eco hometec

Variable Controlled Output

(VCO) Solar Compatible ★★★★★ Gas Condensing Boilers

EC 25 COMPACT

TECHNICAL MANUAL

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eco hometec has a policy of continuous improvement and reserves the right to change any specification without notice. Your statutory rights are not affected.

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

- Wall mounted ultra high efficiency gas boilers
- Suitable for installation into existing systems, new radiator and/or underfloor installations, can also be used with solar heating systems
- A dramatic reduction of the harmful emissions NOx 8.1 – 27.1 ppm and CO 2.9 – 66ppm.
- Long life Austenitic stainless steel heat exchanger
- Energy saving modulating fan
- Energy saving modulating burner
- Energy saving modulating pump
- Energy saving modulating system water temperature
- Corrosion free PPS plastic flue tubes and fittings offering ease of siting
- Data logging via PC for analysing, performance, operating times, temperatures and for fine-tuning
- Built in digital Weather Compensating comfort controller
- HS specification with dual flow temperatures for under floor heating systems
- One of the most complete energy efficient home heating appliance available
- Guarantee periods Heat Exchanger 5 years other components 2 years
- Free help with technical, design and installation issues

2. Introduction

One of the elements in both Natural Gas and Propane is hydrogen. A gas burning appliance mixes the gas with air and during the combustion process hydrogen and oxygen combine together and produce heat (143,100kJ/kg) and water vapour (H_2O).

For every kg of hydrogen burned 9kg of water vapour is produced. The temperature in the heat exchanger of a boiler can reach 1400^0C. The water vapour produced is so hot it turns into superheated steam.

2.1 The Condensing Process

This superheated steam contains both sensible (available heat) and latent heat (heat locked up in the flue gases). A conventional boiler will recover some of the sensible heat by passing these hot gases over a heat exchanger.

The heat exchanger in non-condensing boilers is generally made of cast iron and cools the gases to between 250^0C and 350^0C. A conventional boiler does not recover any of the latent heat and this energy is simply lost to the atmosphere through a metal flue. These flue gases are extremely hot and the lost energy wasted can equate to up to half of the annual running costs.

A simple condensing boiler will however extract more of the sensible heat and some of the latent heat by cooling the flue gases down to below 100^0C.

When a condensing boiler is operating in its most efficient manner flue gas temperatures of around 50^0C will be achieved and the boiler will now start to condense the flue gases. The superheated steam is cooled to its dew point, typically around 55^0C the flue gases give up their latent heat to the boiler and condense out.

The critical factor that ensures maximum efficiency from a condensing boiler is the water return temperature. The water return temperature determines whether the boiler operates in condensing mode, which in turn controls the boilers efficiency.

To sum up, with water return temperature of 55^0C or less, the latent heat is condensed out of the flue gases.

A typical, non-condensing, central heating system is designed with a water flow temperature of 80^0C and a return water differential of 10^0C. This design differential is critical.

System designs had to incorporate high return temperatures (typically 70^0C) to stop any unwanted condensing of the flue gases. The flue gases leaving a conventional boiler have to be discharged very hot for the following reasons.

To propel the flue gases up a chimney or through a flue they have to be discharged hot to give them buoyancy and enough thermal lift to overcome the flues natural resistance.

If the flue gases are not hot enough the effectiveness of the flue system is reduced and harmful by products of combustion could enter the building via the appliance or its flue.

A conventional boiler has to discharge the flue gases hot to prevent any unwanted condensing. If the flue gases are not kept hot enough they will condense allowing water to run back down the flue and into the boiler.

Clearly this has to be avoided. Heat exchangers made of cast iron, or boiler designs not equipped to discharge this water would suffer imminent failure.

The flue gas discharge from conventional boilers has to be maintained at high temperatures.

Questions you might be asking yourself now might include:

Question? Why were such inefficient appliances designed?

Answer: Fossil fuels were cheap and the environmental consequences of burning and wasting so much fuel were not fully appreciated.

Question? Does an eco hometec boiler need to maintain hot flue gas temperatures?

Answer: No, eco hometec boilers and flue systems are designed and constructed from stainless steel and PPS plastic. The condensate water from condensing flue gases does not affect these materials.

Question? What are the advantages of such a design?

Answer: Unlike conventional boilers eco hometec appliances do not need to waste gas in maintaining high flue gas temperatures.

Question? What does that mean in real terms?
Answer: By design eco hometec boilers use less gas. They are a lot more efficient than other boilers and will significantly reduce your annual heating costs.

Question? Why should I choose an eco hometec boiler?

Answer: Heating our homes and water for showers and baths is very costly and bills in the future will only get bigger. By choosing eco hometec for your next boiler you can rest assured you have chosen the most economical and environmentally friendly boiler available.

Question? Finally, what about the environment?

Answer: All eco hometec boilers use less gas and the emissions from the EC25 range are NOx 8.1 – 27.1 ppm and CO 2.9 – 66ppm.

As you can now see there really is no reason at all for choosing a boiler constructed to an old and inefficient design that needs to maintain high flue gas temperatures.

3. Not all boilers are the same

When deciding on a condensing boiler, we know that as a result of their superior heat exchanger design, we are getting a more efficient boiler. Typical efficiencies of 86% are achievable when fitted to an existing system with an $80/70^0$C design.

But, by lowering the water return temperature, condensing boilers are capable of achieving efficiencies up to 98%.

How then can we lower the return water temperature of our heating, increase efficiency and at the same time save gas?
The eco hometec answer Variable Controlled output (VCO)

To achieve optimum efficiency from a condensing boiler we need to control the temperature of the water returning to the boiler.

This can best be achieved by adjusting the output of the boiler and/or the pump speed.
The outside air temperature generally determines the load on a heating system. In the U.K we size a boiler to provide enough heat to keep a house or building warm at -1^0C.

As the outside air temperature rises then less heat is required to heat the building.
If we were using gas fires to heat our home then as the building warmed up we would turn down the gas fire. This has the desired effect of lowering their output and at the same time reducing gas consumption.
If we are using a central heating boiler to heat our home then in an ideal installation, as outside air temperature rise, we would turn the boiler down to lower its output at the same time reducing gas consumption.

The only problem was, until now, the output of a gas boiler was determined by the set up of the gas valve and only the service engineer could carry out adjustments.

Until eco hometec developed Variable Controlled Output it was simply not possible to constantly adjust a boilers output and flow temperature to cope with changing weather conditions.

3.1 How does VCO work?

Unlike most boilers with a constant input and output eco hometec boilers incorporate an integral compensating and modulating

digital controller that automatically adjusts the boilers output depending on system load requirements.

This feature, Variable Controlled Output (V.C.O.), is the very latest from eco hometec in condensing technology and ensures the boiler maintains optimum efficiencies even when operating at part load.

A key component of VCO is the ECONOX premixing, radiant, gas burner.

A unique feature of the ECONOX burner is its radiation cylinder that has been specially designed to suit the geometry of the combustion chamber. It is composed of a perforated sheet of stainless steel. On the surface of this burner, accurate quantities of premixed gas and air are burnt almost without a visible flame

The eco hometec on-board computerised VCO system with integral fault diagnostic facility ensures that optimum efficiency is maintained when operating in both heating and domestic hot water modes.

According to the required flow temperature, the premixing burner modulates constantly.

To save electricity, a 310Volt DC, high efficiency fan is used with a variable speed and power capacity; if the heat demand decreases, the fan will turn at a lower speed, which results in a lower power consumption.

The air fan is programmed to supply given amounts of air for specific burner outputs.
This air pressure then controls the gas valve, which in turn matches the gas pressure to the required gas to air ratio (1:1).

The combustion gases are then passed through the stainless steel heat exchanger to the atmosphere. During their passage these hot gases are used to preheat both the return water to the boiler and the incoming combustion air thus ensuring that all of the available energy is used as efficiently as possible.

3.2 Approvals

The unit has been approved according to the European standards (CE).

3.3 Modulating pump

A modulating integral circulating pump is supplied, which operates at to different speeds and results in lower power consumption.

This feature is to help maintain a temperature difference of $20^{O}C$ between the flow and return temperatures on systems using radiators.

IMPORTANT. Without VCO (Variable Controlled Output) or an alternative control over the temperature of the return water, the performance of a condensing boiler will be impaired and significantly lower.

A modulating pump is essential in all condensing systems if system differentials are to be maintained.

3.4 Frost Protection

If the flow temperature falls below $8^{0}C$, in order to provide frost protection, the pump will run even though there may be no demand for heat. If the temperature continues to fall, at $5^{0}C$, the burner will also ignite. At $10^{0}C$ the appliance will return to standby mode.

3.5 Year Long Protection

During summer months, the pump and mixer valve (if fitted) are exercised daily. This prevents seizure of internal components thus reducing maintenance costs.

3.6 P.P.S Plastic Flue System.

Due to the extremely low temperature flue gases, the boiler may be flued using the lightweight and corrosion resistant eco hometec P.P.S. plastic flue system. The boiler can be flued over distances previously impossible (up to 100 metres depending on output and flue design) from conventional boilers.

3.7 Additional Features

A unique and patented corrosion resistant stainless steel condensate heat exchanger.
Integral sensors (NTC) for monitoring flow and return water temperatures.

3 way switching valve and facilities for connection to an eco hometec DHW storage module or similar.

Computer controlled combustion analysis with built in fault diagnosis facility. These readings can be down loaded onto a PC by using the interface cable and software available from eco hometec.

4. Description of Appliances

4.1 EC 25 H Compact

The 'H' model is suitable for a central heating system with hot water and heating circuit(s) controlled using two or more zone valves.

The appliance produces a low temperature output for under-floor heating or a fixed/variable temperature output for connection to radiators. Flow temperature to hot water cylinder can be set as required (max. 85^{O}C)

Hot water cylinders must be double feed indirect and to aid efficiency and fast recovery times (all appliances are hot water priority) should be of the high recovery type. Recommended minimum coil capacity 25kW.

The unit has a variable capacity of 32 to 100%, while the maximum capacity can be set and adapted to the capacity of the CH system.

4.2 EC 25HS Compact

The 'HS' range are higher specification. With its 4 x 15mm connections it offers a low temperature output, typically 55^{O}C, for under-floor heating or a fixed/variable temperature output for connection to radiators.

Despite the low boiler flow temperatures feature ALL low temperature under floor installations require an obligatory mixing valve or high temperature cut out thermostat installing as part of the system controls.
Flow temperature to hot water cylinder can be set as required (max. 85^{O}C)

The unit has a variable capacity of 32 to 100%, while the maximum capacity can be set and adapted to the capacity of the CH system.
Hot water cylinders must be double feed indirect and to aid efficiency and fast recovery times (all appliances are hot water priority) should be of the high recovery type. Recommended minimum coil capacity 25kW.

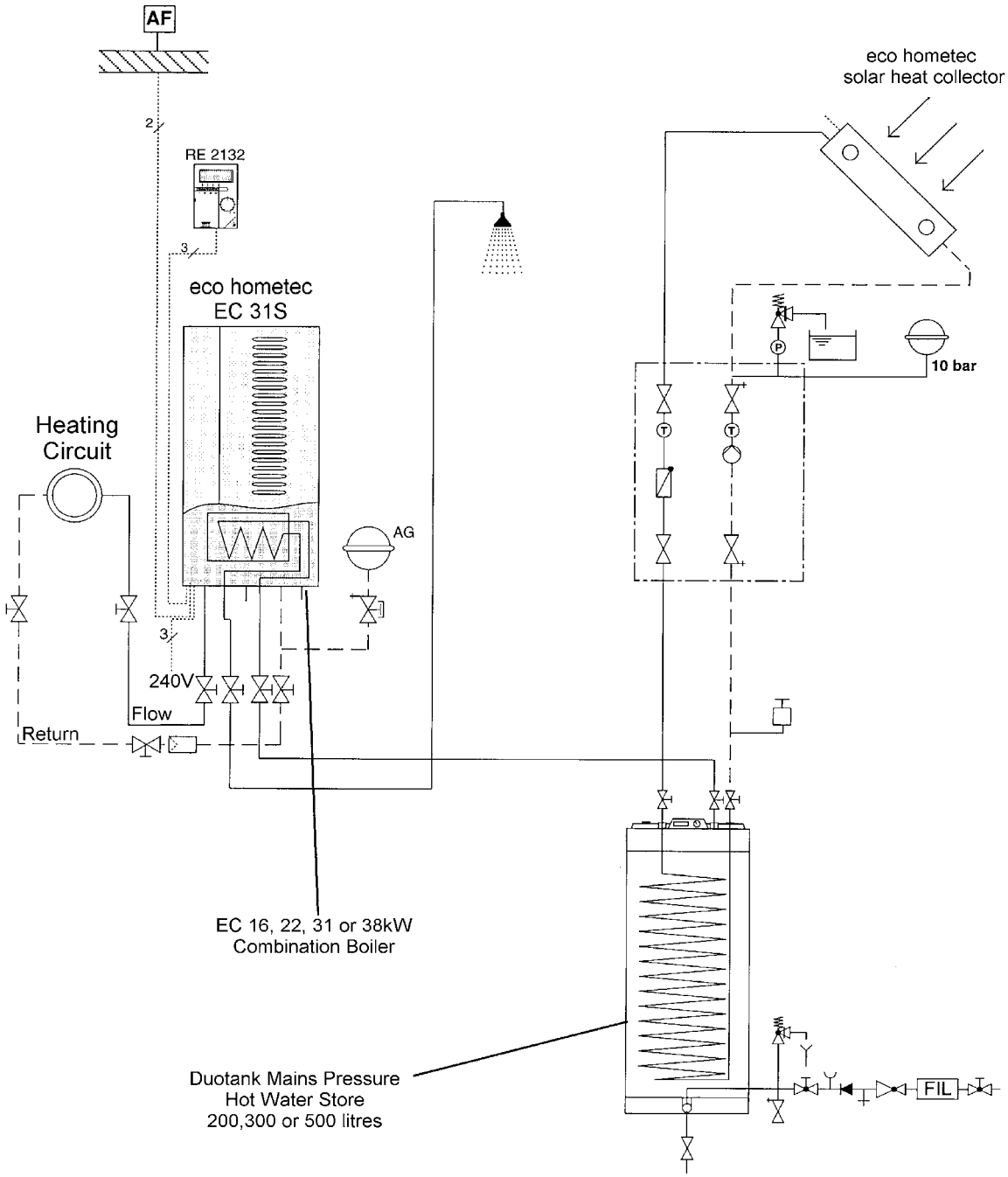
4.3 EC EC 25S Compact

This unit has a built-in heat primary heat exchanger and hot water production is continuous.

The unit has a variable capacity of 32 to 100%, while the maximum capacity can be set and adapted to the capacity of the CH system. The S (combi) range of eco hometec boilers are all solar compatible and can be installed directly as part of a solar heating and hot water system. If you would like more information on the eco hometec solar heating systems and equipment please call or e.mail or sales department.
All appliances are designed for sealed system installation only and require a suitably sized expansion vessel fitting to the system.

Figure 1 Solar heating

EC25 ‘S’ Type Combi Hydraulic system design when installed with solar heating



5. Technical Information.

Table 1 Dimensions & Connections

Product Identification Number	CE ~ 0063 AT3070
Dimensions (H x W x D)	600mm x 360mm x 300mm
Heating Circuit Connections	15mm
Gas Connection	15mm
Condense Drain Connection	15mm
Air Supply/Flue Connections	60mm-60mm (eccentric) 125/80mm (concentric)

Table 2 Heating Specifications

Models H, HS and S		EC25
Nominal Input To Heating	kW	7.2 – 24.5
Maximum Rated Input (S Type combi only)	kW	28
Nominal Output To Heating 80/60^{0}C	kW	7.1 – 24.2
Nominal Output To Heating 50/30^{0}C	kW	7.9 – 25.9
CO_2 % content at min/max load	CO_2 %	8.2 – 8.8%
Dew Point of Flue Gases	0^{0}C	52
Flue Gas Temp @ 80/60^{0}C (Amb 20^{0}C)	0^{0}C	<70^{o}C
* Maximum Flue Resistance	Pa	185
pH value of condensate water	PH	4-5.5
Maximum Flow Temperature	0^{0}C	90
Min/Max filling pressure	bar	1.0 - 3.0
Efficiency @ 80/60^{0}C	%	91.0 – 89.0 % (partial load – full load)
Efficiency @ 50/30^{0}C	%	98.0 – 95.1 % (partial load – full load)
**Efficiency @ 50/30^{0}C	%	109 – 106.1% (partial load – full load)
Hot water efficiency in accordance with CW-test measured over 24 hours	%	85
EPC	%	95.1

* At this resistance, the load will remain within the limits indicated on the data plate.

** European calculation methods are based on efficiency of 100% in units that do not condense the flue gases, and of 110% in condensing units.

Table 3 Capacities & Weights

Model		EC25
Heating Water Capacity	litres	1.5
Heating Water Coil Capacity (S models)	Litres	3.1
Weight (empty)	Kg	35

Table 4 Hot Water Specifications

Model		EC25S
Maximum Rated Input	kW	28
Modulating Output EC25	kW	8-28
Modulating Output EC18	kW	5-18
Hot Water Flow (EC25 only) rates at $\Delta\tau$ 30K (S type)	L/min	13
Maximum Tap Water Pressure	bar	8

Table 5 Connection Values

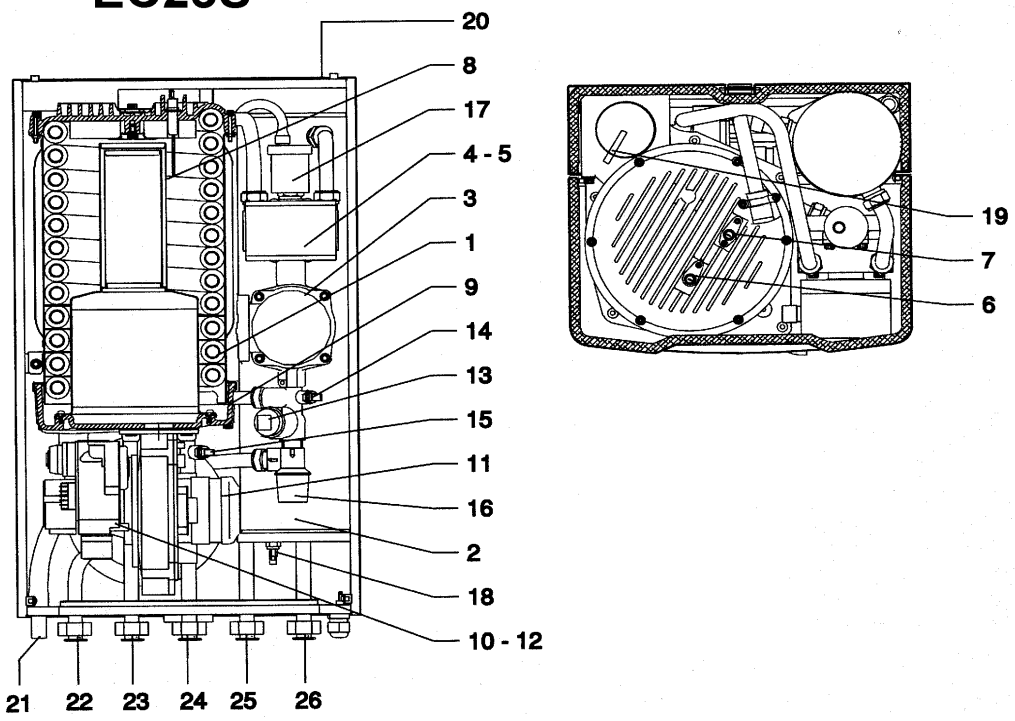
Min/Max Gas Pressure	mbar	20/25
Maximum Input Rate Natural Gas (H & HS Types)	m/h^3	2.58
Maximum Input Rate Natural Gas (S Types)	m/h^3	2.95
Electrical Supply	VAC	230
Power Consumption Average	W	85
Thermostat Voltage	V	24

Table 6 Emission Values

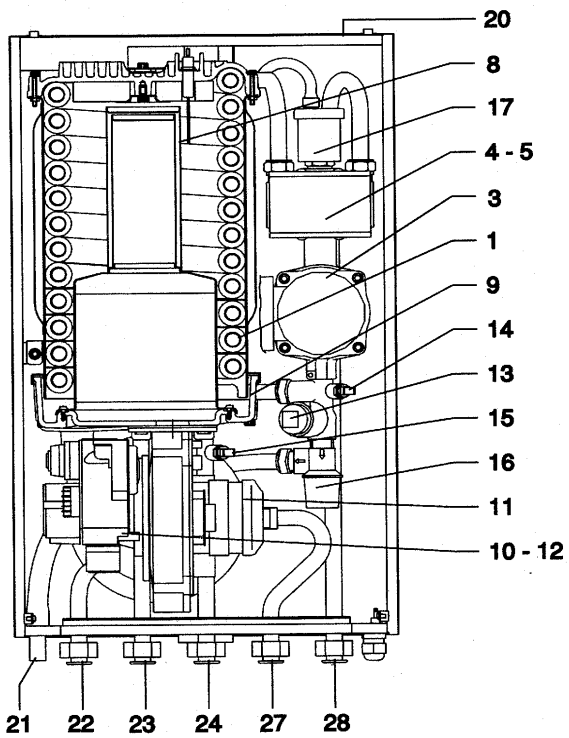
CO_2	natural gas: 8.2 – 8.8 %
CO (0 % O_2)	natural gas: 2.9 – 66 ppm
NOx (0 % O_2)	natural gas: 8.1 – 27.1 ppm
Noise Levels Pump high speed	50 dB(A)
Noise Levels Pump low speed	34 dB(A)

Figure 2 Component Locations

EC25S



EC25HS



EC 25H

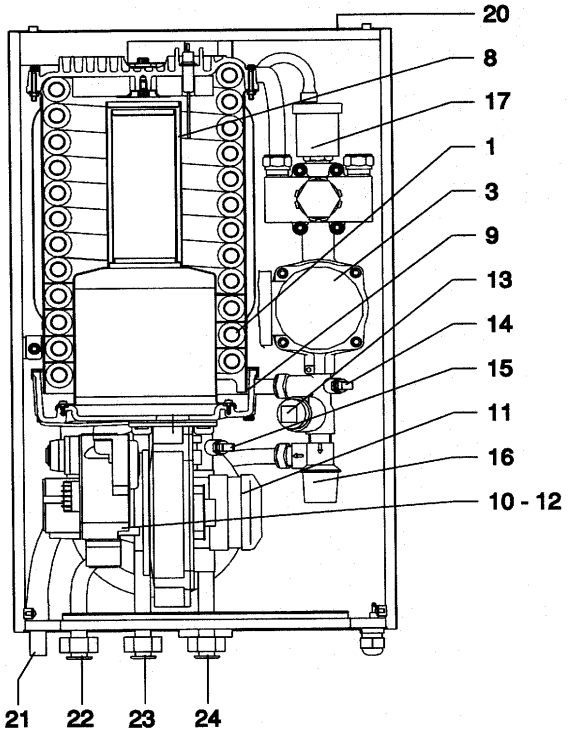


Table 7 Component List

Pos.	Description
1	Heat exchanger
2	Hot tap water boiler
3	Pump
4	Three-way valve
5	Three-way valve internal parts
6	Incandescent igniter
7	Ionization pin
8	Burner
9	Condensation tray
10	Gas valve
11	Fan
12	Venturi tube
13	Water pressure sensor
14	Supply sensor
15	Return sensor
16	Safety device
17	Bleed valve
18	Hot water sensor
19	Exhaust gas sensor
20	Type plate
21	Condensation drain/high pressure protection
22	Gas
23	Central Heating Return
24	Central Heating Flow
25	Hot water outlet
26	Cold water inlet
27	Flow to Hot Water Cylinder
28	Return from Hot Water Cylinder

6. Accessories

The following items are also available from eco hometec at extra cost.

Colour coded 1/4 Turn Isolating Valves.

Stainless Steel Flexible Pipe Connections.

In line Filter/Strainers.

Condensate sump pump for below ground installations. N.B. LPG installations must not be installed below ground level.

eco hometec servicing software and interface cable for connection to a PC.

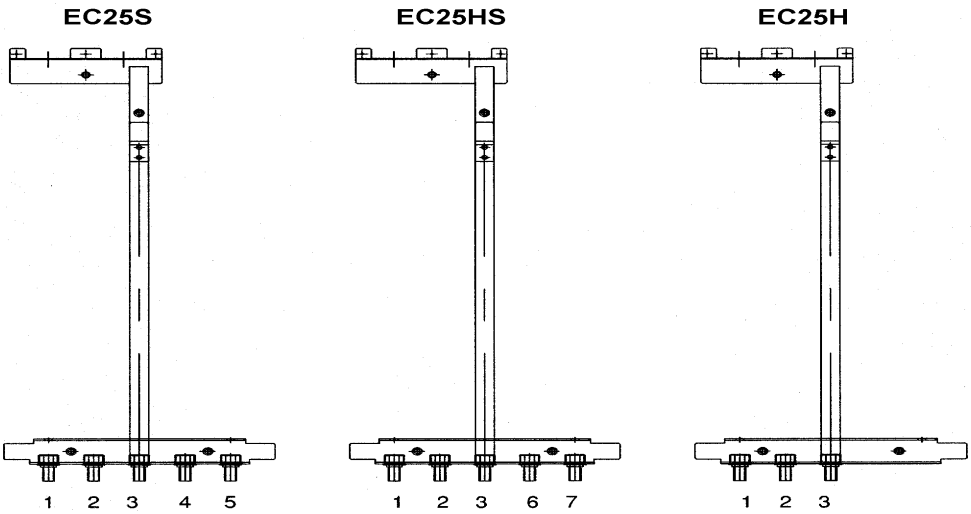
For more details please contact the eco hometec technical department.

Table 8 Extra Items and accessories

All Types	All Types	All Types	Description
X	X	X	Concentric adapter
X	X	X	Connections Cover
X	X	X	Frame and cover with expansion tank
X	X	X	Mounting frame with expansion tank (NL)
X	X	X	External temperature sensor
	X		Hot Water Cylinder sensor

eco hometec comprehensive range of PPS flue kits, fittings and accessories. For more information please see section on flues

Figure 3 Pipework Connections



7. Hydraulic Connections

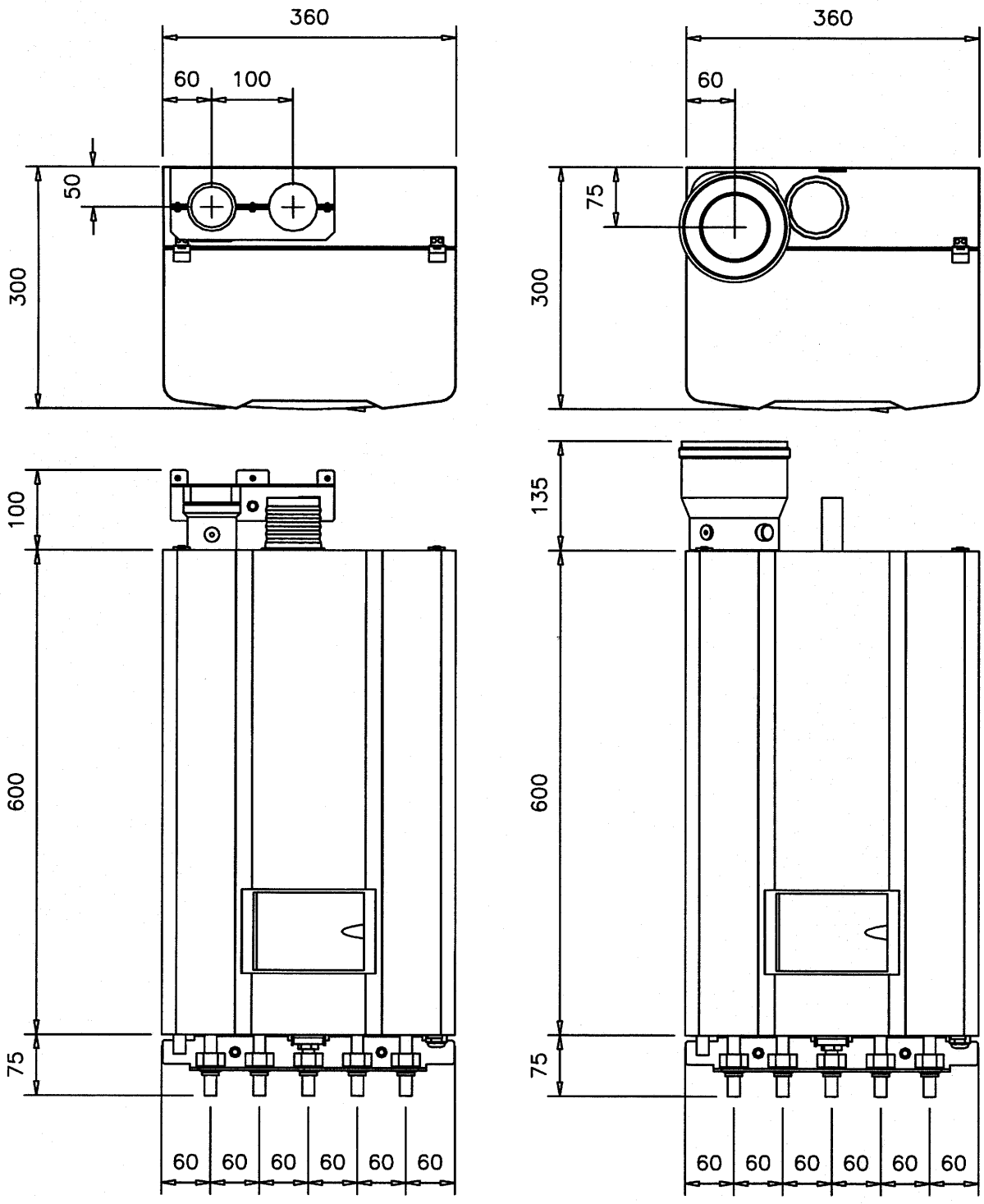
7.1 First Fixing Pipe-work

All the pipe-work and wiring connections enter at the bottom of the unit. To ensure a tidy installation it is important to consider at the first fixing stage the order you arrange the pipe-work and if applicable any cable trunking. Figure 3 shows the order in which to fix the pipe-work.

7.2 Connections

1. Gas
2. Heating Return
3. Heating Flow
4. Flow Domestic Hot Water
5. Cold Mains Water
6. Flow to Hot Water Cylinder
7. Return from Hot Water Cylinder

Figure 4 Overall Dimensions



8. Flues and Ventilation

It is advisable when installing the boiler to use an eco hometec P.P.S. plastic concentric flue system or the twin 60mm tube system. This not only ensures that there is sufficient combustion air, but also reduces room ventilation requirements thus increasing the number of possible suitable locations.

The internal boiler flue system is manufactured in stainless steel and the flue outlet is designed to be connected to an external P.P.S plastic flue system.

8.1 Maximum Flue Lengths

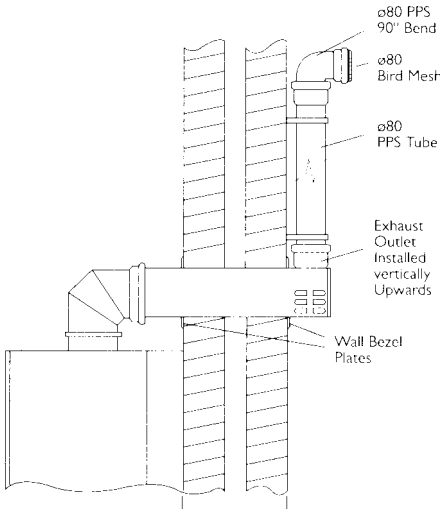
The flue materials, flue insulation, the amount of vertical and horizontal pipe and the amount of bends incorporated determine the maximum permissible flue length. The excess fan pressure available for overcoming the frictional resistance of the flue system is 100 p.a.

8.2 Available Flue Components

80/125 Concentric 500 mm Fanned Flue Kit
80/125 PPS/White Galvanised 90 degree elbow
80/125 PPS/White Galvanised 45 degree elbow
80/125 1000mm length PPS/White Galvanised Concentric Flue
80/125 500mm length PPS/White Galvanised Concentric Flue
80mm 1000mm PPS flue pipe
80mm PPS 45 degree PPS Elbow
80mm PPS 45 degree connector
80/125 Roof Terminal, Pitched roof tile flashing, Aluminium flat roof flashing.
80mm Wall Fixing Clamp + 125mm Wall Fixing Clamp
80mm PPS flexible flue liner (per metre)
80mm PPS flexible flue liner 360-degree spacers
80mm PPS flexible flue liner chimney terminal
80mm PPS flexible flue liner chimney terminal clamp
80mm PPS flexible flue liner boiler flue connector

A range of 60mm PPS bends, tubes and connectors
60mm Grey PPS 45 degree bend
60mm Grey PPS 90 degree bend
60mm x 500mm length PPS/Grey Flue Tube
60mm x 1000mm length PPS/Grey Flue Tube
60mm x 2000mm length PPS/Grey Flue Tube
60mm Inspection point
60mm Tee Piece
60mm Wall Bracket
60mm Wall Terminal Kit (2 wall plates and S/Steel Grid)

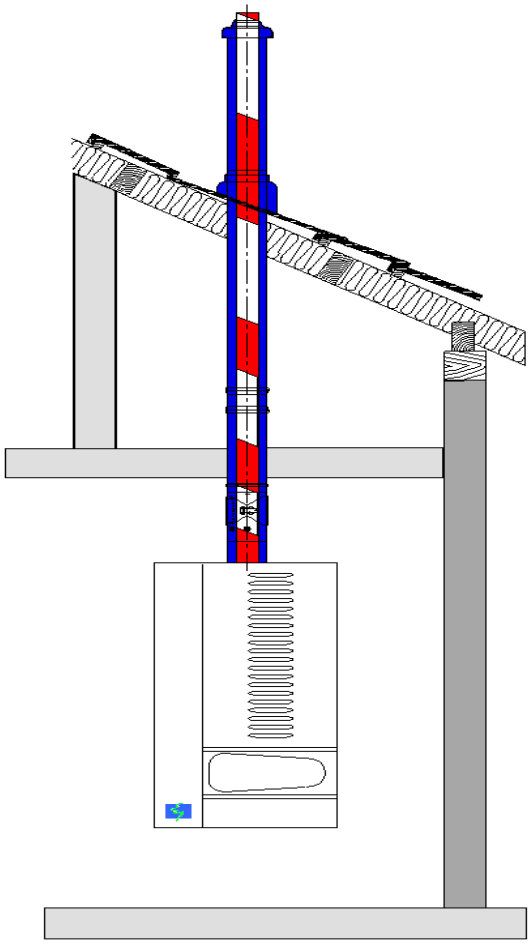
Figure 5 Vertical Wall Terminal



8.3 Vertical flue Installations

For vertical flue applications a range of fittings for both pitched and flat roofs are available. Please contact eco hometec for further advice.

Figure 6 Vertical Flue Application



8.4 Modular installations

For multiple boiler (modular) installations eco hometec supply a range of larger diameter flues.

Sizes are available in 150mm, 200mm and 250mm. For assistance in flue design and specification please call the eco hometec technical department.

Figure 7 Modular Installation.

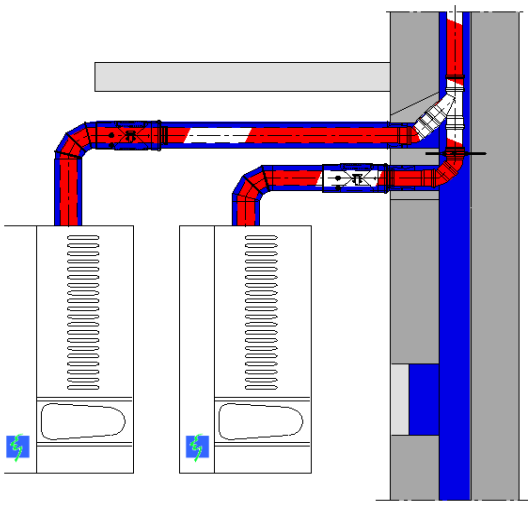
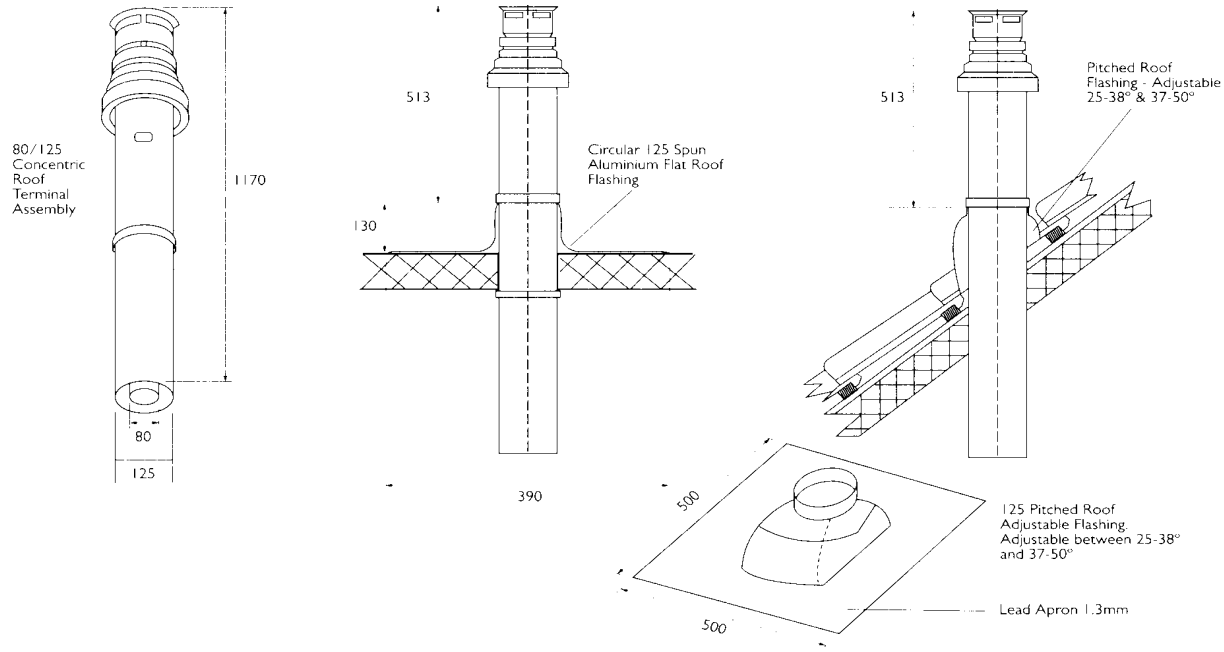


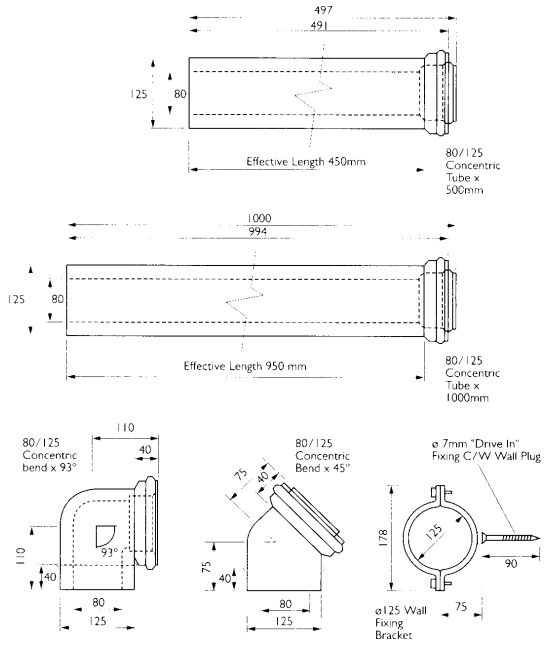
Figure 8 Vertical Roof Terminals



Concentric vertical flue fittings are available from eco hometec.

Concentric flue components have push together spigot and socket joints. The inner PPS flue gas tube has silicone seal rings located in the socket component. The outer air tube has EPDM rubber seal rings located in the socket component. To aid assembly and assurance that the joints have been fully pushed home, the seal rings and make ends of tubes and fittings should be lightly lubricated with silicone grease.
Additional 80/125mm concentric flues tubes and fittings are available from eco hometec details below:

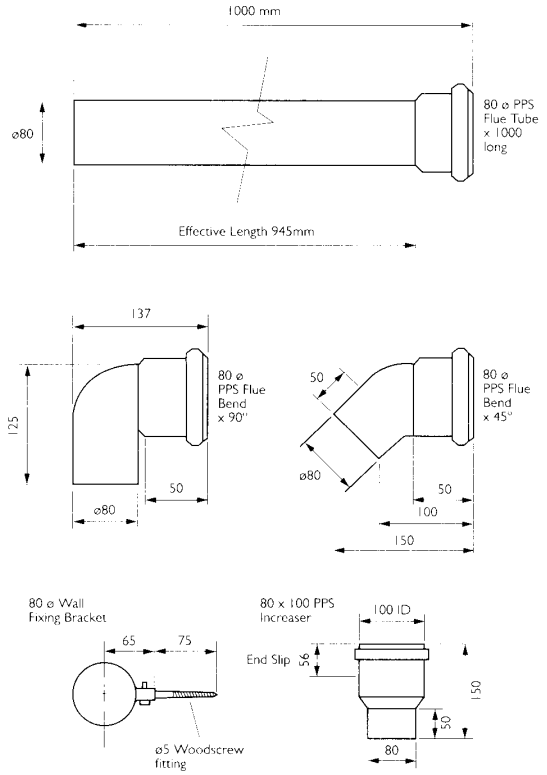
Figure 9 Concentric flue fittings



80/125 1000mm length PPS/White Galvanised Concentric Flue
80/125 500mm length PPS/White Galvanised Concentric Flue
80/125 PPS/White Galvanised 90 degree elbow
80/125 PPS/White Galvanised 45 degree elbow
125mm Wall Fixing Clamp

Additional 80 PPS flues tubes and fittings are available from eco hometec details below:

Figure 10 80mm Flue Tubes



80mm 1000mm PPS flue pipe
80mm PPS 45 degree PPS Elbow
80mm PPS 45 degree connector
80mm Wall Fixing Clamp
80mm – 100mm increaser

Above also available in 60mm

A range of Flexible Flue liners are also available details below.
80mm PPS flexible flue liner (metre)
80mm PPS flexible flue liner 360-degree spacers
80mm PPS flexible flue liner chimney terminal
80mm PPS flexible flue liner chimney terminal clamp
80mm PPS flexible flue liner boiler flue connector

8.5 Condensate Drain

The condense discharge pipe should be continued in ¾ inch **plastic waste pipe** into the household drainage system or out through the wall to an existing gully or soak away. To minimise the risk of freezing all condensate waste pipe-work fitted externally should be 32mm. (The existing drainage system should be corrosion resistant).

8.6 System By-Pass

The boiler is designed to operate at a minimum flow rate. If zone valves are fitted to all the heating circuits then an adequate bypass (Honeywell DU 145 suggested) should be installed across the flow and return so that it is the first flow after the pump and the last return to the boiler.

Please contact eco hometec Technical Department for more information if required.

9. Electrical Connections

Using the 3 core cable supplied connect the boiler to the mains electrical supply.

For the proper functioning of the appliance, it is necessary that live and neutral be correctly connected. Check the status code on the display if the display shows a U, you must reverse the connections to the mains plug in the power supply socket.

10. Heating Control Options

The low voltage terminal strip can be used to connect the following.

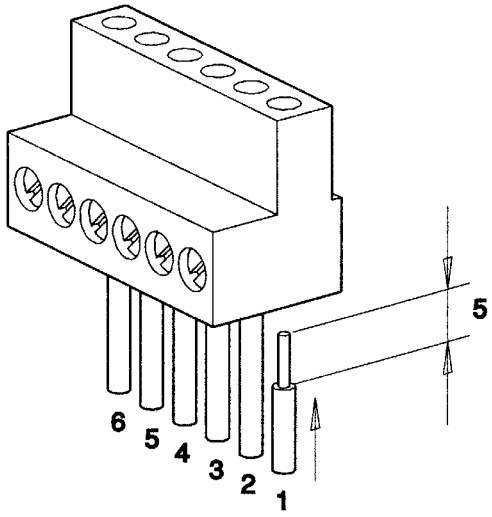
Hot water cylinder sensor.

External temperature sensor.

Room thermostat.

All of the above are available from eco hometec

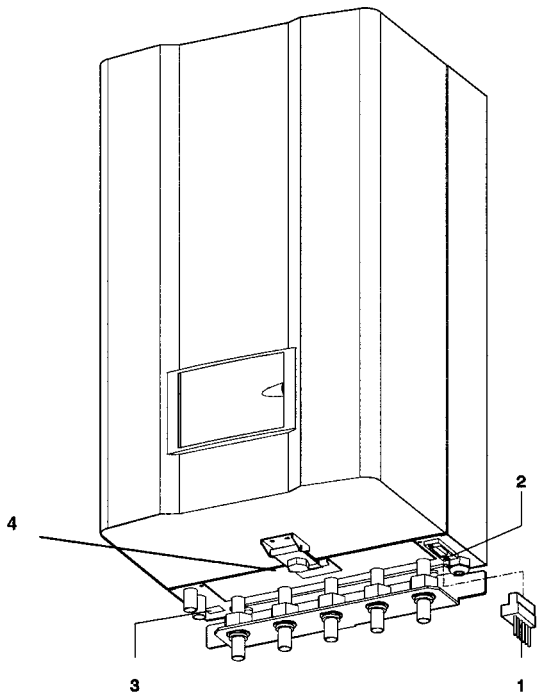
Figure 11 Controls Terminal



The boiler control inputs are all low voltage and must no be connected directly to the mains.

The connection terminal block plug (fig. 18) is located underneath the boiler see fig 19.

Figure 12 Control Terminal Block



11. Additional Features

11.1 Laptop Serial Connection

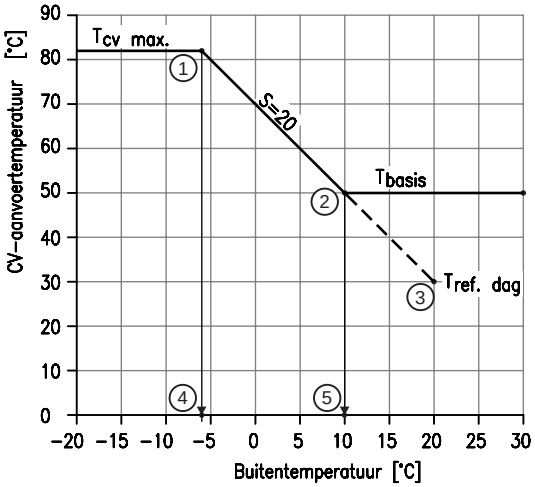
For an extended diagnosis and display of functions, a PC or laptop computer can be connected to connector (3) (Fig. 13). The required connecting cable and software is available from eco hometec as an option.

11.2 8.1.5 Frost protection

If the temperature detected by the supply sensor falls below 8 °C, the pump will be switched on and will circulate water through the central heating circuit. If the temperature detected by the supply sensor falls below 3 °C, the burner will be ignited. As soon as the return temperature reaches 15 °C, the burner will be switched off. The pump will continue to run for the pre-set overrun time. It is also possible to set the pump to run continuously.

11.3 Weather compensation

This function is only available if the optional external sensor is connected. The external temperature control determines the optimum set value of the central heating temperature in relation to the prevailing external temperature.



12. Hot water output

12.1 Combi Type 'S' Tap boiler

The appliance is provided with an integral hot water store that keeps a limited quantity of hot water at a pre-set temperature.

This means that hot water is always available. As soon as the temperature in the tap boiler falls below 5 °C below set point the burner ignites and functions on low load.

12.2 Pump operation

The pump has two speeds: low (1750 rpm) and high (2200 rpm). Normally the pump runs at low speed. When a value for Δt of 30 °C is reached, the pump switches to high speed. Only when Δt is smaller than 10 °C does the pump switch back to low speed.
When the heating demand is removed, the pump continues to run for the pre-set overrun time, at the end of which it is switched off.

12.3 Hot Water Cylinder

A hot water cylinder boiler can be directly connected to the EC25HS. The cylinder temperature can be regulated by means of a thermostat or an NTC temperature sensor. When an NTC-sensor is used, the appliance will modulate during the boiler heating cycle. In the following process description it is assumed that regulation takes place by means of an NTC-sensor.

13. Safety devices

13.1 Flow protection

The appliance is provided with a water pressure sensor that is used in combination with the supply and return sensors to protect the appliance.

For every burner start, the pump is stopped and after a 2 second delay the static system pressure is measured. Hereafter the pump is restarted at high speed. The fan runs and the pre-ignition phase begins.

At the end of the pre-ignition phase the system pressure is measured again.
The following situations are possible:

Pressure difference < 0.06 bar:

1. Air in the appliance

Pump or pump connection is broken. The control system switches to the pump test phase, in which the pump is switched on for 30 seconds and then off for 30 seconds. During this test phase the control system waits until a sufficient pressure difference is created. The display shows 'P' continuously and all heating demands are disregarded.

Pressure difference > 0.44 bar:

Too little flow. In this case the control system also switches to the pump test phase. During this test phase the control system continues to wait until the pressure difference is between 0.06 and 0.44 bar.

Pressure difference > 0.06 and < 0.44 bar:
The burner ignites and the flow monitoring is taken over by the supply and return sensor logic.

The pump is forced to switch over to low speed until there is an increase in temperature. In this way the pump is tested at both speeds: high speed with the aid of a pressure difference, low speed by means of a temperature increase.

If, when the burner is ignited, the pressure rises or falls by more than 0.1 bar within 4 seconds, then the burner will be switched off. The control system then switches to the pump test phase until sufficient pressure difference has been created.

For central heating and hot water operation the appliance modulates back when ΔT > 40 °C. The ΔT regulation in the programme functions as follows:

ΔT	
< 32	complete capacity utilization
32 < ΔT < 40	capacity is reduced linearly to low load at 40 °C
40 < ΔT < 45	low load
> 45	Off

13.2 High temperature protection

The maximum temperature protection is obtained with the aid of the supply and return sensors. If one of these sensors registers a temperature in excess of 93 °C, the burner will always be switched off.
If one of these sensors registers a temperature in excess of 105 °C, the control system blocks all further heating demand and starts pumping through the central heating circuit in order to remove the superfluous heat as quickly as possible. 'H' appears in the status display and the temperature display will show the supply temperature.
If during burning, one of these sensors registers a temperature in excess of 105 °C, the appliance will be immediately blocked with a flashing 'H' on the status display and the supply temperature on the temperature display. Pressing the reset pushbutton on the display can only discontinue this blocking. With a temperature in excess of 118 °C,  will be displayed.

The control system will then perform the following three measurements.

1. Before the control system ignites the burner, the difference between supply and return temperatures must be less than 20°C.

2. The following check measurement will be carried out each time the burner is ignited. Both the supply temperature and the ΔT will be measured just before the burner is ignited. If the control system does not detect an increase of three degrees in the supply temperature or in ΔT after 10 seconds of burning, the burner will be immediately shut down. The control system will wait until ΔT is less than 5 °C and (if there still a demand) will then make another attempt at ignition. If this test is not successful after three attempts, the control system will block further operation with a flashing '2' on the status display and the supply temperature on the temperature display.
Once in every two hours the difference between supply and return temperatures must have been less than 5 °C. Is this not the case, than the burner will not be ignited until this is the case. While the system is waiting for this condition to occur, the status display will show a '2' continuously, and the temperature display will show the supply temperature. A combustion cycle will not be interrupted by this protection.

13.3 Static pressure

The static pressure P in the appliance is monitored. The following situations can occur:

P <= 0.2 bar

All heating demand will be blocked, the pump will be switched off and the status display will show a P continuously.
The static pressure will be shown in the temperature display. This is a indication that the user must top up the appliance.
The blocking will only be discontinued when the pressure exceeds 1.3 bar. This offers the possibility to read the pressure in the appliance during topping up.

0.2 bar < P < 0.5 bar

The capacity of the appliance is limited to low load so that the user can still obtain heat, but because of a reduced level of comfort will realise that something is not in order. In the status display, the letter indicating the condition of the appliance (rest, central heating use or hot water operation) will alternate with 'P'. The temperature display will show the system pressure. This condition will be discontinued as soon as the pressure exceeds 1.3 bar.

P > 0.5 bar

The appliance will function without limitations

P > 3.5 bar

All heating demand will be blocked and the pump will be switched off. This blocking will only be discontinued when the pressure falls below 3.0 bar. The pressure can be read from the display.

14. Condensing System Design

THE IMPLICATIONS OF eco hometec VCOCONDENSING BOILERS
and
THE DESIGN OF OLD AND NEW CENTRAL HEATING AND HOT WATER SYSTEMS

eco hometec VCO condensing boilers are, without doubt more efficient (up to 98% efficient) than conventional balanced or natural draught boilers and condensing boilers without output control.

The principal design criterion for a condensing boiler installation is controlling the return water temperature. If the return water temperature is allowed to rise in excess of 55^{O}C the potential for optimum efficiencies will be lost. This simple fact has design implications that must not be ignored if we are to achieve the maximum fuel savings and efficiencies from a condensing boiler installation. In order to achieve condensing mode the design of old and new systems needs to be considered carefully.

14.1 Design Considerations.

Under-floor Heating System Design.
Radiator sizing and their output.
Pipe sizing - the flow of water.
Controls - Thermostatic Radiator Valves.
Hot water and its control.

The following system temperatures are generally the norm for the following.

14.2 Traditional

Flow temperature	80^{O}C
Return temperature	70^{O}C
System drop	10^{O}C

14.3 Condensing

Flow temperature	70^{O}C
Return temperature	50^{O}C
System drop	20^{O}C

14.4 Under-floor

Flow temperature	50^{O}C
Return temperature	40^{O}C
System drop	10^{O}C

14.5 Under-floor Heating

Under-floor heating systems generally offer the lowest return water temperatures and will ensure the condensing boiler will operate more efficiently. The EC25 may be safely fitted to systems using a high temperature thermal store however we bring to your attention that any heating system using constant high temperature circuits (80^{O}C) will inevitable lead to a reduction in the potential efficiency of a true low temperature design optimised for a condensing boiler. Clearly, for the purposes of condensing boiler efficiency, these types of systems should be considered carefully, ask your heating engineer or call the eco hometec technical department for further advice.

15. Under-floor heating

The EC25 HS (higher specification) condensing boiler has two built in circuits.
The HS range provides 4 No. 22mm connections offering a low temperature circuit for under-floor heating and a high temperature circuit for domestic hot water.
This low temperature heating circuit (50^{O}C) can be dedicated to an under-floor heating system.
Boilers not configured for under-floor designs will overcome the problem by mixing their high temperature flow output with the return heating water via a mixing valve to achieve the required 50^{O}C design temperature.
Controlling the water temperature to 50^{O}C by modulating the burner uses less gas and is obviously more efficient than lowering, with mixing valves, the temperature from a fixed 80^{O}C start point.
The eco hometec range of VCO boilers has been specifically designed to work with low temperature under-floor heating.

15.1 Systems using radiators

Assuming the objective is to maximise the condensing feature of the boiler, when

designing a system using radiators, the ECHS and S Combi model offers the designer two options.
Option 1. Design the system using a variable flow temperature decided by outside air temperature. Maximum flow temperature 85^{O}C system differential 2O^{O}C. Maximum flow temperature would only be required when the outside air temperature is -1^{O}C. For this period (typically no more than 3-4 weeks per year) the return water temperature would be too high to maximise condensing mode. However for the remainder of the year the boiler would adjust the flow temperature (typically 7O^{O}C/5O^{O}C) providing the correct temperature for condensing.
Option 2. Controlling the maximum heating flow temperature to 7O^{O}C with system differential of 2O^{O}C.

15.2 Sizing Radiators and Output

The heat loss for the room should be calculated accurately. Then, the radiators mean water temperature should be used.

$\frac{70 + 50}{2} = 60^{O}C$

or

$\frac{85 + 65}{2} = 75^{O}C$

15.3 Pipe Sizing and Flow Rates

It can be calculated, that a 15mm pipe with an adequate flow rate is able to carry 8kw of sensible heat a 22mm pipe 16kW.
Due to the higher flow and return temperature differentials in a system designed for condensing boilers (approximately twice that of traditional systems) an equivalent size pipe would carry the same amount of heat.
Therefore it can be calculated that a 15mm pipe is able to carry 16kW, a 22mm pipe 32kW.
When designing installations using
eco hometec VCO condensing boiler with radiators sized for a flow temperature of 7O^{O}C with a return differential of 2O^{O}C you may permit the use of smaller pipe diameters for the heating circuits.
This will result in lower heat losses, due to smaller diameter pipework, and should result in installation savings with reduced costs for pipe, fittings, pipe insulation and installation costs.

15.4 Control of Circuits

The relevant new Building Regulation relating to the control of heat input to rooms and houses requires something other than a single room thermostat, Thermostatic Radiator Valves (TRV's) should be used on all new installations.

TRV's on condensing systems offer the ideal solution as they will match exactly the flow of water through the radiator to give the current required heat output taking into account any heat gains from secondary sources such as cooking or solar gain.

We are all aware that TRV's on every radiator were not a good idea because of the above problem and it was usual to leave one radiator without or to install a system by-pass to maintain a flow across the boiler. If this practice were to be continued then the return temperature would rise as room temperatures were achieved. This rise in return water temperatures is counter productive to the condensing mode of the boiler.

The eco hometec super condensing VCO boilers take boiler design and efficiencies to new levels. If you have any queries or points you would like to see discussed and/or included in this guide then please write or e.mail them – address is on the back outside cover.

Finally something, for **YOU,** to consider.
Have you ever bought a gas cooker or a gas fire that you couldn't turn up or down?

The answer is of course no! No one would consider, for even a minute, buying a fire or cooker that could not be turned up or down!

Yet every day hundreds of people buy boilers without automatic output and system water temperature control.

As heating our homes accounts for 70% of our annual fuel bills.

WHY?

Save gas
Save money
Only boilers from
eco hometec are fitted with
Variable Controlled Output

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