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MEADHAM

ENERGY SOLUTIONS LTD

Solar Thermal.

Owning a solar thermal system can be a very good investment, especially if you have high hot water usage, and in light of future fuel price rises. It is however not a “fit and forget” system, and things can get very expensive if left unchecked. The best way to protect your investment is to get to know your system and how it behaves over the changing seasons, that way if something changes you can act before more damage is done. We recommend the following schedule to maintain a healthy system:

Once monthly

Pressure check.
Correct system design should ensure that a minimum pressure of 1 Bar is maintained at the top of the solar collector (N/A to open vented or drainback systems). The system pressure is usually measured at the pump set or cylinder, therefore the measured pressure will depend on the height difference from there to the panel, and the system temperature.
Normal system pressure is usually between 1&2 Bar.

Expansion vessel check.
The pre-charge pressure can only be checked with the expansion vessel disconnected from the system and at atmospheric pressure. A simple check, however is just to tap the side of the vessel, you should hear a hollow metallic ring. A dull thud indicates that the vessel is full of fluid and has likely failed. This is usually also indicated by a drop in system pressure, but high temperatures can mask this during the day.

Pump and flow check.
If you can access the pump when the system is running you can normally hear that it is working. Most systems also have a flow meter before the pump which tells you that the pump is circulating the fluid. This is also the best place to identify air in the system. If the flow meter has a sight glass you can see air bubbles passing through with the aid of a torch. Air also has a characteristic rattle as it passes through the pump.
Air is the most common cause of component failure and poor performance. If present it must be removed by a high pressure flush.

Annual service

We recommend that the systems are serviced once a year. The best time for this is spring or autumn as working on very hot systems makes air bleeding and pressure setting more difficult. If we have to drain a system in hot weather it is best to cover the panel, but this is rarely an option due to access. The alternative is a lengthy flushing process to bring the temperature down.

A standard service comprises:
System condition and control settings check on arrival.
Drop system pressure and if possible remove expansion vessel for checking. Ideally the vessel should be fitted with a dry brake connection to allow flushing with the vessel removed.
Testing of thermal transfer fluid for antifreeze level and PH.
4Bar System flush (lower pressure if EV cannot be isolated) and leak check, Additional antifreeze is added as required, and flushing runs until all air is removed.
Expansion Vessel pre-charge test.
System pressure set.
Final controls check.

Additional Information:

Pressure relief valves.
On most modern systems the PRV is part of the pump set and is very unlikely to cause a problem. However it was previously common to fit the PRV to the end of the panel on the roof. This is a common point of failure as the units have plastic parts which melt if there is inadequate fluid flow to move the heat from the panel. On a healthy system they can last for years, but when a fault occurs they tend to fail in a spectacular fashion and in the worst cases will send a jet of boiling fluid and steam in the direction they point, which could be your neighbours property.
We would always recommend that PRVs be located within the property and discharge into a closed container for safety and a visual indication that a fault has occurred.

Fluid changes.
Guidelines state that thermal transfer fluid should be changed every 5 years. However the necessity to change is determined by the fluid properties as determined by PH test and Refractometer, far more so than age. If a system is allowed to overheat the fluid will break down and go dark in colour, it will also have an acrid smell. In old systems it is very hard to remove all the discolouration and all fluid will appear dark in the sight glass. A high pressure and temperature clean can help in the worst cases where the fluid has evaporated to a gum like state.
The fluid is diluted and partially changed during the standard service flushing procedure.

Leaks.
There are several situations that we find leaks on a system. These fall into two categories: installation faults and component failure (although they are often linked).
Recurring leaks from new are often a sign of poor system design or installation.
Leaks from pipe joints:
If the system uses stainless pre-insulated pipe there is a technique to cutting and flaring the ends to ensure a sound seal with the washers. We often find very poor end flaring which will continue to leak no matter how many times the washers are changed.
Copper compression type systems often leak due to incorrect joint sealing. This arises from thermal expansion and contraction since a system can see 150-200Deg difference over a season. If there are long, straight pipe runs the olives undergo high stress and if not tightened correctly with lubricating sealant will eventually leak. The solution is often a simple dismantle, clean, and rebuild.
Soldered copper systems are not permitted under regulations now but in our experience are the most reliable, some still functioning well after 30 years. These systems only leak due to corrosion or frost damage, both of which can be alleviated by maintaining the correct antifreeze level.
Leaks from components and pump sets:
These are generally caused by the system overheating to a level that high temperatures reach the components. Correct system design should ensure that this does not occur. There are many parts of a pump set that will degrade if exposed to very high temperatures and will eventually fail causing leaking, often at multiple locations.
To rectify this it is often the case that the pump set needs replacing, or at best a full rebuild with new seals. We would also look at why the overheating occurred and recommend measures to alleviate this in future.

Overheating
Correctly designed systems should be able to handle a period of stagnation during hot weather and not suffer damage (For example a 2 week holiday in August).
Pipe Lengths:
There are minimum distances (steam length) between the collector and the nearest perishable component. As a general rule 3m is a minimum but longer is often required dependant on the size of system. This ensures that very hot fluid does not come into contact with perishable components. It is also goo practice, especially where pumps are mounted close to the collector (i.e. a small loft), to run the pipes up from the panel before descending to the pump. Although counter intuitive to air venting this helps by ensuring that any residual air does not collect in the panel as it would if that were the highest point. Air in the panel will very quickly superheat and allow the propagation of a

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steam bubble which will eventually block the pipe and stop flow (This is characterised by a system which works during marginal conditions but stops during hot weather). This pipe design also increases the vertical distance that hot fluid has to descend and also increases the pipe length.

Expansion vessel sizing, pre-charge, and system pressure:

The expansion vessel is the component which buffers the system pressure to thermal change, and is therefore the part under most stress during stagnation periods. The required size is determined by the collectors fitted and volume of fluid in the system. 18L is a minimum but much larger can be needed. The pre-charge and system pressures are set to ensure the pressure at the panel is maintained above 1Bar to resist the propagation of steam bubbles.

Other causes:

As long as the system has been designed and installed correctly, overheating should not lead to component failure but will shorten the life of the transfer fluid. In this instance, higher than normal collector temperature is an indication of poor efficiency and available heat not being used.

Factors to consider:

Failed component preventing flow such as the pump.

Oversized panel array for heat demand.

Other heat source such as boiler or immersion is pre-heating the cylinder/store, reducing the capacity for solar transfer.

Oversized systems.

There is a good case in the UK for over sizing the collector array compared to the cylinder or store volume in order to provide heat for more of the year. There are several approaches to designing these systems correctly, all of which need to address the issue of overheating in the hotter periods.

Heat dumps are quite common. A diverter valve moves heat to a dump radiator when the store is satisfied, thereby keeping the fluid flowing through the collector and limiting the temperatures. The weak point here is the diverter valve, since its failure will very quickly lead to overheating.

Drainback systems are very good and reliable where the situation allows, since they drain the panel of fluid when the pump stops. Multiple drainback pumps can allow parts of the system to act independently to match demand.

Swimming pools can provide an almost infinite heat sink and are a perfect match to solar thermal since they are generally in use when the weather is hot. A diverter valve allows the cylinder to heat first and then moves to pre heat the pool water via a heat exchanger.