eco hometec

World Class Solar Hot Water Heating Systems

TECHNICAL MANUAL

eco hometec
Unit 11E
Carcroft Enterprise Park
Carcroft
Doncaster
DN6 8DD
Tel. 01302 722266
Fax. 01302 728634

e.mail. sales@eco-hometec.co.uk

http://www.eco-hometec.co.uk

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

Contents

1. Why choose eco hometec?

1.1 Benefits at a glance

- 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

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 candies.**
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.

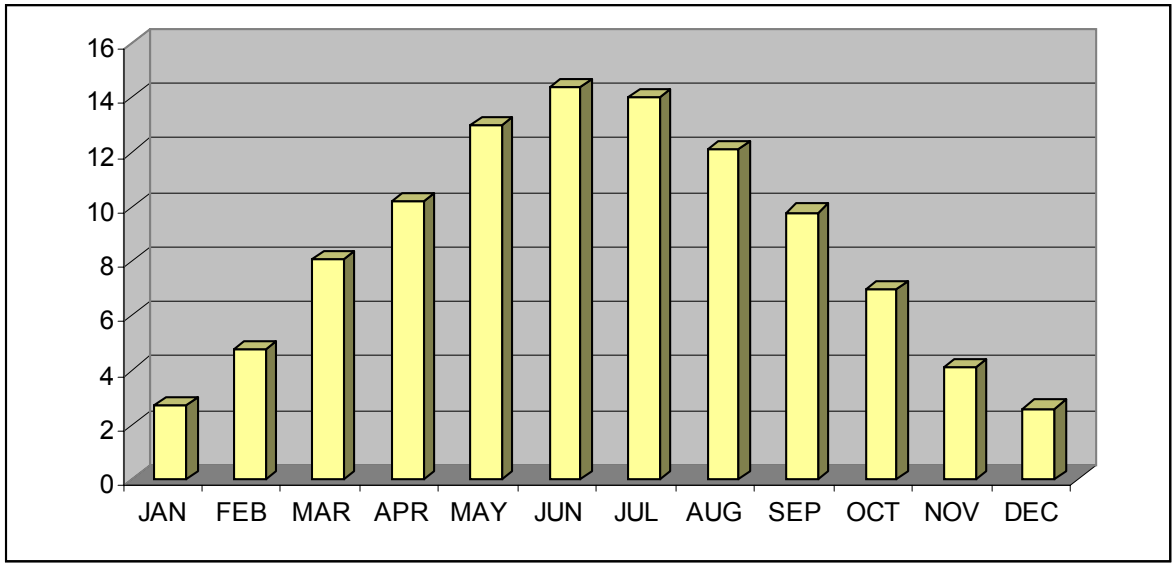
Through advances in the design and performance of solar water heaters we can now capture more of that energy, this manual offers advice and equipment on how to can capture the suns energy. As part of an energy efficient heating system a solar water heater will save fuel, help to achieve reductions in $C0_2$ 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.

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

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.

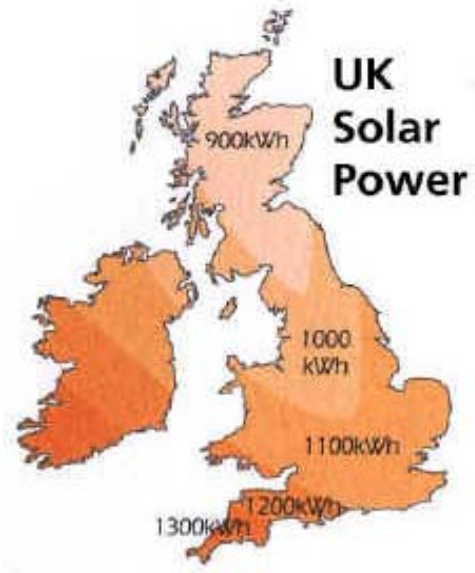
Systems using selective surface flat tubes perform as well as those using evacuated tubes.

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

4.1 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



5. The ecosol system

There is a collector and panel suitable for every budget and every installation.
The collectors can be used to create free hot water, central heating and air-conditioning in domestic and commercial environments.

They are designed in a modular way so that expansion of the system can be accommodated after installation. They will withstand the worst weather and provide high amounts of energy even at Northern latitudes.

All products are made to the highest environmental standards and recover the energy expended in manufacturing them within 2 years. All products are recyclable.

The ecosol 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 ecosol 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.
Compact space-saving design
High quality manufacture
High performance ~Low cost
Tried and tested in thousands of installations

Manufactured by our 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.

6. ecosol 1000 – 4 Solar Collector

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

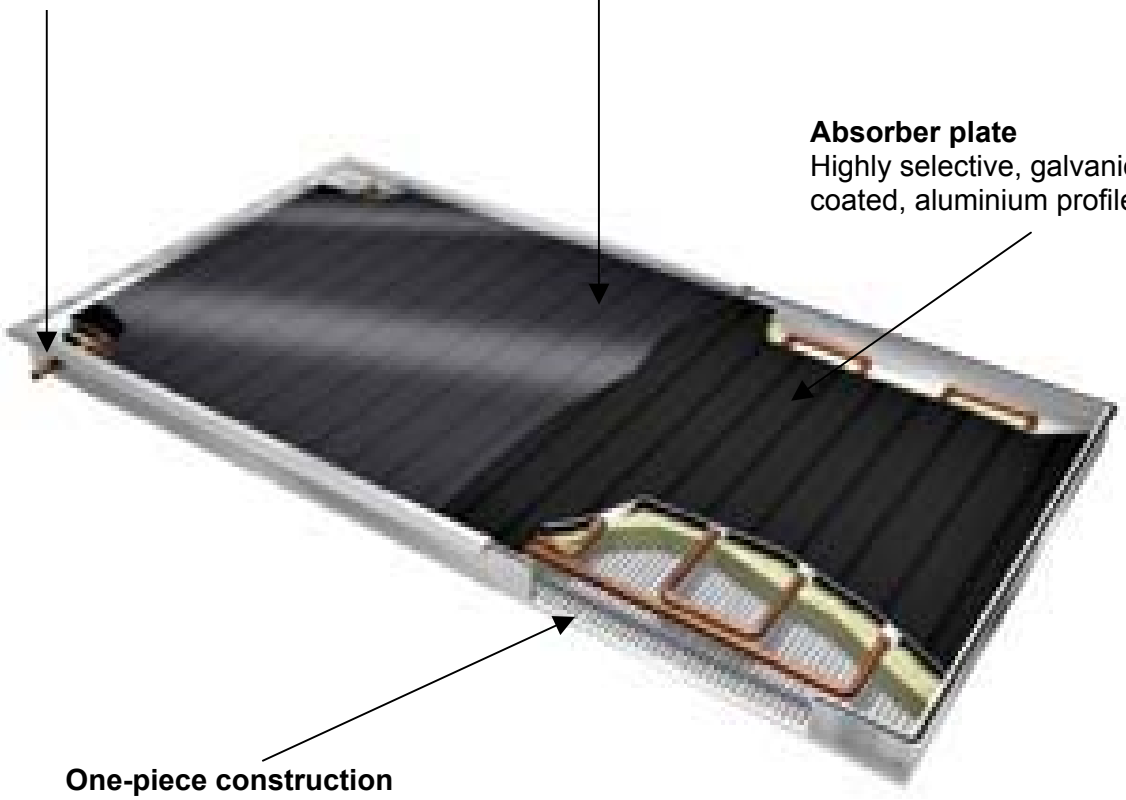
Manufactured from a pressed corrosion resistant housing and framework from sea water resistant aluminium magnesium alloy.

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

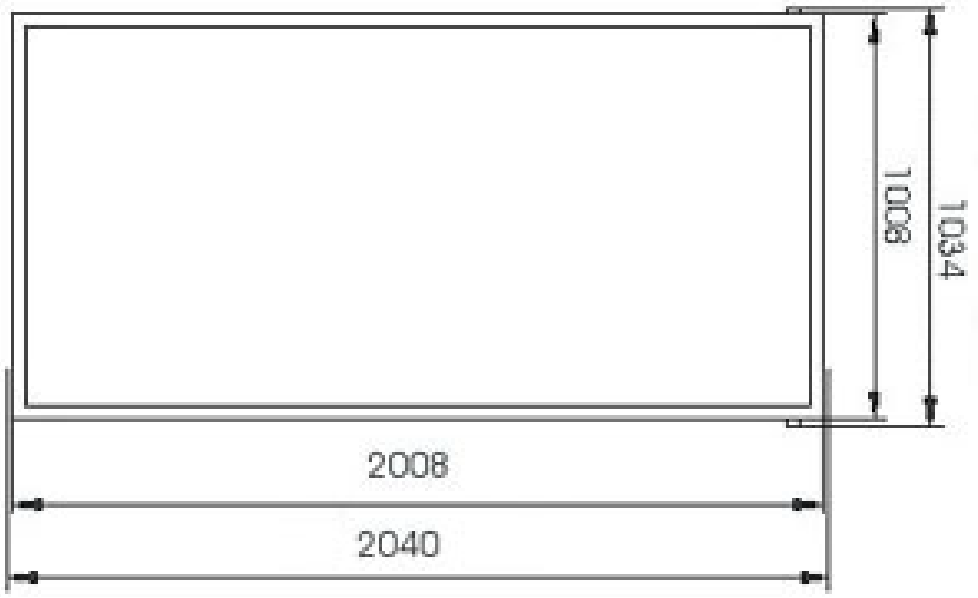


Figure 2 Dimensions

Figure 3 On roof 2 panel mounting frame

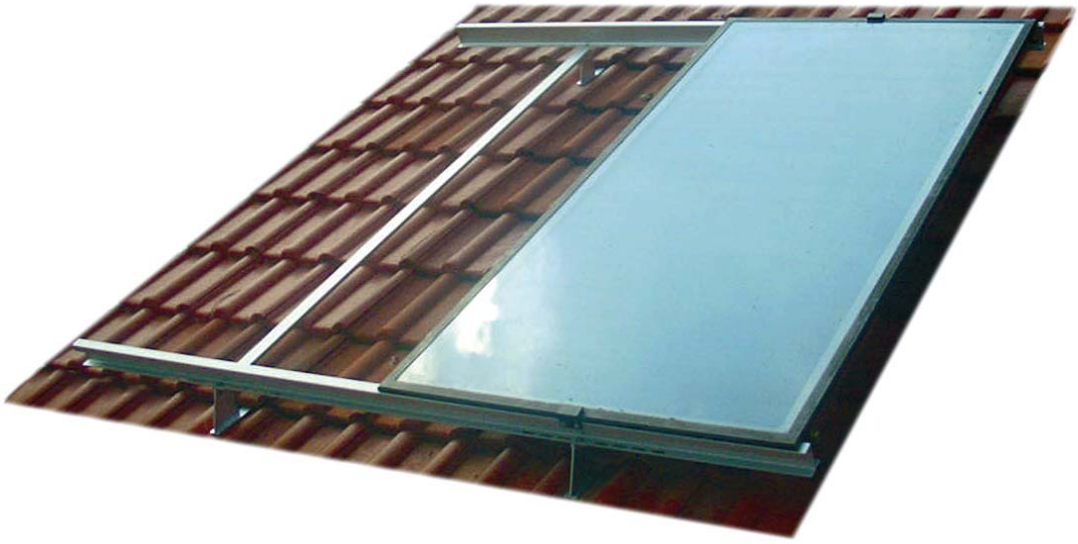


Figure 4 On roof 3 panel mounting frame

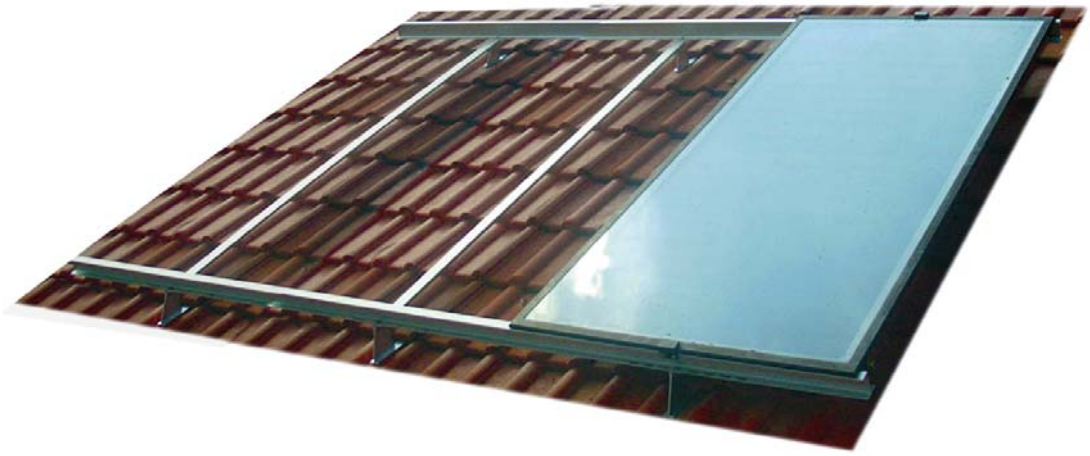


Figure 5 In roof 3 panel flashing and mounting frame

Figure 6 Flat roof mounting frame

Figure 7 Finished installations

- The ecosol 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

7. ecosol Advanced Solar Heating Technology

The ecosol 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.

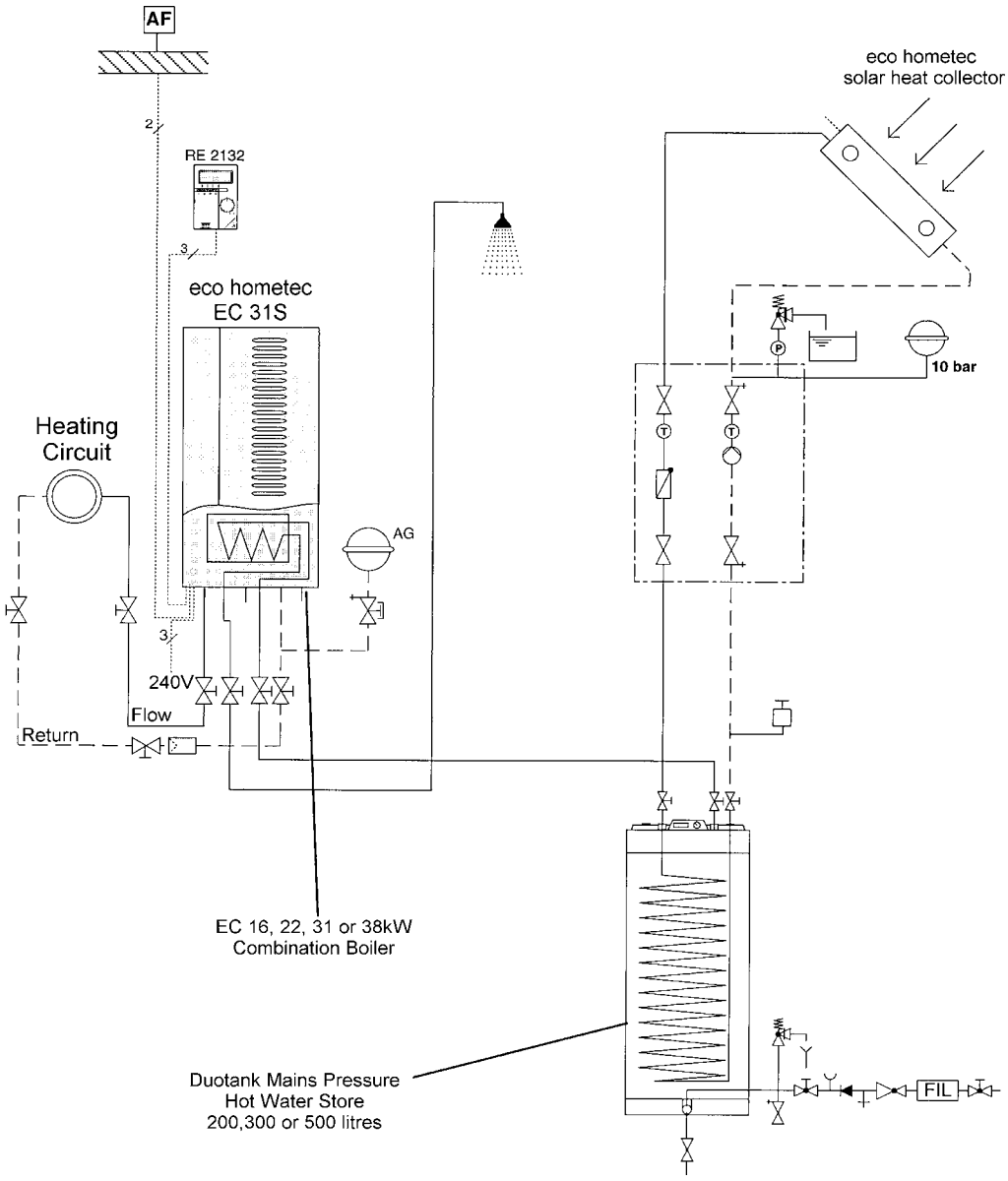
When connected to a solar Combi, solar heated, mains pressure hot water is supplied direct from the AquaSol storage tank to the solar Combi.
Sensors located at the boiler inlet confirm the incoming water temperature and the boilers onboard VCO (Variable Controlled Output) system modulates the burner 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.



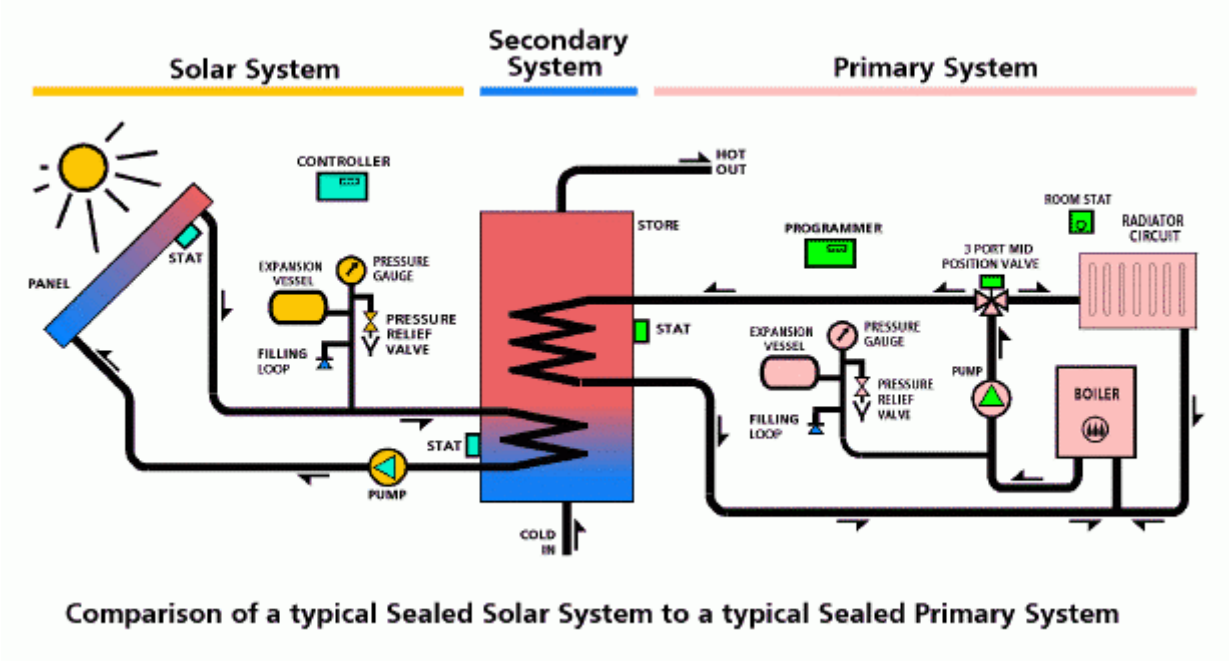
This system design delivers pre-heated, mains pressure water, to the combi. Stored water temperatures can rise to in excess of 80°C. In line blending valve mixes cold mains water with stored water to required domestic hot water set point. Water then passes through combi and boiler controls determine 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

8. 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



9. Stainless Steel Solar Tanks

Stainless Steel mains pressure or vented hot water production and storage tanks, with capacities of 300 and 500 litres.

Constructed of AISI-316, chemically descaled and passivated stainless steel.

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

Designed for vertical floor installation the tank is fitted with optional backup immersion heater bosses above both coils.

The tank has a D.H.W. thermometer on its top cover.

Figure 11 Stainless steel solar storage

10. Copper Solar Tanks

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.

11. Thermal stores or heat banks

The range of Solar Heat Bank units has been specifically designed to provide high performance and quality hot water and central heating services, while making the best use of modern solar technology.

Heat Banks, factory-fitted with all the necessary system controls, allow builders and local authorities to specify the type of system they would like, safe in the knowledge that the entire system is supplied fully assembled, wired and tested, and backed by years of experience in system design.

Heat Banks are manufactured with the installer in mind, the aim being to reduce the amount of on-site labour to a minimum.

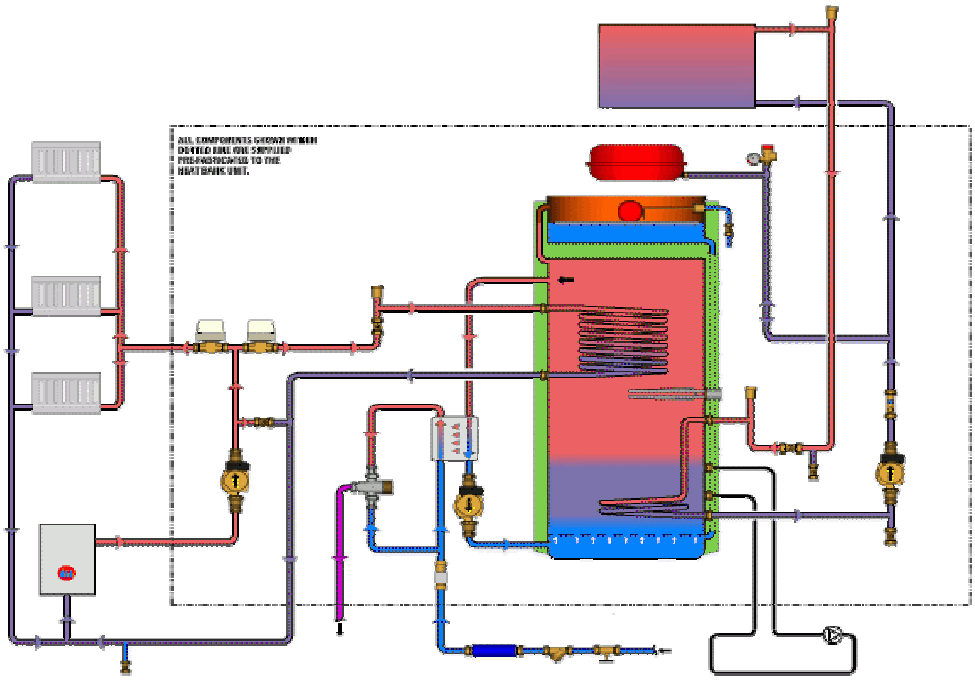
Units are supplied with comprehensive installation instructions, as well as installation check lists to ensure that the final system is put together and working perfectly.

The use of a pre-fabricated system also enables end-users and service engineers to obtain technical information and servicing backup from a central source.

The addition of solar capability to the existing Heat Bank system allows householder to take full advantage of free energy provided by the Sun. The Heat Banks are designed for connection to virtually any type of solar panel on the market, storing thermal energy within the Heat Bank to provide hot water when required.

The components shown within the dotted are supplied prefabricated to the heat bank unit.

Figure 12 Heat bank and components



The Solar Heating Coil is situated in the lowest part of the Heat Bank, to enable the Solar Panels to contribute heat to the entire volume of store water. Two thermostats fitted onto the side of the Heat Bank, in conjunction with a thermostat fitted onto the panel, tell the Solar Controller when the panel is hot enough to contribute heat to the store water. If conditions are suitable, the controller will switch on the Solar Pump, circulating water through the solar system pipework.

Heat will be transferred from the panel into the store water via the solar coil.

The Heat Bank is fitted with a Primary Heating Coil which is connected to a remote boiler.

This will provide the top-up of heat to bring the water in the upper half of the Heat Bank up to 80°C.

The boiler is also used to provide central heating as required. Zone valves divert the flow from the boiler either to the heating coil, the radiator circuit, or both, depending upon the system demands as set by the Programmer.

The Heat Bank is fitted with a 3kW Immersion Heater to act as a backup.

This will require site wiring with heat resistant cabling.

The Heat Bank cylinder itself is fully vented, with its own Feed & Expansion Tank.

The water in the Heat Bank does not mix with the Solar System Water, the Primary Water, or the Domestic Mains Water.

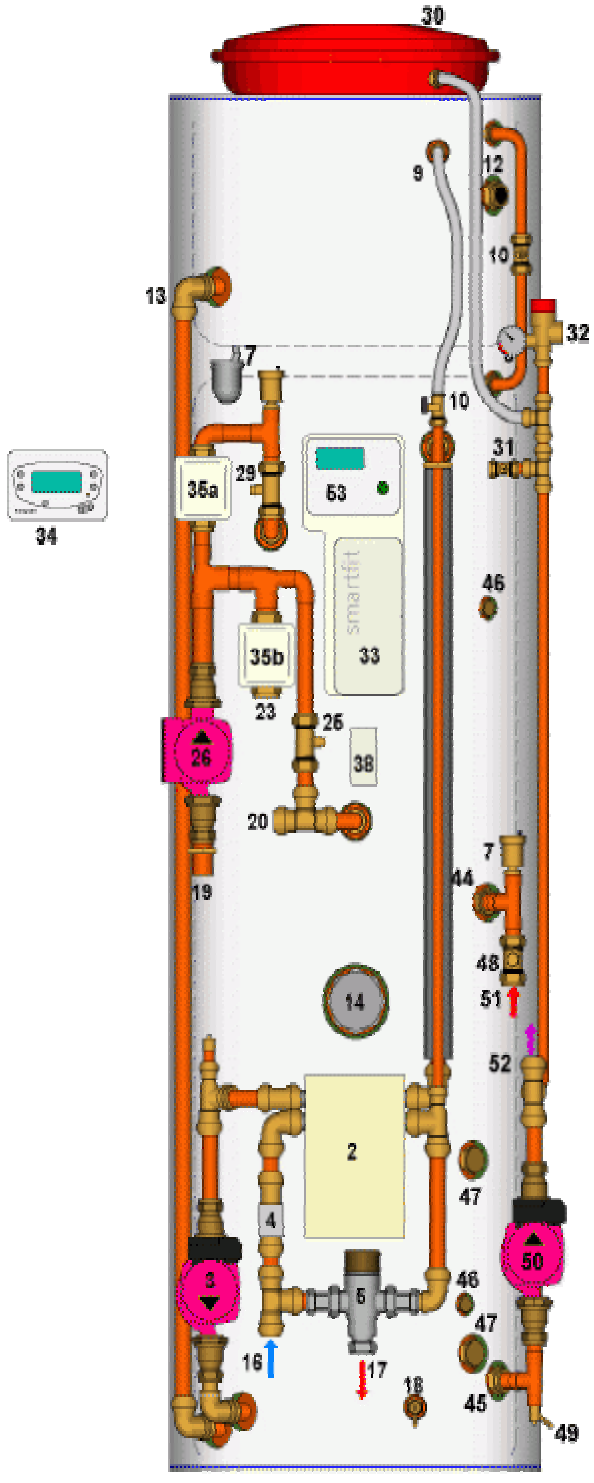
A Thermostatic Blending Valve allows the temperature of the hot mains supply to be limited to a pre-determined temperature between 30 and 65°C as set by the installer/occupier. The setting may be locked to prevent tampering.

A 22mm Y-Pattern Strainer is supplied loose for site fitting close to, and down line of, a Mains Isolating Valve.

A Magnetic Scale Inhibitor is supplied loose, and should be installed immediately following the Y-Pattern Strainer, and no closer than 1 metre from the connection to the Heat Bank.

The Mains Isolating Valve, Strainer & Scale Inhibitor must be fitted in an accessible and clearly visible location within the cylinder cupboard.

Figure 13 Solar thermal heatbank



2 Plate Heat Exchanger
3 Heat Exchanger Pump
4 Flow Switch
5 Thermostatic Blending Valve, Mixcall III
6 Manual Air Vent
7 Automatic Air Vent
8 Filling Vent
9 Feed to Ball Valve
10 Isolating Valve
12 Overflow
13 Cold Feed / Expansion
14 Immersion Heater 3kW Incaloy with Stat
16 Cold Mains In, 22mm
17 Hot Mains Out, 22mm
18 Drain Cock
19 Flow From Boiler 28mm
20 Return to Boiler
23 Flow to Heating 28mm
25 By-Pass with Balancing Valve
26 Primary Pump UPS 15/60
30 Primary Expansion Vessel 8 litres
29 Primary Coil Balancing Valve
31 Primary Filling Point, with Check Valve
32 Pressure Relief Valve with Gauge 3 bar 1/2"
33 Honeywell Smartfit Control Centre
34 Honeywell Smartfit Room Unit, 7 day
35a Two Port Zone Valve - Hot Water 22mm
35b Two Port Zone Valve - Heating 28mm
38 Honeywell Smartfit Cylinder Thermostat
39 White Coated Steel Casing
44 Flow to Solar Coil
45 Return from Solar Coil
46 Solar Sensor Pocket
47 Connections to Solar Heat Dump
48 Check Valve
49 Solar Drain Point
50 Solar Pump
51 Flow from Solar Panels
52 Return to Solar Panels
53 Solar Controller

12. 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 14 5510 M

12.1 Operation

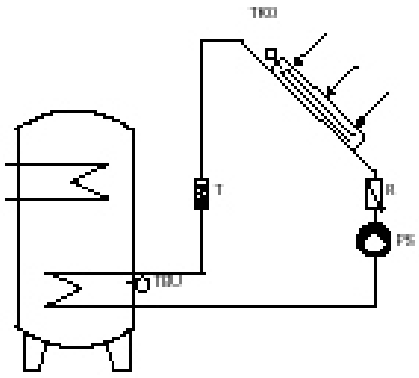
The solar pump is switched on when the difference in temperature at the collector sensor **TKO** and the hot water sensor **TBU** is larger than the given at the programmable set point **dTE**.

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

13. 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.

eco hometec
Unit 11E
Carcroft Enterprise Park
Carcroft
Doncaster
DN6 8DD
Tel. 01302 722266
Fax. 01302 728634

http://www.eco-hometec.co.uk

e.mail. sales@eco-hometec.co.uk