FABRUM
ENERGY SOLUTIONS

# Installation of Solar Water Heating System

This document outlines some approaches to fitting and installing a Solar Water heating system – this information is for guidance only and may not be appropriate for your installation – if in doubt, please seek Professional advice by ringing us to discuss your needs.

The main tasks of the installation, assuming that the installation survey form including site access and safety risk assessment, in addition to having all other tools and equipment in place, are:

Panel Fitting
Cylinder swap
Pump station install
Commissioning
Final operations

## Panel Fitment

The manifold and frame were assembled ready for positioning on the roof (see FES-B20 panel assembly instructions), depending on the type of roofing on the house, particularly if the tiles / slates are friable, it may be advisable to use load bearing blocks under the frame to avoid the tiles being worn away.

This installation used pressure treated angled wooden 'shoes' fitted under the frame and attached using a stainless steel screw with an under head washer, just visible below the hanging strap fixing. The shoes were positioned in the middle of the tile to avoid fragile edges being broken and not too tall causing the above tiles to lift.

**Picture of wooden shoe used to protect roofing tiles from damage.**

The position of the Panel can be roughly determined by using a wooden template of the panel with the appropriate positions marked in place ( Note this template should not be a flat sheet as it can be windy! It should resemble the frame outline as closely as possible and be easily manoeuvrable in windy conditions). The roof mounting straps can then be slid under the tiles from the outside so that the position can be assessed inside the roof space.

With appropriate boarding in place within the loft, it is then possible to determine where all the panels and associated pipework can be sited to avoid the roofing structure and any other obstacles.

**Picture of roof mounting strap at initial location for assessment.**

Where positioning on roof is not compromised by shading or other obstructions it is suggested that the bottom of the panel is located close enough to the bottom edge of the roof to allow assembly of the heat pipes into the manifold without the need to go on the roof, ensuring that the straps are still accessible inside the loft.

**Frame located close to roof edge for ease of assembly and maintenance.**

Once it is established that the positions are OK then the roof structure can be prepared for hanging the solar panels.

Several different methods are possible, here are two preferred examples:

**Left picture shows conventional screwed in place 3”x2” noggin ( 5 screws each end) with strap shown screwed in place. Right picture shows noggin attached using a Cullen mini-hanger with the hanging strap temporarily clamped in position.**

A third option to fix a 3”x2” batten ‘underneath’ the roofing trusses can be used where any additional edge loading of the tile can be accepted (the strap angle over the tiles is normally more bent which leads to higher edge loads).

Once the position of the pipes has been finalised, the holes can be made in the roof tiles. If a spare roof tile is available it is useful to trial drilling a 22mm hole through using a masonry bit with the drill set to the ‘non hammer’ setting. Where the tiles are very hard, use either a diamond hole cutter or after removing the tile an angle grinder

with a small diameter disk to grind away the back of the tile locally before tapping through with a small ball-peen hammer.

Apply some lead compatible sealant around the hole before sliding the pre-shaped lead tile into place. (See our 50p guide fro creating your own weather-tight joints).

**Picture shows finished tile in place**, Armaflex HT installation with glued and taped joints and cable ties to ensure that the insulation will withstand the onslaught of weather. Other joints shown below.

Before completing the insulation of the pipework and fitting of the vacuum heat pipes, ensure that the pressure leak testing of the whole system is completed and that all joints are leak free ( see section on commissioning for details).

**Note: The heatpipe end may become extremely hot if the tube is left exposed to the sun – keep them under wraps until needed. Only complete the heatpipe assembly once the system is filled.**

See FES-B20 Panel Assembly Instructions for further details on insertion of Heat-pipes etc.

**Picture of panels completed and in place.**

**Cylinder Swap**

Before commencing work ensure that the new cylinder will fit into the available space and will pass through the access aperture.

This installation was to replace a conventional vented hot water cylinder, care should be taken to ensure that on draining the cylinder that a vacuum is not created inside the cylinder as this may cause collapse.

Typically, this will involve:

Isolation of the cold water supply via. the service valve for the cylinder. Or, if not available, through isolation of the cold water feed to the header tank.


**Picture shows original cylinder and location of service valves.**

The boiler had been switched off previously to allow the boiler and heating system to have cooled down. Once cooled, the heating circuit was drained.

We checked that the tank contents were cool ( less than 40 degrees Celcius) before draining the cylinder (water can be run off to reduce the cylinder water temperature, if required).

The Isolation valve for the cold water feed was closed

We attached a suitable hose to the cylinder drain point (ensuring that it is capable of withstanding the cylinder water temperature), the drian point and hot taps were opened.

After completing the majority of the drain down the lower joint to the cold water feed isolation valve was loosened to allow any remaining water in the pipe to drain.

The Cylinder was removed and before fitting the new one, the 22mm tundish drain pipe hole was drilled through the 18” stone wall.

The electrical supply for the controller was already in place.


The new 1800mm tall, 400mm diameter cylinder was put into position having suitably strengthened the flooring support. The cylinder position was close to an outside wall with two joists  being spanned by two layers of 16mm marine grade ply glued together.

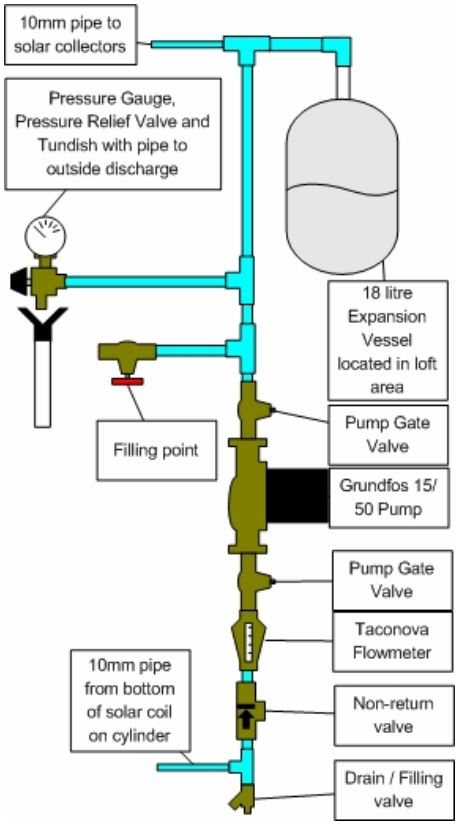

As the cylinder is relatively tall an additional bracing bracket was used at the top.

The boiler coil legs were extended and re-fitted to the new cylinder, the cold water inlet and hot water out were re-fitted to restore the standard hot water supply.

Once this was completed the Pump station and remaining solar pipework was begun.

**Pump Station install**

Whilst there are a number of pump stations available pre-plumbed for this installation individual components were used. The layout was as follows:




The collection of components to be fitted in the cupboard were carefully mounted on a board for ease of fitting and future servicing, should this be required. The expansion vessel was mounted in the loft as little space remained in the cupboard and ease of future servicing dictated that this would not be easily removed from the cupboard if it were located there.

**Note: Expansion vessel mounted upside down compared to normal heating system and on an un-insulated pipe leg on the colder return side to minimise any heat to the vessel.**

The pump station was mounted inside an adjacent cupboard and could be completely removed through the access door.

**Pump station shown left with flowmeter just visible with removable insulation in place.**

**PRV, pressure gauge and tundish shown whilst pressure testing in progress (see commissioning section)**

**Filling point and mains supply detail**

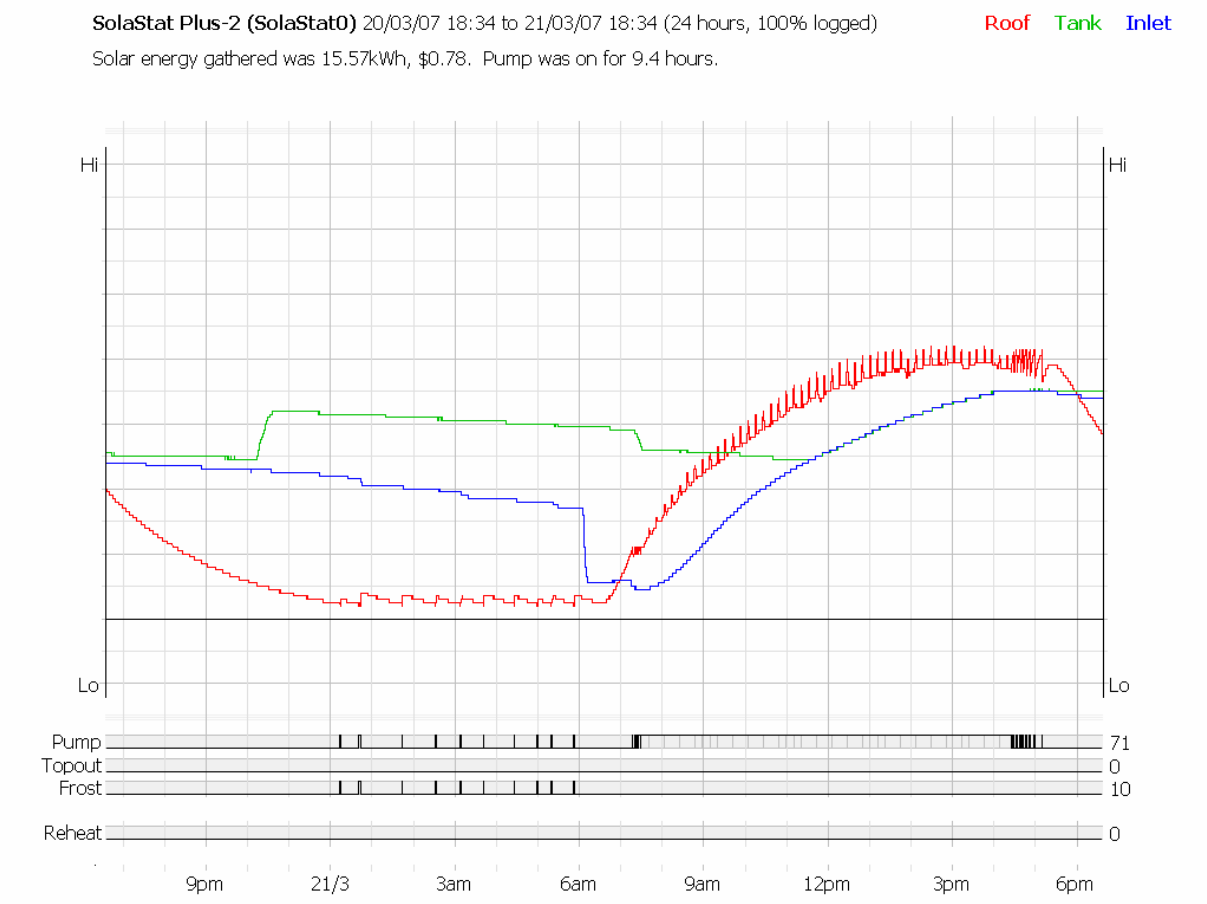
The remaining pipework to and from the panels was completed and the specially designed, easy access, air release system plumbed into the feed to the solar coil **(shown right)**.


**Controller installation**

The controller has three temperature probes and provides an output to a PC to log data as it happens. The probe in the outlet of the collector runs through the leaded roof tile with the pipe. Due to the long length between the collector and controller (over 13m) the probe for this controller was extended using bell wire (note – this may not be appropriate for all types of temperature probe).

The cylinder upper and lower temperature probes were inserted into the cylinder probe pockets with some heat conducting paste left over from the Solar collector assembly and secured in place with a small wedge.

The pump was wired into the controller and once connected was ready for programming.




The initial data from the system was used to fine tune the system and to ensure that the back up heating was programmed to suit customer needs.

**Commissioning**

The commissioning began once the pipework was complete, though a number of smaller tasks including fitting the controller were carried out in parallel.

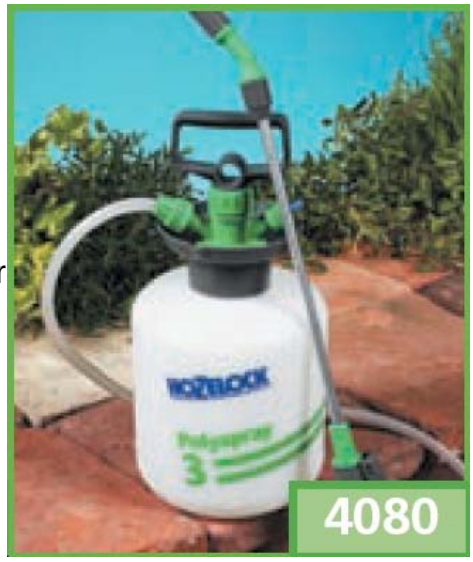
Initial filling was to see if the system would hold any pressure, the air removed through the automatic air vent, once confirmed the pressure was raised to 1 bar and all joints were checked. Once any weeps were fixed the system was left for a further 1 hour at 1 bar.

At this stage the system was thoroughly flushed to remove any residue or particles from the system.

The Pressure was raised to just above 3 Bar to test the PRV operated correctly, both opening and closing and once all air had been removed, the system was then left at 2.7-2.8 Bar for an hour for further leak checking. After confirming that there were no leaks then the process of filling with Antifreeze could begin.

After calculating the system volume ( see Expansion vessel and system calculations in separate document) and determining the correct operating pressure for the system the amount of antifreeze required to achieve a 40% antifreeze mix was determined.

This was added to the system via the filling point using a modified Garden sprayer (e.g. Hozelock Polyspray3) or can be introduced through the top of the automatic air vent (after removing the top and float)). The system can then be fully pressurised using the available mains pressure from the filling loop. Care was taken not to over pressurise the system at this stage as the antifreeze would be over diluted due to the expansion vessel accepting more fluid at a higher pressure.




Once the pump gate valve had been re-opened the system pump was used to fully mix the fluid before the concentration checked using a hydrometer to ensure it was in the correct range.

During initial bleeding of the system the pump was set to maximum speed and all valves fully opened to allow maximum flow rate. The pump was switched off and on to help remove air through the automatic air valve (AAV). Once the system was operating quietly with a steady flow rate the pump was switched to the lowest speed and the flow rate set to 1.5litres/minute using the flow setter part of the flowmeter. Once all air had been removed the AAV isolating valve was closed.

The controllers operation was checked by placing the inlet temperature probe alternately into cold and hot water and observing the pumps on and off temperature differences with the collector temperature shown on controller readout.

**Final Operations**

All pipes were insulated on the solar circuit using Armaflex HT and joints glued and taped with additional cable ties being used on external pipework. Existing cold and hot water pipes were insulated, as were the boiler heating circuit in the cupboard.

Instructions and manufacturers data were passed to the owner and the system operation fully explained.