pressure

The expansion vessel pre-charge pressure should be checked and set to the correct pressure.

Controls and Pumping

A solar station is a standard part of every RVR solar system.

It contains most of the essential control, pumping and safety devices required for satisfactory operation of the solar system.

Thermal Store

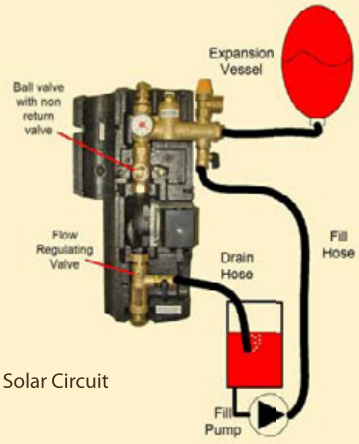

Fig. 58 – Filling and Flushing the Solar Circuit

The thermal store should be well insulated.

If an unvented domestic hot water system is used, it is important that all of the required safety devices are fitted to ensure the domestic hot water system complies with the requirements of standards and Building regulations.

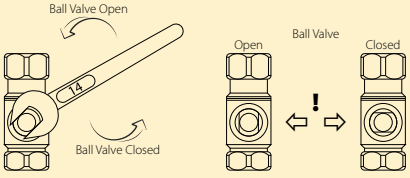

Fig. 59 – Ball Valve

The following safety components must be fitted in the DHW circuit

- Safety valve (release pressure setting = 6bar)
- Expansion vessel (see table 4 for sizes)

Flushing, Filling And Leak Testing

Solar Fluid

The lowest recorded temperature in Ireland is almost -20°C. The solar fluid needs to have a freezing point below this temperature. The addition of 40% propylene glycol to water will produce a solution with a freezing point of -28°C. As propylene glycol is non-toxic and is not an irritant, it is very suitable for use in solar systems. Ready mixed non toxic food grade anti freeze is also commercially available.

Do not use car anti-freeze !!

After mixing the antifreeze concentrate with water to achieve the desired level of frost protection (or using pre-mixed antifreeze) the solar liquid is pumped into the solar circuit through the filling valve on the solar station.

Filling and flushing the solar circuit

- Connect flexible hose to the filling valve under the manometer and open the valve.
- Connect flexible hose to the drain valve and open the valve.
- The slit of the Flow Regulating Valve has to be adjusted horizontally. This closes the integrated ball valve. Open the non-return valve over the pump by adjusting the ball valve with the aid of a combination-or flat-wrench to a position of 45° (half opened, half closed).
- Add sufficient solar fluid for the system into the container of a filling station. Start the pump and fill the solar system.
- Using the filling station flush the solar circuit at least 15 minutes. To get the air completely out of the system, open the Flow Regulation Valve after five minutes and then close it again.
- Do not use water to flush the system as it may present a danger of frost damage if it is not completely purged from the system.
- Close the Drain Valve while the filling pump is running and increase the system pressure to about 3 to 4 bar. The system pressure can be read off at the manometer.
- Close the Filling Valve and switch-off the pump. Open the Flow Regulating Valve (slit vertical).

Please note:

- Start the circulation pump with its maximum pump speed and let it pump for at least 15 minutes.
- To bleed the circulating pump, unscrew the brass screw on the face.
- Afterwards adjust the pump speed to the required speed.
- Adjust the volume flow at the flowmeter using the Flow Regulating Valve according to the values given in the table below.
- Disconnect the hoses from the filling and drain valves and screw the caps onto the valves.
- Recheck the system once again for leaks.
- Open the ball valve above the pump completely.
- Mount the front insulation jacket to the solar station.
- Allow the system to run for several hours to clear further air from the system.
- The system is now ready for use.
- Refer to the controller instructions for further system settings.

Electrical Wiring

- The following are the wiring requirements for the solar system:
- The Solar Station requires a 220V, 50 Hz power supply. Fuse at 5 amps.
- A temperature sensor (PT 1000) should be fitted near to the bottom of the thermal store. This should be wired to the S2 connection on the solar station via a 2 core cable.
- A temperature sensor (PT 1000) should be fitted to the outlet of the collector. This should be wired to the S1 connection on the solar station via a 2 core cable. Please see diagram below.
- When the solar station is used to control the supplementary heat source, a second sensor will need to be fitted to the upper third of the thermal store. This should be wired to the S3 connection on the solar station (where available) via a 2 core cable. Please see diagram below.

Fig. 6oa – Electrical Wiring

Fig. 6ob – Electrical Wiring

Maintainance

The RVR solar heating system requires minimum maintenance to ensure continued efficient operation.

The following maintenance should be carried out periodically. Every two years would normally be sufficient as a maintenance interval.

- Check that all the fastening screws of the collector supports and the screws of the fixing pads are secure and well tightened. If not, fix them properly or change them if necessary.
- Clean the glass of the flat plate collectors or the vacuum tubes to increase efficiency.
- For vacuum collector models change any broken vacuum tubes. To change a tube, loosen the screws of the retaining bracket on the lower part of the collector and slide out the broken tube.
- Slide the new one in place and re-mount the bracket.
- A broken vacuum tube does not prevent the system from running, but it will cause the loss of efficiency and will be liable to frost.
- A vacuum tube that contains a white dust at the lower end of the tube has lost its vacuum and must be replaced.
- Check the level of the thermal fluid and fill the system if necessary using the filling method described in the previous section. The PH level and freezing point of the thermal fluid should also be checked.
- Check for any leakage in the collectors and joints.
- For any other queries about maintenance and troubleshooting, please contact RVR.

Installation Tips

- Remember that the solar fluid can reach temperatures as high as **200°C** under certain circumstances.
- On the Calpak 12-VTN vacuum panel, there is a dry pocket built into the top **left** of the panel close to the 22mm copper pipe header. This is the position where the temperature sensor must be installed.
- **Always** fit the PT-1000 sensor which has **black heat resistant** silicone cable to the outlet side of the solar panel. This is the hottest place in the circuit.
- On the Calpak 12-VTN vacuum panel the flow (**hot**) connection to the solar coil is on the top left, and the return (**cold**) from the solar pump outlet goes to the top right of the panel *(anti-clockwise circuit).*
- If the collector sensor is on the return side of the circuit the system will **not** work properly because it will be cooled too fast.
- **Always** fit the sensor for the solar heating as close to the **bottom** of the storage tank as possible to maximise the volume of hot water.
- The solar coil in the heating tank is generally the **lowest** one available.
- For efficiency reasons the flow (hot) solar connection is the **highest** of the solar coil connections. (*Some TiSUN tanks have a different configuration see diagrams)*
- Always use pipe thread sealant where you have male to female threaded connections *(Check with your sealant supplier for compatibility i.e. Propylene glycol@200°C)*
- Compression fittings and flat seal connections **do not** require any sealant or tape as they are designed to be fitted dry. *(In fact some sealants can be deposited on the threads and stiffen the nut resulting in an under compressed connection.)*
- Invest in proper tools for the job e.g. use **two** tight fitting open spanners on compression fittings.
- If the installation is in an **awkward location** the panels could be laid out at ground level and all the connections can be pre-made, then take them apart and re-do the arrangement on the roof.
- Do **not** fully tighten the mounting clamps on the brackets until you have all your compression fittings fully tightened.
- Hold the **body** of the compression fitting still, and tighten the back-nut, this ensures that you don't twist the copper pipe causing a leak somewhere else.
- The Calpak 12-VTN vacuum panel comes with a white plastic wrapping; ideally this should be **left on** until they are commissioned.
- **Never** fill solar panels when they are **hot,** the solar fluid will get very hot and may even vaporise suddenly, causing burns and/or broken vacuum tubes.
- An air compressor is very useful for pre-checking the circuit for leaks. Pressurise the system to 4 bar, close the valves and observe the pressure gauge for a while.
- The air compressor can also be used to cool down the panels if they are not covered.
- Solar Fluid gets thinner and the flowrate rises as the temperature rises so the system should be commissioned when cold **≤ 30°C approx**.
- The ends of the exterior pipe insulation should be properly sealed to prevent water running down along the metal pipe to the tank/controller
- The simplest and best way to install a collector array is to have them on the same orientation i.e. the same roof surface. If you have them in **different orientations** e.g east/west you will need a controller that can sense the temperature in both arrays and be able to mechanically pump the fluid around the first/second or both arrays at a time.

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