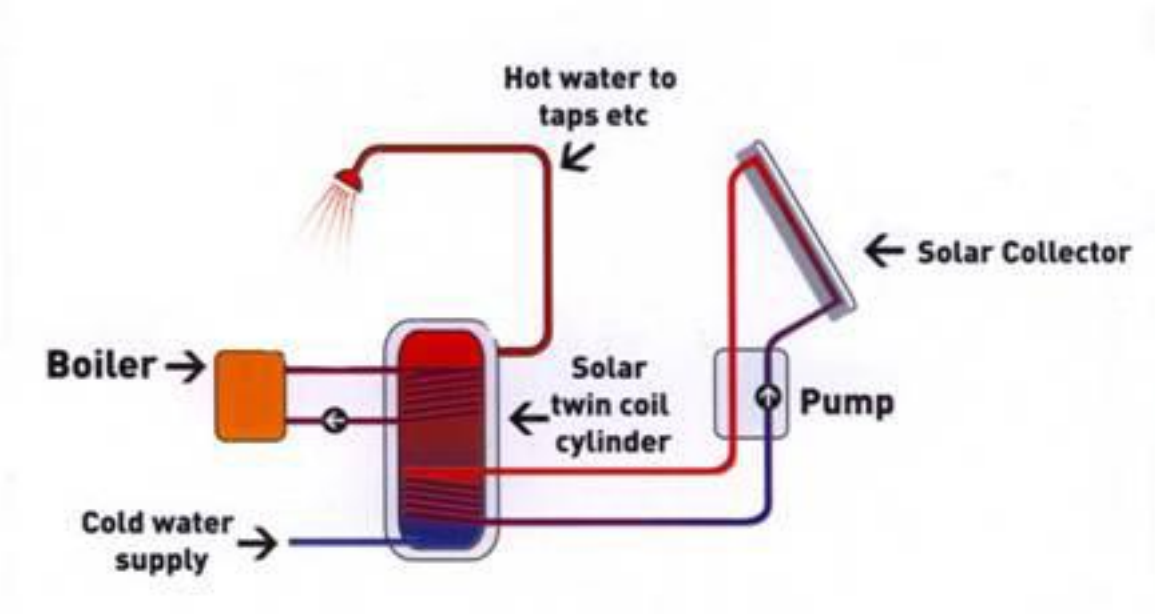
How solar panel hot water systems work

The solar thermal system



Our solar thermal panels consist of evacuated tube collectors (flat plate panels can also be installed). These are attached to a southerly facing roof. Water and a special antifreeze mixture is the pumped through the panel, where it gets heated by the sun. The heat is then transferred by a high efficiency coil in a specialist solar cylinder heating the water (the boiler can be used to top up the water temperature if required).

The different types of solar panels

The panels fall into two main categories: flat panels and evacuated tube panels. Both have got their advantages and are used in different scenarios and different projects. We have installed both types and will give you recommendations for your specific project.

Flat solar panels

Flat panels consist of a layer of glass, an air gap, the selective metal surface that is heated by the solar radiation, a meandering pipe to remove the conducted heat energy, a thermal insulation panel and a back cover to seal the panel.

Flat panels work best when the difference in ambient temperature and the required hot water temperature is small, i.e. in swimming pool systems or hot water systems

closer to the equator. However, they can still perform quite well in Northern Europe throughout most of the year.

A flat panel on a frame that is oriented in the best location to get maximum exposure to the sune

Cross section of flat solar thermal panel.

Evacuated solar tubes

Evacuated tubes allow the solar energy to travel through the glass wall (single or twin) and when it hits the selective surface it turns into solar heat. This is then transferred by a metal heat sink. Evacuated tubes panels tend to perform very well in cooler climates, i.e. when the difference in the ambient temperature and the required hot water temperature is significant.

Viessmann solar thermal tube collector

Vaillant Solar Panel of evacuated tubes
Evacuated tubes come in many different varieties but there are two further main categories.

Heat pipe evacuated tubes

These tubes rely on a heat pipe to transfer the heat from the collection surface inside the tube to the antifreeze that is pumped around the system. Evacuated tubes tend to be the most reliable and can be used in both drain-back and pressurised systems.

Thermomax HP 400 conductor detail view

Direct flow evacuated tubes

Direct flow tubes rely on a flow rate of antifreeze to travel down and up the tube gathering heat. This type of tube is exceedingly powerful, but in order to maintain reliability care must be taken to avoid overheating. This type cannot be used in drain-back systems.

Thermomax DF100 direct flow evacuated tube detail

Pipework in solar thermal systems

This corrosion resistant flexible pipework is used to transfer the energy generated in the panel to the hot water cylinder.

Solar thermal stainless steel pipework with solar sensor cable

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Solar thermal pump station

The solar pump circulates the antifreeze mixture or water mixture around the system used to transfer the energy generated in the panel to the hot water cylinder. The pump speed is electronically controlled to transfer at the maximum rate off efficiency. A PWM (pulse width modulation) pump and controller are used.

Resol Flowsol B pump station

Wilo Yonas PWM (pulse width modulation pump)

The Electronic controller

The solar thermal controller can be set up for several different complex systems, but its basic function is as follows:

- To measure the temperature in the solar panel(s) and compare with the temperature in the cylinder.
- To start, stop and control the speed of the solar pump relative to the temperature difference between the solar panel and the cylinder.
- To switch off the pump when either the cylinder temperature is reached or when there is no more solar thermal energy available.

Resol solar thermal controller

The solar system expansion vessel

During heating the liquid in the solar panel, pipework, coil and pump will expand then when they cool contract. The expansion vessel buffers this maintaining an even pressure.

Solar thermal expansion vessel

Solar pre-cooling vessel (only fitted in certain circumstances)

Where overheating is deemed likely, the pre-cooling vessel is placed in line with the expansion vessel to protect it.

Solar thermal pre-cooling vessel

Pressure relief/discharge vessel

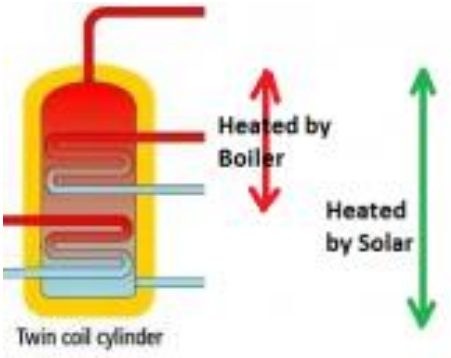
In the unlikely event of the system over-pressurising this will catch the antifreeze discharged by the pressure relief valve.

Solar glycol pressure relief-catchment container

Solar twin coil cylinder

The cylinder has a solar coil at the base that will heat the entire cylinder. If the is insufficient solar gain to get the water hot enough the boiler / immersion heater can be used to top up the water temperature.

Kingspan tribune direct solar twin coil cylinder



Solar twin coil heating explanation