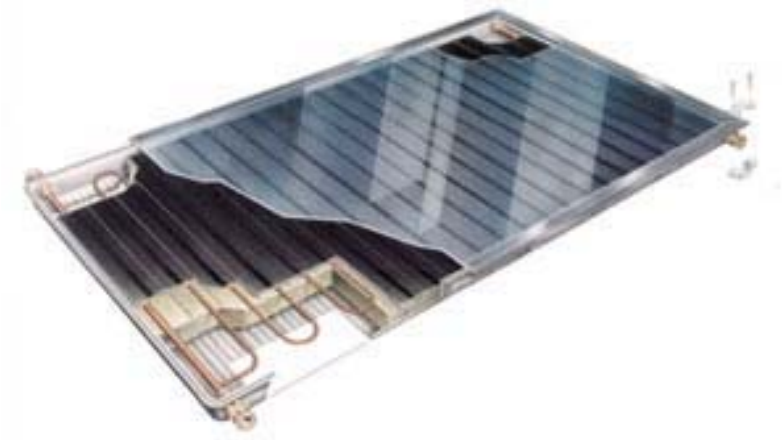
eco hometec

World Class Solar Hot Water Heating Systems



TECHNICAL MANUAL

ENERGY EFFICIENCY™
SAVE ENERGY MONEY ENVIRONMENT

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eco hometec is committed to design, develop and produce environmentally friendly appliances for both domestic and commercial applications

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1.1 Why choose eco hometec

- Compact space-saving design
- High quality manufacture
- Supplied as a complete kit of parts for quick and simple installation
- Virtually maintenance-free
- Unobtrusive roof-integrated solar collector
- Simple and safe feature against overheating and freezing
- High performance
- Low cost
- Tried and tested in thousands of installations
- Domestic water heating
- Industrial water heating
- Hot water for hotels, schools, offices, shops, canteens etc.
- Swimming pools
- Caravans, boats, holiday parks
- Greenhouses
- Fish farms
- Car washes
- Heat exchangers
- Agricultural and industrial processing

1.2 Solar Fact File

1. In half an hour enough of the sun's energy reaches the Earth's surface to meet the World's energy demand for a year.
2. The sun produces 400,000,000,000,000,000,000,000,000 watts of power. That's 400 x $10/^{12}$ TW.
3. The World's average energy consumption is around 14 TW!
4. Just one square cm of the Sun's surface burns with the brightness of 232,500 candles.
5. All the Earth's oil, coal and wood supplies would fuel the Sun for only a few days
6. Solar constant (energy per second before entering the atmosphere): 1,373W/m^2
7. Solar energy reaching the ground (averaged over day and year):
8. In Glasgow 2.38 kW hours/day
9. In Plymouth 3.03 kW hours/day
10. In Europe, around 500,000m^2 of solar water heaters are sold each year and as many as 1.5 million households use the sun to heat water

The sun radiates energy mostly in the form of electromagnetic waves, ranging from infrared through visible light to ultraviolet.

When it reaches the earth's atmosphere, just one square metre of this radiation (measured at right angles to the beam) is equivalent to a power source of well over a kilowatt. About half the energy is lost before it reaches the earth's surface - an estimated 18% is absorbed by the atmosphere and 28-35% is reflected back into space. However, the remaining energy still amounts to about one kilowatt per square metre at the equator at noon.

Solar energy is the source of all life on Earth. Without it, we would not be here today living on such a rich and diverse planet. Most of the energy available to us radiates from the Sun. It provides us with food energy through plant photosynthesis and provides the heat that we need to survive. Trapped solar energy is released when we burn fossil fuel reserves and the sun drives the earth's weather systems, which provide renewable forms of energy like wind, solar and wave power.

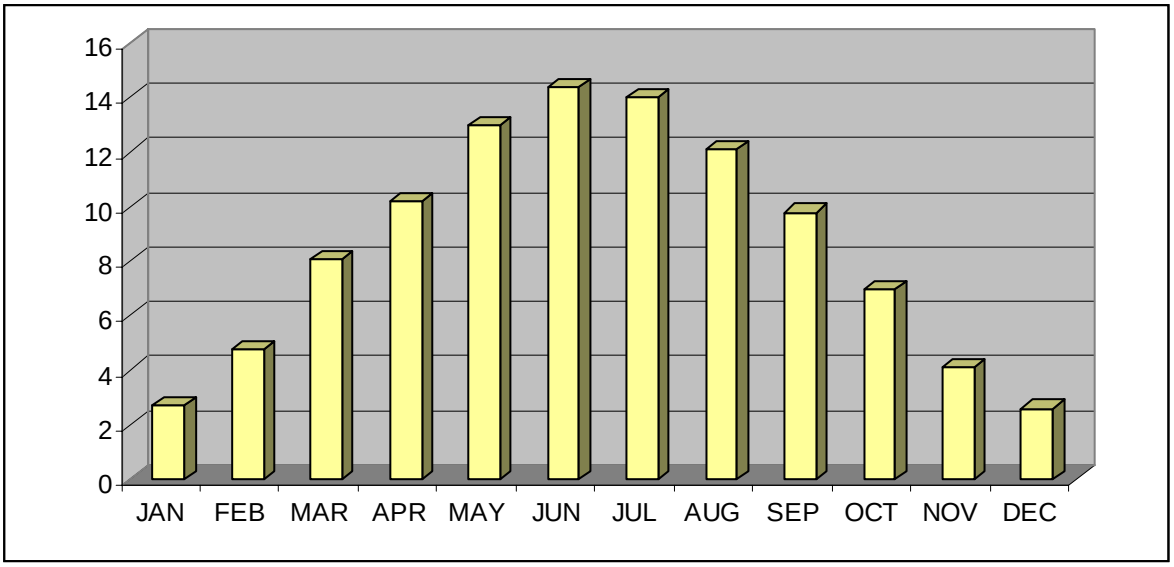
Through advances in the design and performance of solar water heaters we can now capture more of that energy, this manual offers advice and equipment on how to can capture the suns energy. As part of an energy efficient heating system a solar water heater will save fuel, help to achieve reductions in $C0_2$ emissions, and as more use is made of this free source of natural energy, our exposure and that of future generations to dangerous technologies such as nuclear power will be reduced.

1.3 Solar Heating In The UK?

Solar energy availability in the UK is much greater than most people imagine. Indeed the UK receives on average approximately 65% of the annual radiation experienced by the South of Spain and even 55% of that received on the Equator. The solar energy that we experience is accounted for by approximately 40% direct radiation (received when it is sunny) and some 60% diffuse, or scattered, radiation (received on cloudy days).

The solar radiation received on a plane, facing due south, which is inclined at $3O^0$ (this is a typical inclination for solar collectors situated on a pitched roof in the UK, varies from about 900 kWh/m^3 per year in the North of the UK to approximately 1,300 kWh/m^3 per year in the South West. Whilst the highest amounts of monthly solar radiation are obviously experienced in the summer months, there is enough radiation coming from the sun in spring, autumn and winter to make a very useful contribution to a household's energy needs.

Monthly distribution of annual solar radiation received on a plane inclined at $3O^0$ facing South in the South of England.



The contribution that a solar water heating system can make toward a households energy requirements with a properly sized solar system can he expected to provide:

80 - 90% of all summer hot water needs

40 - 50% of spring and autumn requirements

10 - 15% of a household's winter water heating needs

1.4 Types of Solar Collectors

There are four types of solar heat collectors:

1) Un-insulated polypropylene collectors with non-selective surface.
2) Flat plate collectors with with non-selective surface (usually black paint).
3) Flat plate collectors with with selective surface.
4) Evacuated tube collectors with selective surface.

A non-selective black paint is a good absorber of radiation (95%). However is also, when the water in the system gets hot, a good radiator of heat energy. At temperatures required for domestic hot water therefore its efficiency falls.

A selective surface is also a good absorber of radiation. However, unlike black paint it is a bad radiator. In a typical year a selective surface absorber will collect and retain 15-20% more energy than a non-selective surface. The efficiency of a selective surface collector falls with temperature rise but much less steeply than a non-selective surface.

It is commonly believed that evacuated tube collectors have an efficiency advantage over flat plate collectors in the temperature range of 60 – 70^{0}C normally required for domestic hot water. The advantage increases at higher temperatures and decreases below these temperatures.

A recent independent survey carried out on behalf of the Department of Trade and Industry surveyed 700 solar systems installed in the UK between 1970 and 1994.

Among the conclusions were:

Solar domestic hot water systems perform well in all parts of Britain although slightly better in southern areas compared with the north of England and Scotland.

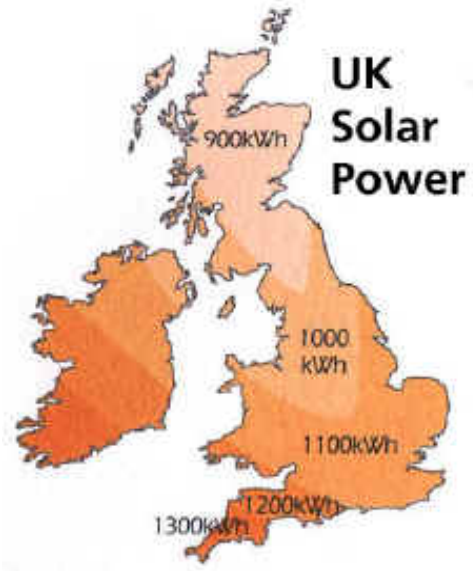
Systems using selective surface flat tubes perform as well as those using evacuated tubes.

Most systems perform as well now as they did when they were new.

1.5 Day Temperatures ^{0}C

Average Sunny Day Maximum Storage Temperatures ^{0}C

	Mid Summer	Mid Winter
Selective Surfaced Flat Plate	70	41
Evacuated Tubes	71	40-42



1.6 The Genersys system

This document is not intended to be a substitute for an installation guide or for the experience and know how of a qualified thermal solar engineer.

It is intended to bring to the attention of the reader some of the issues that Genersys and eco hometec regards as important and which may not be widely known. These issues cover all aspects of thermal solar installations that commonly arise, including environmental issues.

Genersys thermal solar systems are high quality thermal solar water heating systems. They are usually used for domestic water heating but also have industrial applications where hot water is required. Genersys systems are indirect, pressurised, and pumped.

They produce hot water without creating any carbon dioxide or any other greenhouse gas and create no pollution. They produce energy without using scarce fossil fuels and are cost effective.

Its associated company, ThermoSolar AG, manufactures Genersys systems. Genersys have around 100,000 systems actively in use in Europe and other countries in the world. Altogether Genersys systems are used in over 40 countries.

Genersys is an ISO 9001 company and its product is manufactured in a fully qualified ISO 9806 parts 1 & 2 factory. The panels and systems are certified to BS EN 12975 (parts 1&2). This is the highest standard of certification for the United Kingdom and the whole European Community. Very few other systems have this standard. Detailed test results are available on request.

1.7 Flat plate panels or vacuum tubes?

There has been much debate in the United Kingdom that has centred upon whether flat plate panels or vacuum tubes are better for heating our domestic water. Both systems have their supporters and both systems have been around for a number of years, so it is possible to utilize actual case studies and experience in making a comparison, rather than theoretically based assumptions. Every engineer knows that what may be predicated in theory can often prove to be very different when the theory is put to practical applications.

Both flat plate panels and tubes work in the same way; radiated light is used to heat up a surface, usually selectively coated with a substance and in a way to collect light and convert it into heat efficiently. The surface is called an absorber or blackbody. The blackbody transmits heat to a pipe, which carries a heat exchange fluid, and the fluid delivers the heat to where it is needed. Both types of collectors come in various designs with comparable efficiency. The ability to provide useful hot water is in both cases limited by the laws of physics and the demand requirement of domestic hot water.

In the case of vacuum tubes the blackbody is enclosed within a glass tube, which is then evacuated. Light can travel through a vacuum but heat cannot, so in effect the vacuum is used to insulate the system and prevent virtually all heat loss. The glass tube, when evacuated, is connected to a metal condenser and the heat is directed to the condenser, which fits into a manifold. The vacuum seal is located where the glass tubing meets the manifold. The heat exchange fluid passes through the manifold.

In the case of flat plate panels the heat exchange fluid serpentines in pipes connected to the absorber plate. The Genersys 1000-10 and the Genersys 1450 panels are constructed so that the absorber plate wraps around the heat pipe, enabling almost complete contact between the two. Other panels have the pipe welded or soldered to the absorber plate.

Vacuum tubes were first developed by the aerospace industry with the help of copious grants from the German Government and various international organizations. They are manufactured in many countries but the highest concentration of manufacturers is in China, where the products are used quite extensively. Flat panels have been developed in many countries but the leading product design and develop is also German.

It may be thought by a layman that solar collectors are designed to collect as much light as possible and convert it to heat. This is actually not the case. When designing domestic water systems engineers know that in fact what you need is a compatibly designed system of collectors. There is no point in overheating the system because the hot water usage and storage capacity is finite and the way in which people use hot water and the times at which they use also have to be taken into account.

At Genersys, we use ThermoSolar AG designed and manufactured selective coating, which is designed not to get too hot. There are other coatings that we could use, at lower cost differentials, which get hotter but we have to bear in mind that we are not making collectors to create more heat than can be usefully used because the higher the stagnation temperature and the more frequently the system reaches stagnation temperature the quicker is the aging process of the whole system.

We stress that both vacuum tubes and flat plate panels are viable and suitable systems for heating domestic water. If they are properly manufactured they should both give many years of useful production. In larger installations a competent engineer should make an evaluation that takes into account all the factors that apply in the particular circumstances of the user and the location.

The very design of vacuum tubes inevitably creates certain advantages and disadvantages.

1.8 Reasons to install vacuum tubes:-

- They are quite easy to fit as the manifold can be mounted on the roof and the tubes carried up to the roof by one person. Flat plat panels can be heavy. The Genersys panels weigh around 40 to 50 kilograms and therefore need two people to lift them to the roof.
- Tubes perform slightly better in relation to their size; generally a vacuum installation needs around 10-12% less roof space than an equivalent flat plate system.
- If an individual tube fails it can be replaced; the whole manifold of tubes does not need replacement. There is a relatively much higher failure rate of individual tubes (compared to the failure rate of well engineered individual panels). A tube failure can be diagnosed either when fogging is apparent or frost is not visible on a tube when it is visible on other tubes in the same manifold.

1.9 Reasons to install panels:-

- Tubes are prone to over heating because it is difficult to design tube systems in a way that avoids overheating. Some tube systems try to overcome heating issues by incorporating automatic valves in the manifold. Flat plate panels, like Genersys panels, never suffer from overheating that can damage the panels or the system components because the panel is designed specially to avoid this, as the BS EN 12975 testing demonstrates. System components (other than panels) can take temperatures in excess of 120°C.
- Overheating reduces the life of the whole systems and therefore panel systems tend to last much longer than tube systems
- Well engineered panels, like the Genersys range are much more robust than tubes
- The stresses caused by the expansion and contraction of the glass in tube systems (the coefficient of expansion of glass and metal are not identical) can lead to stress where the glass is joined to the condenser and sometimes stress fractures are caused, which means that the vacuum fails. The whole of the heat systems in panels is made of metal; glass covers the absorber plate but rests on a washer which allows of differentials in expansion and contraction.
- The vacuum seal, located as it is in tubes where the glass tubing meets the manifold is actually located upon the hottest part of the collector. This causes stress upon the seal. In the case of the 1450 Genersys vacuum panel the seal between the glass and the metal is not part of the heat pipe and never exceeds 100°C
- The system of holding the tubes in a manifold and securing the tubes to a roof means that in windy conditions minor tube movement can create glass fractures, which lead to vacuum failure. Panels do not suffer from this inconvenience.
- In snowy conditions snow tends to remain in the gaps between the tubes, reducing efficiency, whereas it tends to slide off panels much sooner that it clears from tubes.
- Panels can be roof integrated and are actually generally cheaper to install in new build situations. It is not possible to integrate tubes into the roof.
- Installations with vacuum tubes usually require more service calls than installations with panels owing to the more fragile construction of tubes.

You will observe that we have not touched upon the aesthetics of tubes and panels. This is a matter of personal taste. Some people like an array of futuristic looking tubes on the roof whereas others prefer the flexibility that panels bring; panels can be fitted on roof, in the way that tubes are, but unlike tubes panels can be roof integrated, which I think makes them look more pleasing and fits in better with architectural designs. A large array of panels can be made to look interesting by contrasting the roof tile colouring with them or could be made to blend by using blacks and dark blues as a roof tile colouring.

Finally the proof of this particular pudding is in the eating. In Germany, where both types of solar systems have been used for over twenty years, (in numbers that are far greater than in this country) the market originally favoured

tubes and panels were considered as a second best choice. Today vacuum tubes comprise only 18% of the market, with flat plate panels taking a massive 82%. The end users found panels just as efficient, more aesthetically pleasing but also longer lasting with fewer faults and service calls required.

If you really want vacuum technology or have limited roof space then Genersys can offer a solution with its 1450 panel. This is a flat plate panel that is evacuated on site. It, being a panel, does not have over heating issues, and the differentials in expansion and contraction are not relevant as there is no condenser/glass connection. The vacuum is likely to need re-evacuation every five to ten years but this is a simple job that can be done from inside the building.

Whichever the market chooses, it is important to remember that these products need excellent and careful installation by trained professionals. The technology is designed to deliver heat where and when it is required and years of design and technology can easily be wasted if the installer adopts poor practice.

1.10 Systems using photovoltaic panels to drive the pump

There are systems on the market today, which comprises a plastic thermal panel and a small PV cell. In this system the domestic hot water is pumped through the panel and then into the cylinder. The system requires very little plumbing. It does not have freeze protection because the plastic pipes it uses are designed to freeze without damage being caused.

The pv panel drives a small dc motor, which is all that is required. These systems do not provide a good solar fraction – rarely do they achieve more than 50%, and they are incapable of providing very hot water, although they can make a valuable contribution to a domestic hot water system.

They have the advantage of saving electricity and being able to function in a power cut. In our view these systems are really “hobby” systems. The electricity savings of not having a controller and pump hard wired to the mains are only in monetary terms around £6 per annum. The additional cost of the pave panel is such that it cannot, in our view, be justified on economic terms.

Also it is our experience that long term electrical power cuts most often occur when a thermal system would not be experiencing any solar gain – normally at night in winter when peak demand is high.

If power cuts are caused by adverse weather conditions then in daylight these systems will still function, provided that the adverse weather conditions has not interfered with the water supply.

In our view it is not worth running our thermal panels in conjunction with PV unless the installation is large and it is in an area where mains electrical power is uneconomic.

1.11 Glycol

All our experience in Europe of hundreds of thousands of installations leads us to understand that the glycol far more important than most installers appreciate as an integral part of a good solar system. Our engineers have spent a lot of time working with the glycol producer until they have found a satisfactory product.

Some installers may be using something like Fernox Protector Alphi-11, which contains mono-propylene glycol. If they use it in 25% concentration they will

protect down to -11 degrees Celsius. There are several reasons why we want them to use our own glycol, which has been specially designed for solar installations.

- Our research and experience shows that if you mix glycol yourself you do not tend to mix it with distilled water so introduce some impurities into the solution.

- Our experience shows that if you mix it yourself you rarely mix it thoroughly and you can get crystals forming in solar systems with the high differential of temperatures that can be experiences. These formations, of course, weaken the anti-freeze properties of the glycol and you can get freeze damage to the heat exchange pipes and to the pipes in the collectors. Factory mixed solutions should be used.

- Our solutions protect down to -30°C. Over a ten or fifteen year period all glycol loses its anti-freeze properties to some extent. Our glycol will after 10 years still protect down to -11°C...

- We do not use mono propylene glycol but polypropylene glycol, which is much more suitable because it is approved for use in the food industry and in the tobacco industry and is an ingredient in proprietary hair growing preparations. It is safe and edible.

- Under no circumstances should any ethylene based glycol be used in solar systems.

1.12 Safety controls

Safety

Safety is central to Genersys; we are not aware of any safety issues or claims or proceedings involving our systems anywhere in the world. Genersys Systems are designed to high degrees of safety but account must be taken of the differing safety regulations that apply throughout the world.

The thermal solar market in the United Kingdom is very small. There are various types of systems available (such as drain back, direct, and evacuated tubes) and many of the system types have specific disadvantages. It is important that specifiers may distinguish between Genersys systems and other systems on the market and to understand that safety issues that may arise with other manufacturer's thermal solar systems do not arise Genersys solar systems.

In this context "Safety" includes

- Safety to the Installer when installing a System
- Safety to the Consumer when using a system
- Water Safety Issues.
-

1.13 System overview

A typical Genersys system will include two or more panels mounted on a south facing roof area; the panels contain a sealed heat transfer pipe which directs heat to a coil in a hot water cylinder. The heat exchange is indirect.

1.14 Safety to the Installer when installing a System

Genersys Systems are not marketed towards or intended to be installed by do it yourself unskilled or untrained installers. Every installer authorised to

install Genersys panels has been trained by Genersys. Installers usually have many plumbing qualifications.

Installers are trained to use scaffolding and proper up to date safety equipment and in the dangers of working at heights.

We have several training installers; they are all fully qualified plumbing and heating engineers, members of the Institute of Plumbing and Heating Engineering and some are members of the Water Industry Approved Plumber Scheme (WIAPS) duly certificated.

1.15 Safety to the Consumer when using a Genersys System

There are many safety controls built into every Genersys system. Genersys relies on a number of safety strategies and in our view a properly engineered thermal solar system, like Genersys', is as safe if not safer to the consumer than the consumer using a pressurised central heating system in the home to heat water.

1.16 Over Heating Issues

These are traditionally associated with thermal solar installations. Genersys panels have a stagnation temperature of 170°C, the system has a minimum of an 18 litre expansion vessel, and a pressure relief valve, set to 6 bar, the system is pressurized to 3 bar but tested independently to still remain viable at 10 bar.

The system is designed so that when the Glycol vaporises in the panels (which takes place at about 140^{o}C), the vapour volume is pushed into the expansion vessel. Even on the hottest days the pressure relief valve should not relieve.

The system has a built in solar pressure relief valve rated for temperatures in excess of 180^{o}C. All other components used in the system are temperature and pressure rated well over there expected operating temperatures and pressures on the system. We recommend, if there is room, that the discharge from the expansion relief valve is run to a container within the vicinity of the pump station. This container is twice the size of the volume of glycol above the valve.

All the Genersys controllers control the temperature of the cylinder and will shut the pump off when the desired predetermined temperature (set by the installer) is reached. As can be imagined, the heat exchange pipe work gets very hot. Heat exchange piping must be insulated by using solar quality insulation, so that there is no pipe exposed inside the house that can be touched by the homeowner. This prevents contact burns.

If an unvented cylinder is used, we install an additional two port valve wired to spring shut the flow from the solar, if overheating should arise, in accordance with building regulation G3. The over-heat thermostat is wired though the solar and heating controls so all solar thermal operations stop and is an easy visual indicator to the home owner something is wrong. It must be manually reset as an additional safety measure.

1.17 Water Safety Issues

The solar system is a sealed system, so the heat transfer fluid does not at any time come into contact with the domestic hot water. We require the pipe work on the sealed system to be brazed or else to be joined using recommended compression joints with approved solar quality press fit joints ensuring that pipes have the right support sleeves in place. The cylinder has to be designed

with a separate solar coil. The risk of cross contamination is slightly lower than that occurring in coiled cylinders connected to a boiler which covers both space heating and water heating as we demand a higher specification of the cylinder coils.

Gas central heating that connects to a coil in the boiler has chemical addictives to product pipe work. Thermal solar has anti-freeze properties to prevent frost damage. However, in order to ensure the safety of the consumer we use only polypropylene glycol, which is approved throughout the world for use in food and consumer products. We refuse to approve the use of mono-propylene glycol. Under no circumstances should any ethylene-based glycol be used in solar systems.

Our research and experience shows that installer mixed glycol is rarely mixed thoroughly and never with distilled water. Poorly mixed glycol allows crystals to form in solar systems with the high differential of temperatures that can be experienced. These formations, of course, weaken the anti-freeze properties of the glycol and you freeze damage can occur to the heat exchange pipes and to the pipes in the collectors. Factory mixed solutions should be used.

To overcome the use of incorrectly mixed glycol or the wrong type of glycol, Genersys recommends is own ready mixed glycol solution which it sells with complete solar kits or separately.

Genersys solutions protect down to -30°C. The constant heating and cooling of glycol eventual after a ten year period tends to reduce its anti-freeze properties to around -15°C. The exact state of the glycol can be tested by drawing off a small sample from within the home.

1.18 Installer Safety Issues

When inspecting or servicing any part of the equipment care must be exercised (1) not to turn any valves or change any digital controller settings and (2) not to touch any part of the collector or heat transfer system with bare hands. Very high temperatures can arise in the heat transfer system, which, if touched, will cause severe burn and the shock of which may cause the operative to slip or fall**.**

The Genersys solar collectors can be linked to a hot water cylinder or thermal store.

On average a household in the United Kingdom expends around 1 third of its energy on heating water.

In addition the enormous amounts of energy wasted in transmitting the energy from the place where it is created into the home means that in the average household installation Genersys solar collectors or panels will save 700kgs of carbon-dioxide a year making the most significant contribution to preventing Global Warming available in the United Kingdom today.

The panels are manufactured to the highest specification using high-grade aluminium from one of the World's leading aluminium manufacturers whose product is used in the production of top quality high performance car engines.

The panels are particularly suitable for integrated roof installation where the panel would become an integral part of the building.

The panels have a life expectancy of at least twenty years and require little or no maintenance. Households spend on average 27% to 35% of their total energy cost on heating water.

Panels, which act as a supplement to existing water heating arrangements, will significantly reduce bills and at the same time substantially reduce carbon dioxide emissions.

eco hometec have calculated that if half of our domestic housing were equipped with solar panels the United Kingdom would achieve all its international obligations in cutting greenhouse gases, carbon dioxide emissions and energy from renewable sources.

At times when solar radiation is too low to meet all the hot water needs the existing heating boiler (not part of the package, and can be any make) is tripped in to provide top-up heat.

1. Compact space-saving design
2. High quality manufacture
3. High performance ~Low cost
4. Tried and tested in thousands of installations

Panel are manufactured in Slovakia by the innovative German environmental Architect Johann Kollmannsberger.

Although only 41, Kollmannsberger is one of the leading specialists in this field.

The result of 20 years' development, the system makes solar energy affordable for the small to average home, and is attracting much interest from local authorities and housing associations.

1.19 Genersys 1000 – 4 Solar Collector

The Genersys flatbed collector is design and certified to comply with DIN 4757.

Manufactured from a pressed corrosion resistant housing and framework from sea water resistant aluminium magnesium alloy.

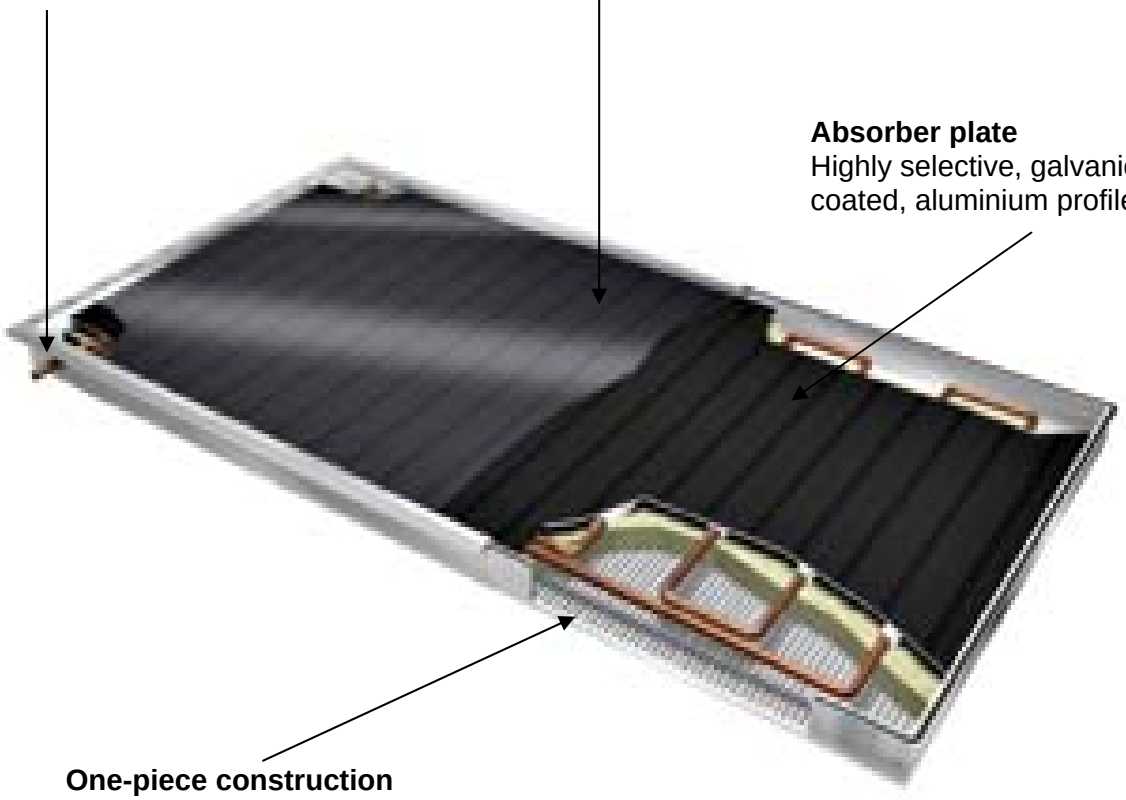
The panel is covered with 4mm low reflective safety glass.
The solar absorber is a galvanically applied, highly selective coating with integral copper waterways.
The panel water connections are connected to the hydraulic circuit by using a supplied clamp fitting removing the need for soldering.

Aluminium fins metallurgically bonded to rhombic shaped copper water ways providing large water to wall contact for maximum heat transfer. Selectively coated surface layer combines metallic nickel in aluminium oxide. Absorption coefficient = 0.97; emission coefficient = 0.13

Hydraulic Connections
Pressure tight clamp connections ~ no need for soldering

Low-reflective 4mm safety glass
Tested to ISO standards for strength and long term durability

Absorber plate
Highly selective, galvanically coated, aluminium profiles



One-piece construction
Pressed seamless Al-Mg corrosion resistant for long life & maintenance free design

Table 1 Technical data

TOTAL AREA	2,03 M²
Absorbing surface	1,76 m²
Linkage dimension	1040x2040 mm
Cover glass	4mm solar safety
Hydraulic Connections	12mm clamp and O ring (supplied)
Panel Casing	Pressed non-corrosive Aluminium – Magnesium sheet
Sensor Phial	4mm or 6mm sensors
Thermal insulation	Mineral wool
System fluid capacity	1.2 litres
Total weight	43kG
Conversion layer	Highly selective based on colloidal nickel pigmented aluminia
Solar absorptive	Min. 0.94
Thermal emissivity	Max.0.16
Optical efficiency	80%
Operating temperature	<100^{O}C
Max. Permissible operating pressure	10 bar
No load temperature at radiation 1000w/m^2 @ ambient 25^{O}C	178^{O}C
Max.working over pressure of system fluid	600kPa
Recommended minimum flow rate for system fluid	60 litres per hour
Part number	S1465GB
Connection length	It is possible to connection of up to 4 collectors in series

Figure 1 Dimensions

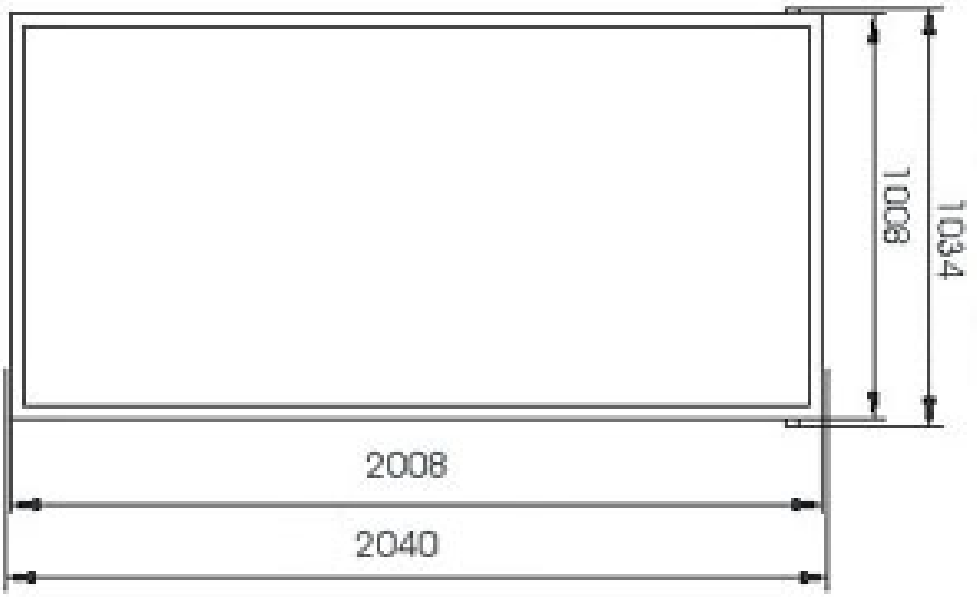


Figure 2 Dimensions

Figure 3 On roof 2 panel mounting frame

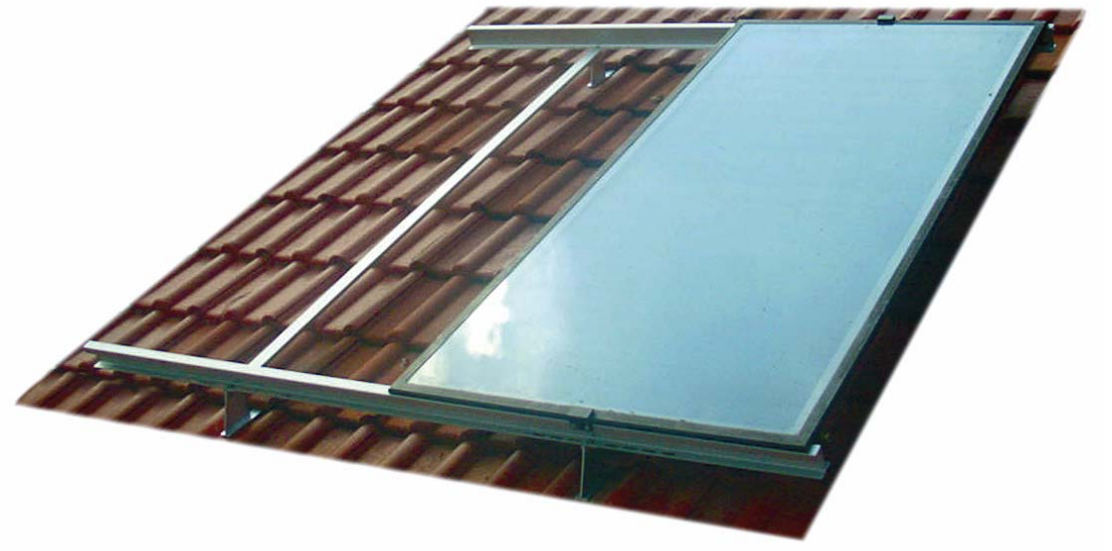


Figure 4 On roof 3 panel mounting frame

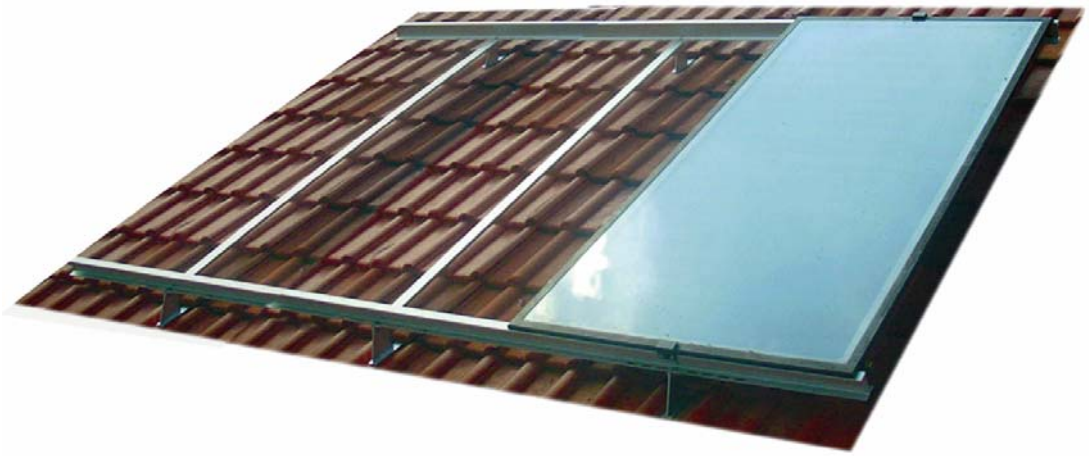


Figure 5 In roof 3 panel flashing and mounting frame

Figure 6 Flat roof mounting frame

Figure 7 Finished installations

- The Genersys 1000 – 4 collector, offers outstanding long term performance and is particularly interesting due to its outstanding price performance ratio
- pressed housing from sea water resistant aluminium magnesium alloy
- collector module with 2m² gross surface
- highly selective absorber layer using patented thin-film technology
- super transparent, non-reflective safety glass
- available with on roof or in roof fitting and flashing kits for vertical or horizontal alignment
- attractive appearance due to modular construction and integral hydraulic connections

1.20 Genersys Advanced Solar Heating Technology

The Genersys system can be used directly connected to an eco hometec Solar Compatible Combi or alternatively as part of conventional boiler and hot water cylinder system.

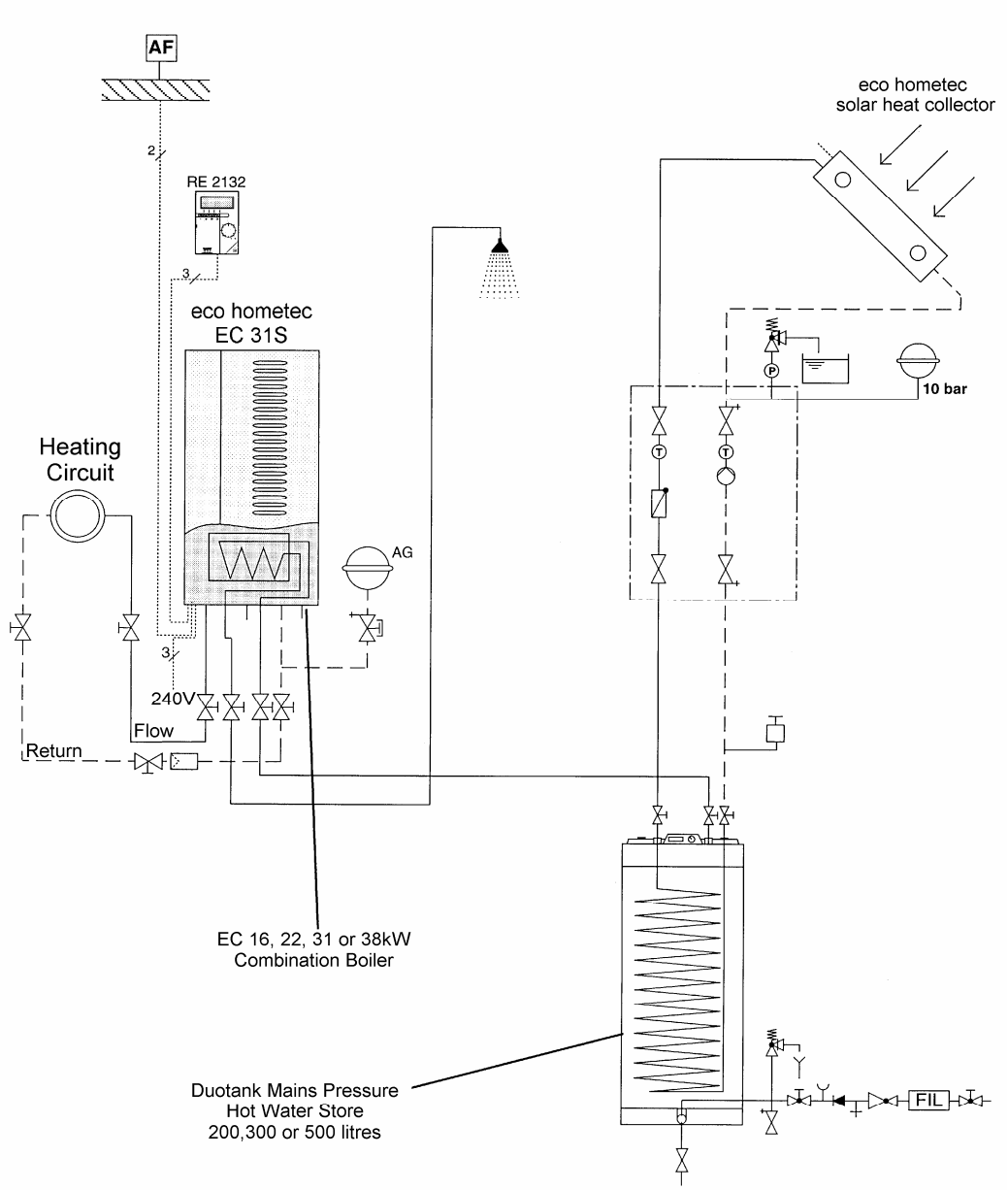
When connected to a solar Combi, solar heated, mains pressure hot water is supplied direct from the AquaSol storage tank to the solar Combi.
Sensors located at the boiler inlet confirm the incoming water temperature and the boilers onboard VCO (Variable Controlled Output) system modulates the burner so as just enough gas is used to raise the water temperature to the required set point, typically 55 – 60^{O}C for domestic hot water.
During the summer months the Aquasol's water temperature maybe greater than the required set point a blending valve, fixed before the solar Combi water connection, mixes cold mains water with water from the AquaSol to the required set point. When the inlet temperature is at set point the VCO system prevents the burner from igniting.

Figure 8 EC25 Solar Compatible Condensing Boiler

FEATURE	BENEFIT	BENEFICIARY THE USER	BENEFICIARY THE ENVIRONMENT
Uses Solar Energy To Heat Hot Water	Less Fuel Is Used For The Production Of Hot Water	✓	✓
Uses Condensing & Solar Energy In One Compact Unit	Can ½ Fuel Bills And Save Up To 6 Tons Of CO_2 Emissions	✓	✓
Pre-Heated Water Improves Combi Flow Rates	All The Benefits Of Combi + Fast Mains Pressure Hot Water	✓	✓

Figure 9 EC25 'S' Type Combi Hydraulic system design when installed with solar heating

Please call the eco hometec technical department for more advice on Solar heating installations.



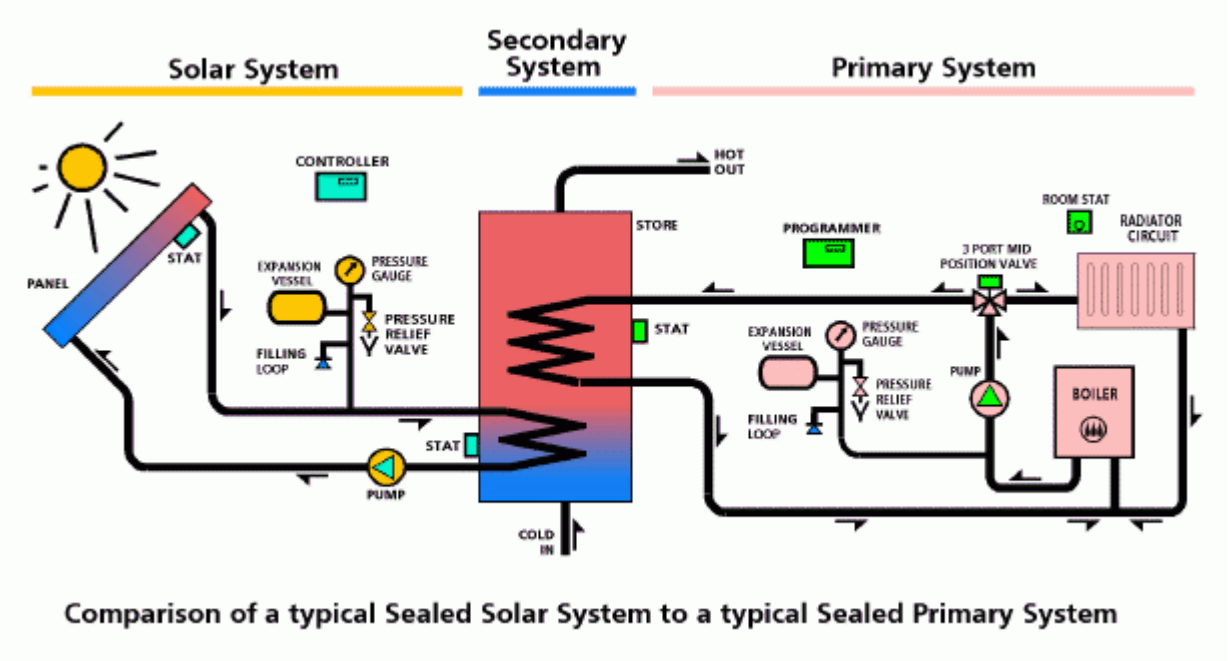
This system design delivers pre-heated, mains pressure water, to the combi. Stored water temperatures can rise to in excess of 80^{o}C. In line blending valve mixes cold mains water with stored water to required domestic hot water set point. Water then passes through combi and boiler controls determine whether to fire the boiler and to what output. Combi used simply to top up stored water temperature to set point. System benefits include:

1. Faster flow rates of domestic hot water.
2. Minimal gas consumption for hot water production.
3. Constant hot water
4. Reduced emissions of greenhouse gases
5. Uses renewable energy and minimises use of fossil fuels
6. Simple controls no need for end user interaction

1.21 Conventional Boiler and Solar Installations.

For traditional boiler and hot water storage tank installations a range of twin coil, copper or stainless steel, insulated tanks are available.

Figure 10 Solar system with twin coil cylinder



Comparison of a typical Sealed Solar System to a typical Sealed Primary System

1.22 Stainless Steel Solar Tanks

The ecoSolcyl is a "ClearSkies" approved twin coil stainless steel unvented hot water cylinder. The cylinder is designed to be used with solar panels but is also ideal for use in properties with two different controllable boilers.

The ecoSolcyl incorporates two separate heating coils in the base and middle of the cylinder. The principle source of heat should be connected to the lower coil and the back-up heat source to the upper coil. The cylinder is fitted with bosses to accommodate solar sensor pockets to enable correct heat control on a solar system.

ecoSolcyl is available in three capacities of 210, 250 and 330 litres. The units can be adapted if necessary to contain 250, 300 and 380 litres respectively by the addition of a separate expansion vessel and removal of the hot water dip pipe.

Equipped with two heating coils it is ideal for a combined boiler-solar panel installation. Thermally insulated with CFC-free, mould injected polyurethane foam.

Figure 11 Stainless steel solar storage

Designed for vertical floor installation the tank is fitted with optional backup immersion heater bosses above both coils.
Factory Insulated and fitted with twin coils eco hometec can fabricate, to order, solar hot water tanks for any requirement. Available in different grades of copper please call the eco hometec sales department for more advice.

CAPACITY LITRES	210	250	330
HEIGHT	1400	1600	2090
DIAMETER	580	580	580
WEIGHT EMPTY	60	64	82
MAX WEIGHT FULL	261	303	397
COIL RATING KW			
UPPER COIL	12	12	18
LOWER COIL	12	26	26

The ecoSolcyl unvented unit is designed for use with supply pressure up to 16 bar.
For pressures over 16 bar an additional pressure reducing valve must be fitted in the supply pipe to the unit. Wall mounting brackets are available for ecoSolcyl unvented units 210 litres capacity

1.23 Solar storage heater controller PS 5510 M

The PS5510 M controller assures optimum performance of the solar system and can be supplied to fit any combination of panel and solar hot water tank installation.

Figure 12 5510 M Solar Controller

1.24 Operation

The solar pump is switched on when the difference in temperature at the collector

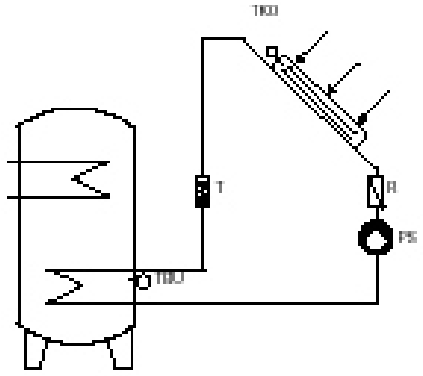
sensor **TKO** and the hot water sensor **TBU** is larger than the given at the programmable set point **dTE**.

The solar pump is switched off when the difference in temperature at the collector sensor **TKO** and the hot water sensor **TBU** is smaller than the given set point **dTA**.

By controlling the speed of the pump, the controller helps to maintain a transfer temperature at the collector sensor **TKO**.

The set point **xs** is given by the following formula:

If the temperature rises above the set "maximum storage temperature" **Tma** the solar pump switches off. If a temperature of above 130°C is reached at the collector sensor, the solar pump is switched off.



Explanation of terms and abbreviations:

PS	solar pump
TBU	hot water temperature / lower sensor
TKO	collector temperature / sensor
BW	mode selector
	Auto = automatic
	ON = pumpe on at 100 %
	OFF = controller off, display only
Tma 85 °C	max. storage temperature 20-90 °C
dTE 15 K	solar diff. ON 0-40 K
dTA 5 K	solar diff. OFF 0-40 K
PH	phase
N	neutral conductor
PE	Power Earth

1.25 Additional Equipment

Extra Solar items available from eco hometec include the following:
temperature & energy recorders
double thickness pipe-insulation
double thickness solar-storage insulation
high recover twin coil hot water copper cylinders
solar compatible condensing boilers & controls.

Systems available for flat roofs, vertical walls, swimming pools, space heating & industrial processes.

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