The **Greenstore System and Combination** series of ground source heat pumps from Worcester

Technical and specification information

Compliant with Building Regulation G3

WORCESTER
Bosch Group

Worcester, Bosch Group headquarters

Worcester and you. Making a difference.

BOSCH
Invented for life

Working together for many years, heating professionals and Worcester have been making a real difference in hundreds of thousands of homes across the UK. We are recognised as a market leader in high efficiency, condensing boiler technology and are also committed to providing renewable energy solutions.

As part of the Bosch Group, our products are designed and manufactured to provide the high levels of quality and reliability which are synonymous with the Bosch name throughout the world.

We're a leading British company, employing more than 1,800 people at our headquarters and manufacturing plants in Worcester and at Clay Cross in Derbyshire, including a nationwide network of over 300 Service Engineers and over 60 technically-trained Field Sales Managers.

As part of Europe's largest supplier of heating products, Worcester, Bosch Group has the UK-based resources and support capability to offer you the value-added solutions we feel you deserve.

"At Worcester we recognise the vital role you, our customer, has in the specification and installation of 'A' rated, energy efficient appliances in homes across the UK. We will continue to invest in our products, people, facilities and added value services such as training, to give you the support you require in providing a total solution for your customers' comfort."

Richard Soper,
Managing Director, Worcester, Bosch Group

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The Greenstore ground source heat pump series

Global responsibility for nature and the environment

As part of the Bosch group, Worcester is committed to environmental protection. Product development is prioritised in the interests of the safety of people, the economical use of resources and environmental sustainability.

With this in mind Worcester is proud to offer a range of ground source heat pumps which allow the consumer to take advantage of renewable and sustainable energy.

Worcester heat pumps make use of the energy from the sun which is absorbed by the earth. The energy below the surface is available to be extracted by the heat pump.

The heat pumps use the constant energy available in the ground with a refrigerant circuit to allow the temperatures to be boosted to a useful level for the provision of heating or hot water for the home.

The system is made up of an energy collector, generally a ground source heat pump, a hot water store and the heat delivery system of the property, preferably an underfloor heating or alternatively oversized radiators.

Worcester heat pumps are available in two versions. The System version has been designed for use with Worcester Greenstore cylinders for the production of hot water. A Combination model is available which includes a built-in store of 185 litres of hot water which is fully compliant with section G3 of the Building Regulations.

Worcester heat pumps are intended to be the sole source of heating and hot water production for the home giving the home owner the option of removing the existing heat source from the property and in most cases, making the heat pump the only source.

The appliance is dispatched complete with comprehensive installation, maintenance and user instructions.

Please note that this leaflet is a guide to installation only. For full details please refer to the installation and commissioning instructions.

The Greenstore ground source heat pump range at a glance

	Greenstore 6 System	Greenstore 7 System	Greenstore 9 System	Greenstore 11 System
Output kW 0/35ºC[1]	5.7	7.2	9.1	10.9
Output kW 0/50ºC[1]	5.4	6.8	8.5	10.1
COP* 0/35ºC[1]	3.8	3.9	4.1	4.6
COP* 0/50ºC[1]	2.8	2.9	3.0	3.2

	Greenstore 6 Combi	Greenstore 7 Combi	Greenstore 9 Combi	Greenstore 11 Combi
Output kW 0/35ºC[1]	5.7	7.2	9.1	10.9
Output kW 0/50ºC[1]	5.4	6.8	8.5	10.1
COP* 0/35ºC[1]	3.8	3.9	4.1	4.6
COP* 0/50ºC[1]	2.8	2.9	3.0	3.2
Storage cylinder capacity (litres)	185	185	185	185

Note: 0/35ºC is used to designate in a situation where the collector side of the system generates a temperature of 0ºC and the flow temperature from the heat pump is 35ºC.
[1] According to BS EN 14511
** Co-efficient of Performance*

Features	Benefits
Extracts stored energy from ground.	Reduced requirement for purchase fuels.
Electrically powered compressor.	Avoids fossil fuel price increase.
Integrated additional heater.	No supplementary heat source required.
Built-in hot water storage**.	Heating and hot water solution.
Text display menu.	Easy to operate.
Excellent COP ratings.	Better return on investment.
Scroll compressor.	Flow temperatures up to 65ºC.
Soft start compressor.	Low starting current draw.
Low noise output.	Quiet operation.
2 years parts and labour warranty*.	Peace of mind.
No annual servicing.	Money saving.
No flue system.	Ease of siting.
No gas or oil required.	Ease of siting.
Low flow temperature design.	Compatibility with underfloor heating.
New range of cylinders available.	Heating and hot water solution.

**Terms and conditions apply*
***Combination model*

The Greenstore series of ground source heat pumps

Principles of operation – how the heat pump works

1). Heat transfer fluid in. The heat pump collects stored solar energy. It contains a heat transfer fluid which is a solution of water and glycol. This antifreeze mixture collects the heat from the earth and is fed into the evaporator. The temperature is on average around 3-5ºC.

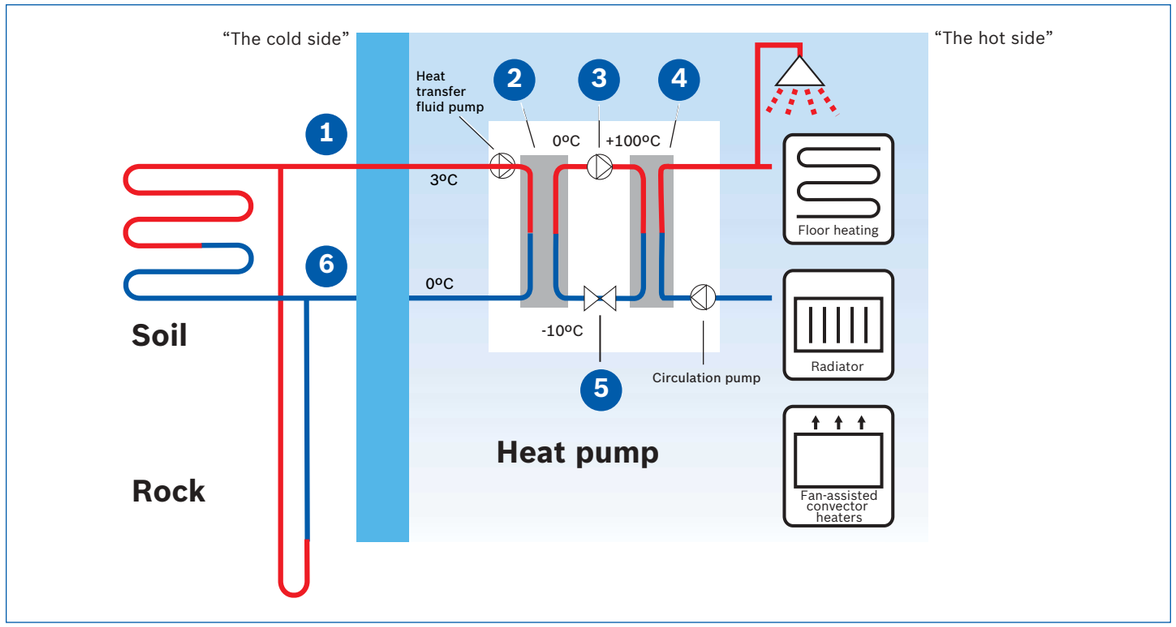
2). In the evaporator, the heat transfer fluid meets the refrigerant. At this stage, the refrigerant is in a fluid state and is at approximately -10ºC. When the refrigerant meets the heat transfer fluid it starts to boil. It then forms a vapour, which is fed into the compressor. The temperature of the vapour is around 0ºC.

3). The pressure of the refrigerant increases in the compressor and the vapour temperature rises from 0ºC to approximately +100ºC. The hot gas is then forced into the condenser.

4). The condenser transfers the heat to the heating system (underfloor heating or perhaps radiators) and the hot water system. The vapour is cooled in the condenser and becomes liquid. The pressure in the refrigerant is still high when it reaches the expansion valve.

5). The refrigerant pressure is lowered in the expansion valve. At the same time, the temperature also drops to approximately -10ºC. When the refrigerant passes the valve and the evaporator it changes to vapour again.

6). The heat transfer fluid is led out from the heat pump to the ground loop to collect new stored solar energy. The temperature of the fluid is approximately 3ºC cooler than the flow in.



Application of Worcester Greenstore ground source heat pumps

Worcester offers a series of 8 ground source heat pumps which are intended to provide all the heating and hot water requirements of the home. The System variant heat pumps can also be combined with solar panels for hot water production, when used with the Greenstore solar compatible cylinders.

Performance

Greenstore heat pumps feature a highly efficient and effective scroll-type compressor which allows around 65ºC flow temperature from the appliance. This higher output temperature allows Worcester heat pumps to be effectively combined with radiators which should be typically oversized by around 30%. However, wherever possible Worcester recommends an underfloor heating system as the most compatible heat emitter system. The scroll compressor allows Worcester heat pumps to offer excellent COP ratings.

Co-efficient of performance

The performance and efficiency of a heat pump system is commonly measured by the Co-efficient of Performance. The COP is a simple calculation which works out how much energy the heat pump is able to extract from the energy source compared to the amount of electrical energy used by heat pump.

$$\text{COP} = \frac{\text{Heat output of system (useful heat)}}{\text{Electrical input from compressor and circulating pumps}}$$

E.g.:

$$\text{COP of 3.3} = \frac{\text{9kW heat pump}}{\text{2.7kW of electrical input}}$$

The COP depends on the temperature that can be extracted from the collector and the temperature required by the heating system of the house. The best combination for a high COP would be a higher source temperature (e.g. 10ºC) and a lower flow temperature for the heating (e.g. 35ºC). The return on the energy employed in this case is higher since the heat pump has to increase the temperature by only 25ºC. If the energy from the source is lower in temperature and the required flow temperature is higher the COP will be reduced.

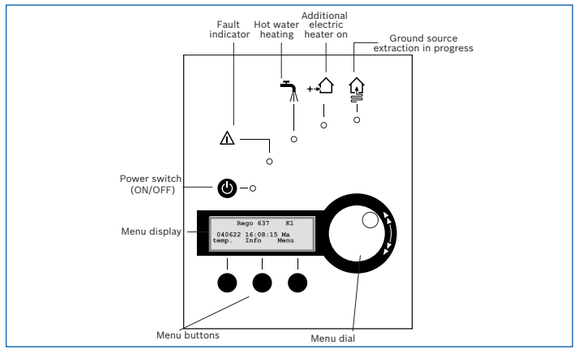
The equation shown above results in 2.7kW of heat provided by the pump (which is provided by electrical consumption) and 6.3kW of energy extracted from the ground source.

The table below shows the relationship between flow temperature and COP. The COP stated is for use only as typical examples and will differ between installations.

Relationship between flow temperature and COP		
Heat delivery method	**Typical COP**	**Flow temperature**
Oversized radiators	3	40 - 45ºC
Underfloor heating	4 - 5	30 - 35ºC

Controls

Greenstore heat pumps are controlled by the Rego 637 control unit. The unit ensures that the heat pump runs efficiently when required and dictates that hot water heating is given priority over space heating.



Outdoor sensor

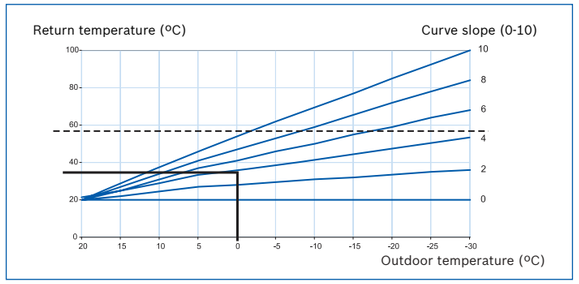
The heat pump is controlled with an outdoor sensor which determines the temperature outside of the property (on a north facing wall) and relays this back to the heat pump. The control on the heat pump uses a heat curve to provide a corresponding flow temperature from the appliance, always endeavouring to provide the lowest flow temperature possible yet still maintain desired room temperatures.

Room sensor

In addition to the outdoor sensor a room sensor supplements the control of the heat pump. This allows the controller to compare the internal and external temperatures and provide the best possible energy savings.

Heat curves

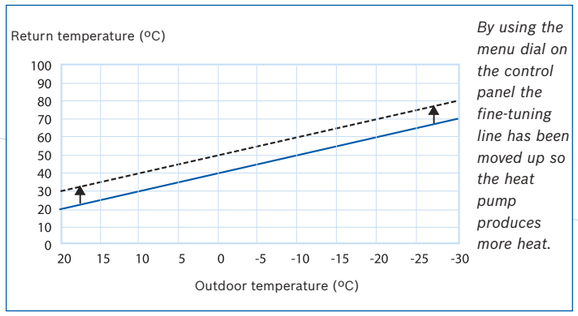
The return temperature to the heat pump is determined directly by the outdoor temperature sensor according to a heat curve. The heat curve can be changed to provide different responses from the heat pump to the outside temperature.



Curve slope:

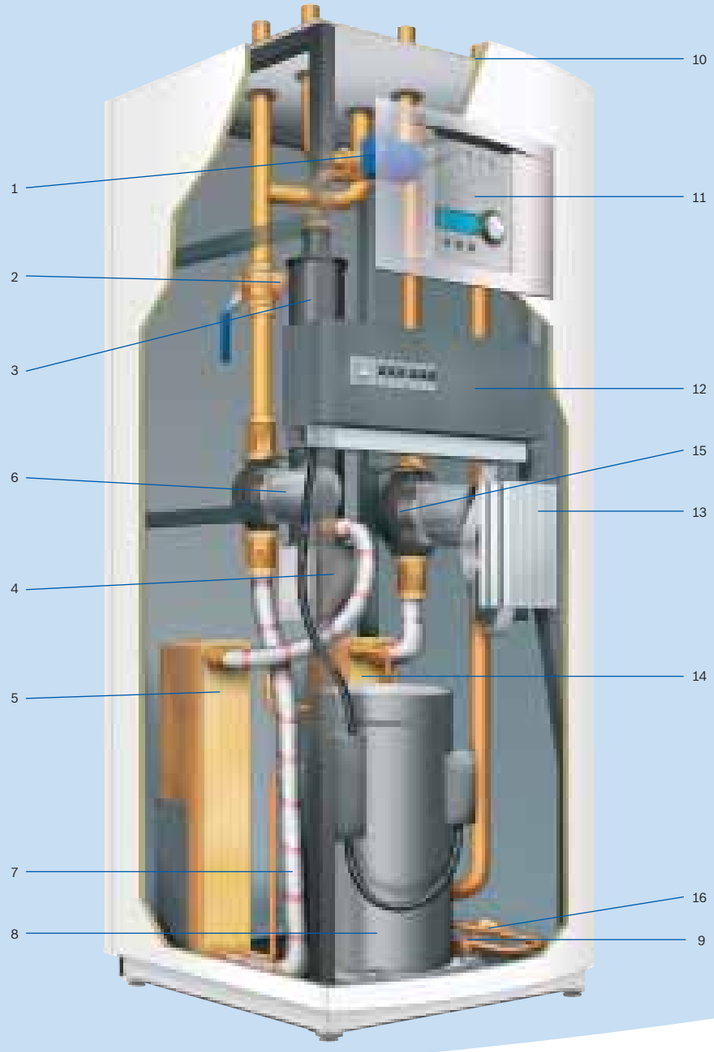
2 - 4 Normal setting for floor heating
4 - 6.5 Normal setting for radiators
7 - 10 Abnormal high setting (not normally required)

Heat curve slope 4 gives a return temperature of +35ºC when it is 0ºC outdoors. If the outdoor temperature drops the return temperature increases. The colder the outdoor temperature the higher the return temperature. At an outdoor temperature of approximately -30ºC the curve slope has nearly reached the limit value (+57ºC) for the return temperature.



Fine-tuning the heat curve

The Greenstore ground source heat pump – inside story (system models)



Key to components

1. Three-port Valve
2. Filter
3. Additional Electric Heater
4. Reset Button (Electric Heater)
5. Heating System Heat Exchanger (Condenser)
6. Circulation Pump (Heating)
7. Flexible Hoses
8. Compressor
9. Sight Glass
10. Electrical Connections
11. Control Panel
12. Circuit Breakers
13. Control Unit
14. Heat Transfer Fluid Heat Exchanger (Evaporator)
15. Heat Transfer Fluid Pump (Collector)
16. Expansion Valve

Technical data – Greenstore System ground source heat pumps

Model	Greenstore 6 System	Greenstore 7 System	Greenstore 9 System	Greenstore 11 System
Height (mm)	1,520	1,520	1,520	1,520
Width (mm)	600	600	600	600
Depth (mm)	600	600	600	600
Weight (kg)	149	153	155	164
Emitted/supplied output at 0/45ºC[1] (kW)	5.19 / 1.80	6.55 / 2.20	8.20 / 2.67	9.63 / 2.92
COP 0/35ºC[1]	3.8	3.9	4.1	4.6
COP 0/45ºC[5]	2.89	2.97	3.06	3.29
COP 0/50ºC[4]	2.8	2.9	3.0	3.2
Min. flow heating side (l/s)	0.14	0.18	0.22	0.26
Nominal flow heating side (l/s)	0.20	0.25	0.31	0.37
Max. pressure available heating side (at nominal flow) (kPa)	36	36	34	33
Nominal flow of antifreeze mixture to the collector hose (l/s)	0.30	0.38	0.46	0.57
Max. pressure available to collector hose (at nominal flow) (kPa)	49	45	44	80
Type of antifreeze	Bioethanol-water or propylene/ethylene glycol/water	Bioethanol-water or propylene/ethylene glycol/water	Bioethanol-water or propylene/ethylene glycol/water	Bioethanol-water or propylene/ethylene glycol/water
Freeze protection temperature (ºC)	-15	-15	-15	-15
Max. pressure heating side (bars)	2.5	2.5	2.5	2.5
Max. pressure on collector hose side (bars)	4	4	4	4
Max. outgoing temperature to the heating system (ºC)	65	65	65	65
Max. return temp. from heating system (ºC)	57	57	57	57
Working temperatures on collector hose side (ºC)	-5 to +20	-5 to +20	-5 to +20	-5 to +20
Integrated collector hose and heat carrier pump	•	•	•	•
Power supply	230V 1N~ 50Hz	230V 1N~ 50Hz	230V 1N~ 50Hz	230V 1N~ 50Hz
Additional heat settings (kW)	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0
The recommended type of fuse depends on the electrical output[2] (AaM)				
6kW electric heater	40	40	50	50
9kW electric heater	50	63	63	63
Starting current (A)	22.9	23.8	30.9	34.6
Compressor	Scroll	Scroll	Scroll	Scroll
Type R407c HFC refrigerant (kg)	1.35	1.4	1.5	1.9
Connection for heat fluid out/in (mm)	Cu 22	Cu 22	Cu 22	Cu 22
Out/in collector hose connection (mm)	Cu 28	Cu 28	Cu 28	Cu 28
Control unit	Rego 637 W	Rego 637 W	Rego 637 W	Rego 637 W
Sound power level[3] (dB(A))	47.2	50.1	51.9	48.3
Sound pressure level[4] (dB(A))	34.5	37.4	39.2	35.6

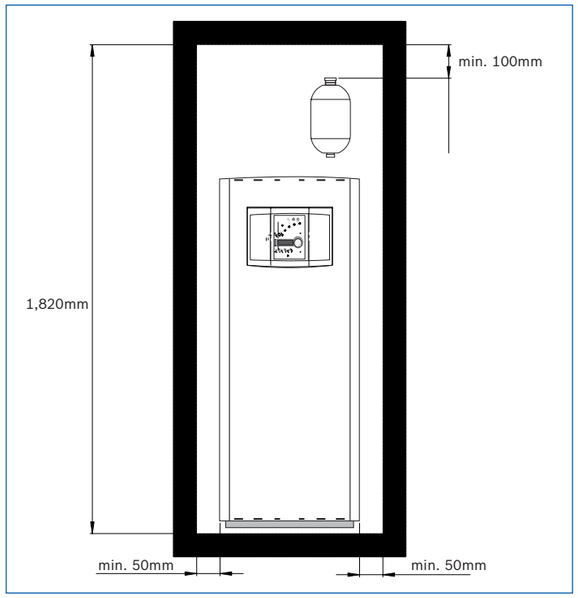
1 Data at 0/45ºC according to the European standard EN 14511. Data applies to a new unit with clean heat exchangers
2 aM type fuse, D characteristic MCB
3 Measurement according to EN ISO 3743-2
4 Calculated values at 1m distance according to EN ISO 11203
5 According to EN14511

Installing the Greenstore System ground source heat pump series

Siting of appliance

The appliance is most suited to a utility room, boiler house or garage installation. The installation location must remain between 0ºC and 35ºC. Consideration should be given to condensation which may form on exposed pipework. It is recommended that pipework is insulated.

Installation clearances



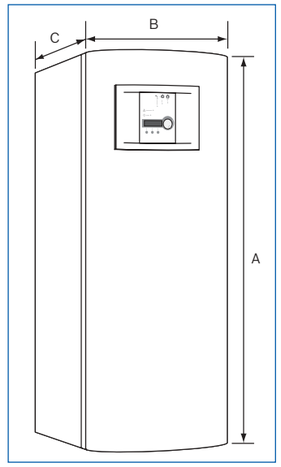
Servicing clearances around heat pump casing	
Above	300mm*
Front	600mm
Sides	50mm

**Where expansion vessel is not installed directly above appliance.*

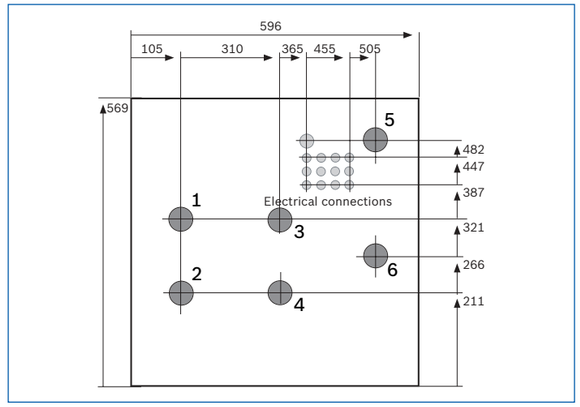
Floor preparation

The appliance is designed to be free standing and should be located on a flat surface which is able to support the weight of the product and accessories and fluid content. The appliance has rubber feet which can be adjusted to suit the installation.

Casing dimensions and pipe work connections



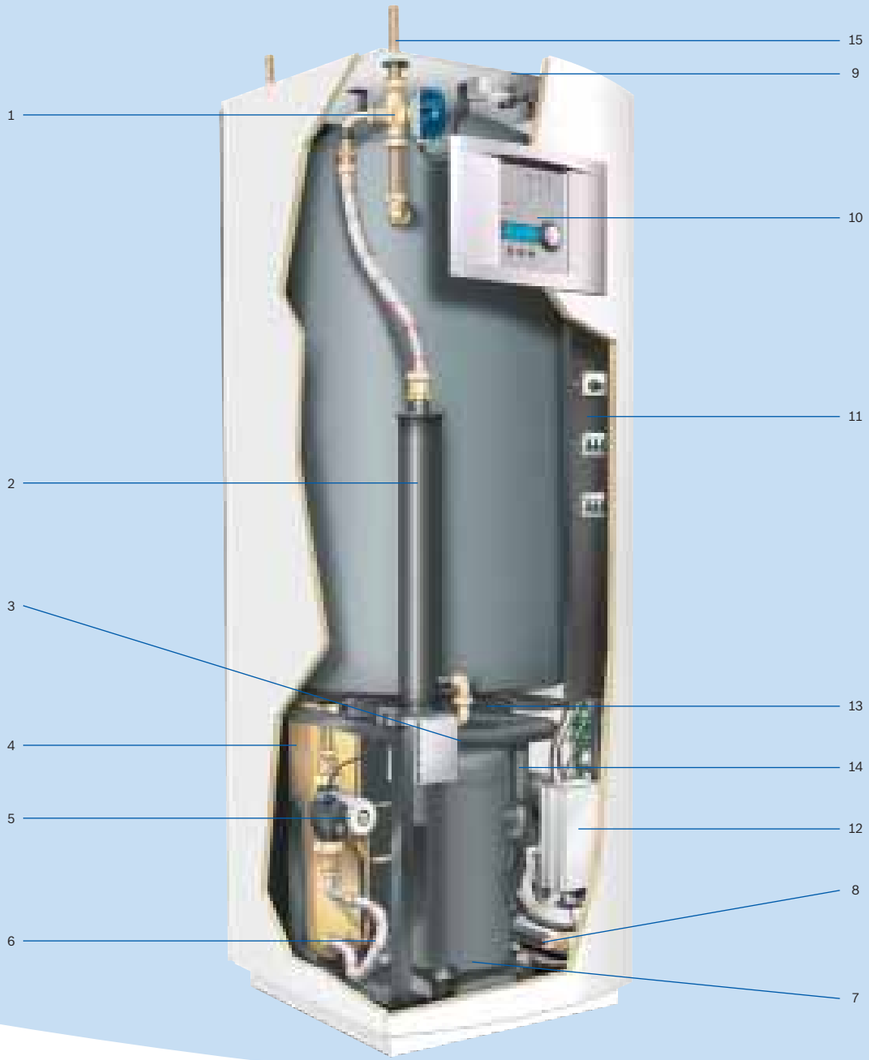
Cabinet dimensions (mm)	
A	1,520
B	600
C	600



Pipework connections		
1	Heating return	22mm
2	Heating flow	22mm
3	DHW cylinder return	22mm
4	DHW cylinder flow	22mm
5	HTF (collector) out	28mm
6	HTF (collector) in	28mm

The Greenstore ground source heat pump – inside story (combination models)

Compliant with Building Regulation G3



Key to components

1. Three Port Valve
2. Additional Electric Heater
3. Reset Button (Electric Heater)
4. Heating System Heat Exchanger (Condenser)
5. Circulation Pump (Heating)
6. Flexible Hose
7. Compressor
8. Sight Glass
9. Electrical Connections
10. Control Panel
11. Circuit Breakers
12. Control Unit
13. Heat Transfer Fluid Heat Exchanger (Evaporator)
14. Heat Transfer Fluid Pump (Collector)
15. Temperature and Pressure Relief Valve

Technical data – Greenstore Combination ground source heat pumps

Model	Greenstore 6 Combination	Greenstore 7 Combination	Greenstore 9 Combination	Greenstore 11 Combination
Height (mm)	1,800	1,800	1,800	1,800
Width (mm)	600	600	600	600
Depth (mm)	600	600	600	600
Weight – empty (kg)	213	217	219	222
Weight – full (kg)	438	442	444	447
Emitted/supplied output at 0/45ºC[1] (kW)	5.19 / 1.80	6.55 / 2.20	8.20 / 2.67	9.63 / 2.92
COP 0/35ºC[1]	3.8	3.9	4.1	4.6
COP 0/45ºC[5]	2.89	2.97	3.06	3.29
COP 0/50ºC[4]	2.8	2.9	3.0	3.2
Min. flow heating side (l/s)	0.14	0.18	0.22	0.26
Nominal flow heating side (l/s)	0.20	0.25	0.31	0.38
Max. pressure available heating side (at nominal flow) (kPa)	36	36	34	32
Nominal flow of antifreeze mixture to the collector hose (l/s)	0.30	0.38	0.46	0.57
Max. pressure available to collector hose (at nominal flow) (kPa)	49	45	44	80
Type of antifreeze	Bioethanol-water or propylene/ethylene glycol - water	Bioethanol-water or propylene/ethylene glycol - water	Bioethanol-water or propylene/ethylene glycol - water	Bioethanol-water or propylene/ethylene glycol - water
Freeze protection temperature (ºC)	-15	-15	-15	-15
Max. pressure heating side of heat pump (bars)	2.5	2.5	2.5	2.5
Max. pressure on collector hose side (bars)	4	4	4	4
Max. outgoing temperature to the heating system (ºC)	65	65	65	65
Max. return temp. from heating system (ºC)	57	57	57	57
Working temperatures on collector hose side (ºC)	-5 to +20	-5 to +20	-5 to +20	-5 to +20
Integrated collector hose and heating system pump	•	•	•	•
Power supply	230V 1N~ 50Hz	230V 1N~ 50Hz	230V 1N~ 50Hz	230V 1N~ 50Hz
Additional heat settings (kW)	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0	3.0 / 6.0 / 9.0
The recommended type of fuse according to electrical output[2] (AaM) 6kW electric heater 9kW electric heater	 40 50	 40 63	 50 63	 50 63
Starting current, soft start (A)	22.9	23.8	30.9	34.6
Compressor	Scroll	Scroll	Scroll	Scroll
Type R-407C HFC refrigerant (kg)	1.35	1.4	1.5	1.9
Connection for heat fluid out/in (mm)	Cu 22	Cu 22	Cu 22	Cu 22
Out/in collector hose connection (mm)	Cu 28	Cu 28	Cu 28	Cu 28
Integrated hot water cylinder with double shell	Stainless steel	Stainless steel	Stainless steel	Stainless steel
Volume of integrated hot water cylinder (l)	185	185	185	185
Primary water volume (l)	40	40	40	40
Control unit	Rego 637W	Rego 637W	Rego 637W	Rego 637W
Ambient temperature – indoor use (ºC)	+10 to +30	+10 to +30	+10 to +30	+10 to +30
Max. relative humidity (rH)	60%	60%	60%	60%
Sound power level[3] (dB(A))	47.2	50.1	51.9	48.3
Sound pressure level[4] (dB(A))	34.5	37.4	39.2	35.6

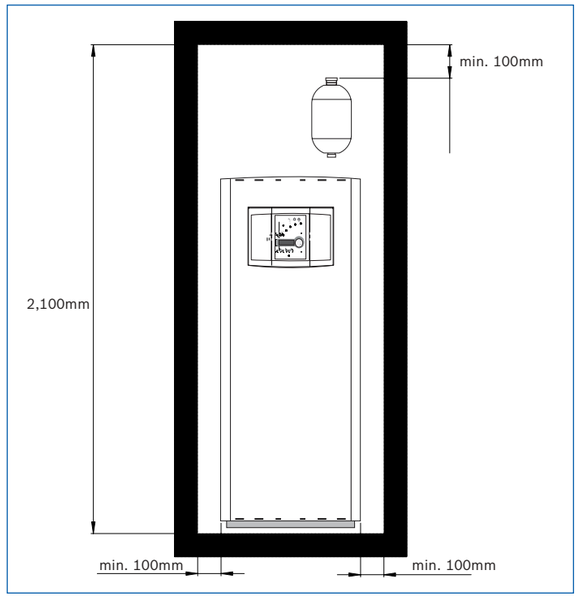
1 Data at 0/45ºC according to the European standard EN 14511. Data applies to a new unit with clean heat exchangers
2 aM type fuse, D characteristic MCB
3 Measurement according to EN ISO 3743-2
4 Calculated values at 1m distance according to EN ISO 11203
5 According to EN14511

Installing the Greenstore Combination ground source heat pump series

Siting of appliance

The appliance is most suited to a utility room, boiler house or garage installation. The installation location must remain between 0ºC and 35ºC. Consideration should be given to condensation which may form on exposed pipework. It is recommended that pipework is insulated.

Installation clearances



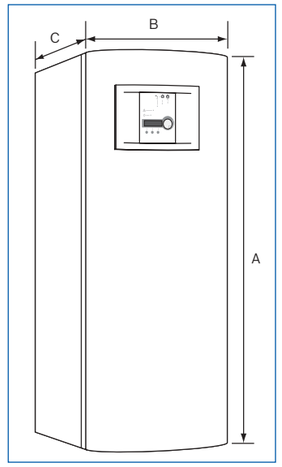
Servicing clearances around heat pump casing	
Above	300mm*
Front	800mm
Sides	100mm

**Where expansion vessel is not installed directly above appliance.*

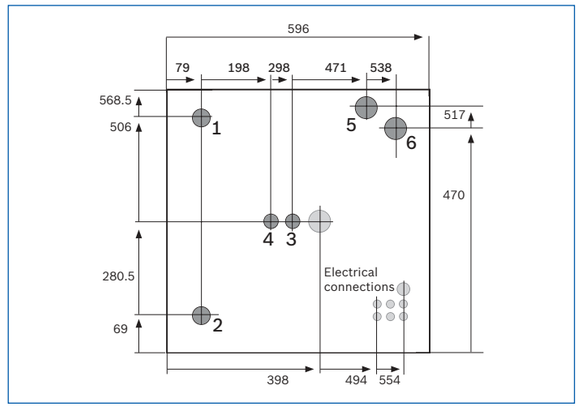
Floor preparation

The appliance is designed to be free standing and should be located on a flat surface which is able to support the weight of the product and accessories and fluid content. The appliance has rubber feet which can be adjusted to suit the installation.

Casing dimensions and pipe work connections



Cabinet dimensions (mm)	
A	1,800
B	600
C	640



Pipework connections		
1	Heating return	22mm
2	Heating flow	22mm
3	Mains cold water inlet	22mm
4	Domestic hot water outlet	22mm
5	HTF (collector) in	28mm
6	HTF (collector) out	28mm

Worcester Greenstore cylinders

Application of Worcester Greenstore cylinders

Worcester offers a range of 2 unvented cylinders for exclusive use with Greenstore System heat pumps. The cylinders are available in 180 and 280 litre sizes according to hot water requirements. Greenstore cylinders feature a tank-in-tank design whereby the domestic hot water tank is surrounded by primary water to provide a large heat transfer surface area along the cylinder to make the most of the energy from the heat pump.

In common with the Combination heat pumps the cylinders have been approved to part G3 of the Building Regulations.

Both cylinders include integrated indirect heat exchange coils in the lower section of the tank to allow Worcester solar systems to be connected to provide solar water heating in conjunction with the heat pump.

Worcester Greenstore cylinders at a glance

	Greenstore 180 Cylinder solar compatible	Greenstore 280 Cylinder solar compatible
DHW volume (litres)	180	280

Compliant with Building Regulation G3

Technical data – Greenstore cylinders

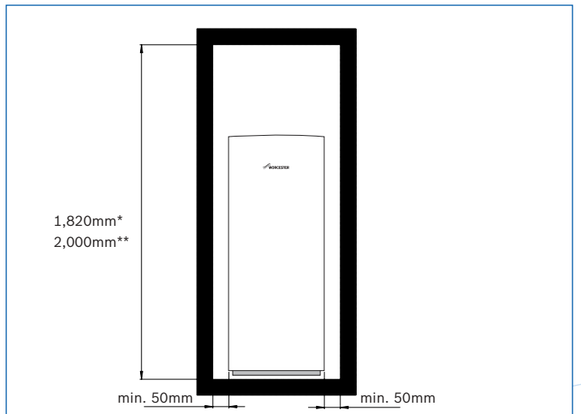
Model	Greenstore 180 Cylinder	Greenstore 280 Cylinder
Height (mm)	1,520	1,700
Width (mm)	600	695
Depth (mm)	650	695
Weight – empty (kg)	97	136
Weight – full (kg)	387	596
Max. operating pressure primary side (bar)	2.5	2.5
Max. pressure DHW (bar)	3	3
Reheat time 15ºC to 60ºC (mins)	144	163
Reheat time for 70% volume (mins)	47	53
TPRV	7 bar/95ºC	7 bar/95ºC

Installing Greenstore cylinders

Siting of appliance

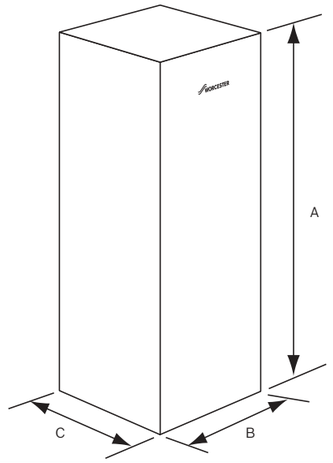
The appliance is most suited to a utility room, boiler house or garage installation. The installation location must remain between 0ºC and 35ºC. Consideration should be given to condensation which may form on exposed pipework.

Servicing clearances around cylinder casing	
Above	300mm
Front	600mm
Sides	50mm

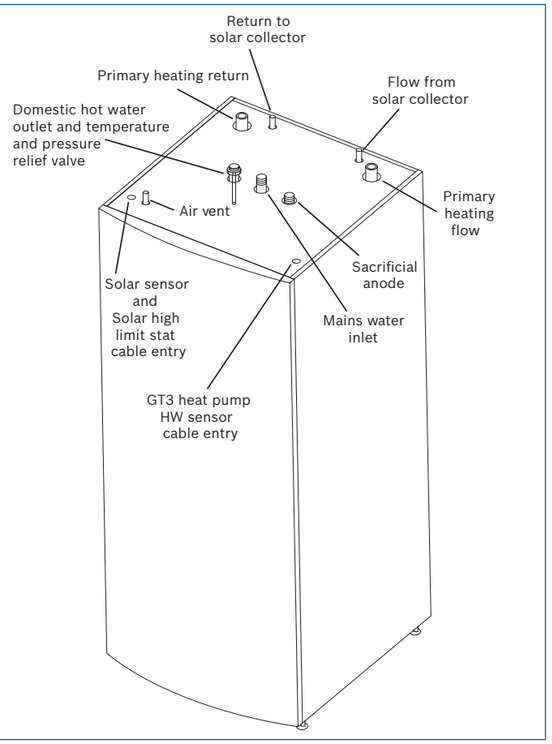


**Greenstore 180 Cylinder*
***Greenstore 280 Cylinder*

Casing dimensions and pipework connections



Cabinet dimensions (mm)		
	Greenstore 180 Cylinder	Greenstore 280 Cylinder
A	1,520	1,700
B	600	695
C	650	695



Cylinder connection

System layout

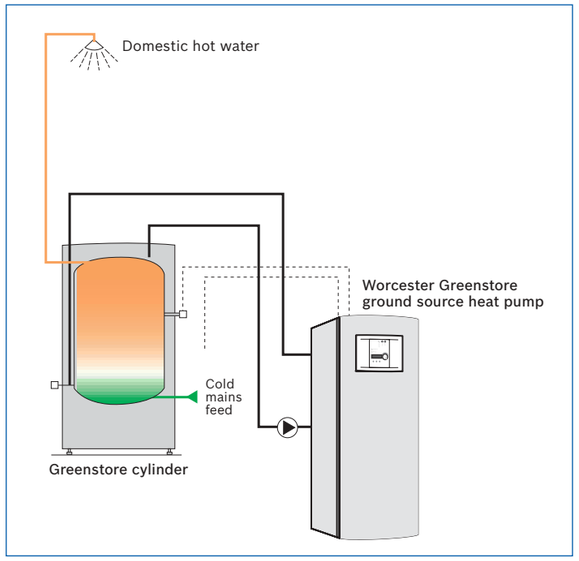
The Greenstore series of heat pumps has the versatility to be used in a variety of different system designs.

The Greenstore Combination models benefit from a built in 185 litre store of unvented hot water, providing a convenient hot water and heating solution in one product.

Greenstore ground source heat pump and hot water cylinders

Hot water cylinders used with heat pumps must have sufficient surface area for heat transfer. This ensures that the lower flow temperatures and small temperature differential do not adversely affect the re-heat time. The heat pump operates on hot water priority so it is important to minimise the heat uptime to lessen the effect on heating. Cylinder designs with coil heat exchangers are not usually suitable for use with heat pumps.

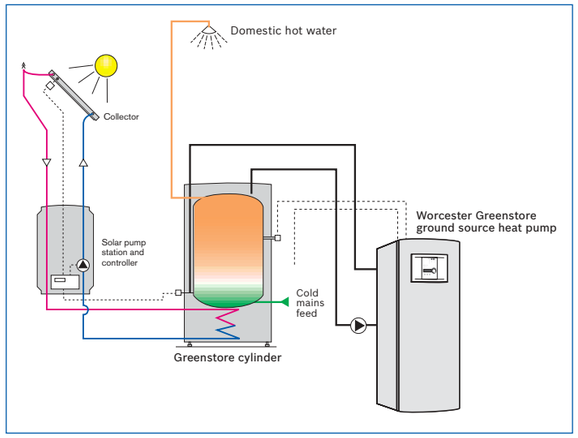
With this in mind Worcester offers two Greenstore solar compatible cylinders, in sizes of 180 and 280 litres and with a tank-in-tank design for use with Greenstore System series heat pumps.



Greenstore ground source heat pump with solar support

This system uses the same products as the system above but with the solar coil in the cylinder linked to a Worcester Greenskies solar system. The system allows each of the technologies involved to work together with the fewest compromises. The advantage is that the heat pump is not required to be the sole provider of the domestic hot water and therefore will have the opportunity to run at lower flow temperatures when the solar is producing the hot water.

As well as providing the heating the heat pump provides any additional heat that might be required over that provided by the solar system.

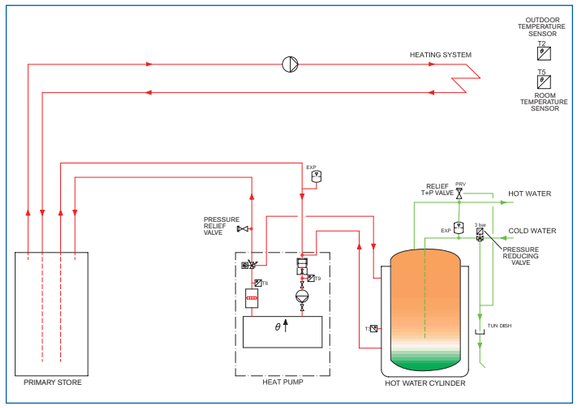


System design requirements

The heating system should be designed to maintain 70% of the nominal flow of the system across the heat pump at all times.

Underfloor heating systems should have at least half of the coils fully open at all times. Alternatively, or where TRVs are fitted throughout, a by-pass may be fitted in order to maintain the flow around the system.

Where it is not possible, due to the design of the heat emitters, to maintain this flow rate a low loss header or a Worcester primary store of around 100 litres should be fitted.



Connecting the heat pump to the heating system

Care should be taken to avoid excessive use of flux on copper pipe connections to minimise the amount of debris that the filter can come into contact with.

System flushing and care

Central heating systems must be flushed before the heat pump is installed. The system should be prepared in accordance with the guidelines of BS 7593 : 2006.

The filter on the primary circuit should be checked during the first week of operation to ensure that any debris is removed.

Groundworks and collectors

Survey

It is strongly recommended that a ground survey is carried out to identify any service/utility pipes or other underground obstacles in the area, before any groundworks are commenced.

Groundwork considerations

All groundworks should be carried out with the proper safety considerations appropriate to the depth of any trench work being carried out. Shuttering should be considered on steep sided trenches where people will be working.

Groundwork contractors

An experienced groundwork contractor should be used for trench work. Services can be obtained from:

Bemand Contracts Ltd, Holloway Common Farm,
Hampton Charles, Tenbury Wells, Worcestershire WR15 8PY
Telephone 01885 410338
www.bemandcontractsltd.co.uk

Consideration should be given to settlement of the backfilled earth.

Borehole contractors

Specialist borehole contractors will be required for vertical collector installations. Contractors are normally able to drill the borehole and supply, fill and install the collector ready for connection by the installer. The collector must be filled before being lowered into the bore hole. The contractor should be able to provide a geological survey of the area before drilling commences.

Borehole services can be obtained from:

Roger Bullivant Ltd, Walton Road, Drakelow,
Burton-on-Trent, Staffordshire DE15 9UA.
Tel: 01283 511115

WB & AD Morgan Ltd, Presteigne Industrial Estate,
Presteigne, Powys LD8 2UF
Tel: 01544 267980

Ground loop connections

Pipework connecting collectors to the appliance should be buried to a depth of between 800mm and 1,200mm. It must also be insulated in accordance with the recommendations made in the insulation section. The minimum permitted bend radius is 1 metre.

Where possible collector pipework should be run in the longest single lengths possible to reduce the number of connections in the system. The connections in 40mm PEM pipe or compact collectors can be made using ultrasonic welding equipment or using compression fittings.

Suitable fittings are available from:

Uponor Housing Solutions Ltd, Snapethorpe House,
Rugby Road, Lutterworth, Leicestershire LE17 4HN
Tel: 01455 550355

George Fischer Alprene, P.O. Box 2932, Coventry CV2 2YZ
Tel: 024 7653 3800

Philmac, Diplocks Way, Hailsham, East Sussex BN27 3JF
Tel: 01323 847323

Plasson UK Ltd, Parbrook House, Natts Lane, Billinghurst,
West Sussex RH14 9EY
Tel: 01403 782782

Care should be taken to ensure that all connections remain clean and free from debris and all pipe ends must be capped when not in use. It is also important to ensure that pipe cuts are fully deburred. It is recommended that hose pliers are used to make clean pipe cuts.

A fluid leak test should be made on all connections between the heat pump and the ground loop.

It is recommended that external pipework is marked to ensure that the correct connections are made at the heat pump.

Ground loop testing and filling

The collectors should be pressure tested with air before filling. A 40mm PEM pipe loop system should be tested to a pressure of 3-4 bar over a period of 2 hours. Compact collectors should be pressure tested at 3-4 bar for a minimum of 3-4 hours.

It is advisable the collector is pressurised (to 2 bar) during the back filling process.

Care should be taken when disconnecting from the ground loop. Ensure that the pressure is reduced fully before disconnection.

After filling the system with the required concentration of heat transfer fluid the filling pump should be run for an hour to ensure that all the air has been purged from the system.

Insulation

All pipework from and to the collector (which is not active collector) must be insulated especially when there is less than 0.8m separation between the pipes. Insulation which is to be buried must be robust enough to withstand the weight of the earth above it.

All pipework running to and from the collectors inside the property must also be insulated. In addition, all pipework outside the property must be insulated for a distance of at least 2 metres from the property. It is recommended that insulation is done prior to clipping pipes to walls to ensure complete coverage.

In some instances on pipework and exposed fittings, condensation may form which should be accounted for when choosing to site the product.

Suitable insulation is available from:

Armacell UK Ltd, Mars Street Oldham Lancashire. OL9 6LY.
Tel: 0161 287 7100

Worcester system design service

Worcester is pleased to offer a full design service to specify the ground source system according to individual requirements.

Worcester on-site technical expertise

Worcester has a team of technical representatives based at head office for telephone assistance and national coverage of technical representatives available for on-site assistance.

Heat pump sizing

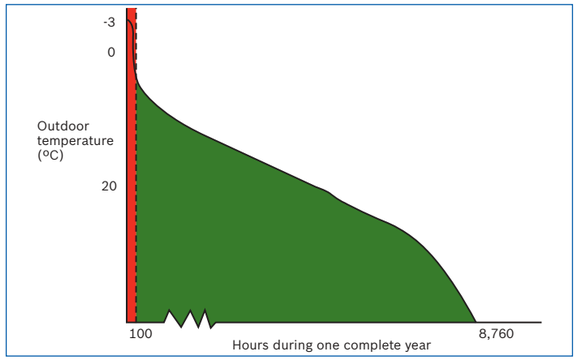
Although the sizing of the heat pump can only be accurately carried out by taking all factors into consideration this section offers some explanation of the principles behind the sizing of heat pump according to the energy requirement of the property.

The following examples are for demonstration purposes only:

A heat pump is typically sized to provide around 75-80% of the peak load of the house on the coldest day. Since the number of days that this requirement occurs is relatively low, taken as a proportion of the total year, the heat pump is typically sized to provide 95% of the total heating requirement for a property over the year as a whole. The remaining energy is provided by the built-in electrical heater.

The benefit of sizing the heat pumps below the peak load requirement is that the pump, for the majority of the year, is able to remain on and deliver a ‘trickle charge’ of heat to the property, rather than being oversized and constantly cycling in and out of operation. This helps the heat pump to offer better efficiency.

The graph below is intended to show the principle behind the sizing of heat pumps to take into account the small number of hours where the peak heating load of the house is required. The dotted vertical line shows that there have, in the example shown, only been 100 hours of outdoor temperature below 0ºC in the given 8,760 hours.



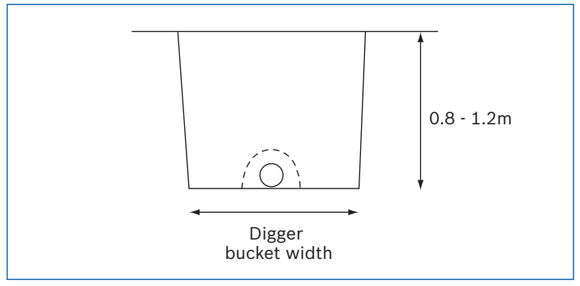
There are significant climatic differences across the UK and this example is not intended to provide information on any particular installation. The Worcester system design service is able to provide information on an individual basis.

For more information on the suitability of heat pumps for your home visit **www.worcester-bosch.co.uk**

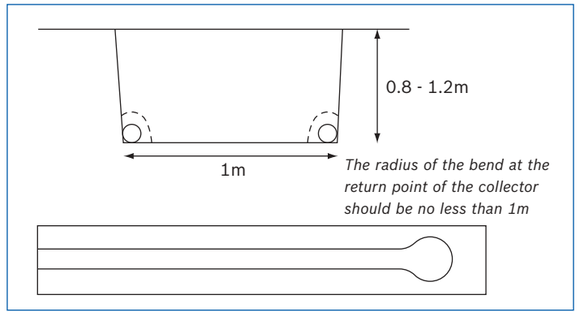
Collectors

Horizontal collector
Horizontal collectors were the collection method originally introduced with ground source heat pumps. The horizontal collector recommended in this case is 40mm diameter pipe. Compared to other options this method has a lower energy yield per metre of collector. As such a larger collector is required.

Installation option 1
The collector should be covered in 10cm of sand where the material to be back filled contains sharp stones which may damage the collector. Sand should not be required where the earth to be backfilled contains smaller round stones.



Installation option 2



Collectors should be buried to a depth of at least 0.8m to avoid the effects of frost on the collector. A depth of 1m tends to be favoured.

This type of horizontal system typically provides between 10 and 18W of energy per metre of active collector. The lower figure in the range would apply if the heat pump is running all day whereas the higher figure would be typical of a system running a few hours per day. When sized to 75%-80% of the peak load of the house the energy drawn from the collector could be around 15W per metre.

Compact collector testing and filling

The collectors should be pressure tested with air before filling. A 40mm PEM pipe loop system should be tested to a pressure of 3-4 bar over a period of 2 hours. Compact collectors should be pressure tested at 3-4 bar for a minimum of 3-4 hours.

It is advisable that the collector is pressurised (to 2 bar) during the back filling process.

Care should be taken when disconnecting from the ground loop. Ensure that the pressure is reduced fully before disconnection.

After filling the system with the required concentration of heat transfer fluid the filling pump should be run for an hour to ensure that all the air has been purged from the system.

The amount of energy extracted also depends on the amount of moisture that the collector is in contact with in the ground.

Appropriate pipework (PEM 40x2.4 SDR 11) is available from:

Uponor Housing Solutions Ltd, Snapethorpe House, Rugby Road, Lutterworth, Leicestershire LE17 4HN
Tel: 01455 550355

Rehau Ltd, Hill Court, Walford, Ross-on-Wye, Herefordshire HR9 5QN
Tel: 01989 762537

Sizing the horizontal collector to the heat pump
The sizing of the collector depends upon, in addition to other factors, on the COP (Co-efficient of Performance) of the heat pump system.

In simple terms the length of collector will be determined by a simple equation of the energy to be extracted from the ground in Watts divided by the yield from the collector in Watts per metre.

Using the example from the section of this document on the COP the following would apply. A heat pump capacity of 9kW has been taken as the example simply to show the calculations involved.

Heat pump capacity	= 9kW
COP	= 3.3
Energy provided by ground source	= 6.3kW (6,300W)
Energy yield per metre of collector	= 15W
6,300 ÷ 15	= 420
Collector required	= 420m

Taking an example of 6,300W to be extracted from the ground and dividing the yield of 15w/m into this the required length of collector would be 420 metres.

As a rough guide, following the yield and COP above, a 6kW heat pump would require 280m of collector and a 9kw would require 420m. A single loop collector is generally possible in a length of up to 450m.

These lengths would normally have to be increased by 20 to 25% for a collector in sandy soil and decreased by 20 to 25% for wet soil (water permanently present).

Length of active collector (m) & no. of circuits required				
	6kW	7kW	9kW	11kW
Collector length	280	325	420	260
No. of circuits	1	1	1	2

Compact collectors

The compact collector allows a heat pump to be installed with a reduction in the area of ground required compared to a typical horizontal collector.

The compact collectors measure 1.5 metres wide and 2 metres tall and are connected together using either compression fittings or fusion welding.

Reloading
Compact collectors can be used with or without reloading. Reloading is a method of returning energy to the ground around the collectors when the heat pump is not using it, thereby increasing the amount of energy stored in the ground for use when it is required.

Reloading is typically achieved using an air recovery system whereby waste heat from the air in a property is used in a heat exchanger to transfer energy back into the ground.

Compact collectors are available at stockists of Worcester Greenstore ground source heat pumps.

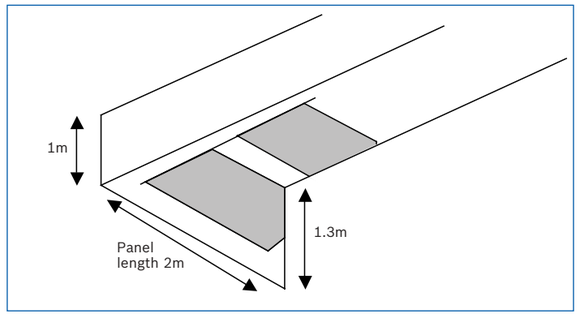
Sizing the compact collector array to the heat pump
As a rough guide (based on a COP of 3.3) the table below shows the required number of compact collector panels with and without reloading.

Required no. of compact collector panels				
	6kW heat pump	7kW heat pump	9kW heat pump	11kW heat pump
With reloading	9	11	14	17
Without reloading	18	22	28	33

Required no. of compact collector panels		
	No. collectors per kW of heat pump output	Energy recovery per panel approx.
With reloading	1.5	450W
Without reloading	3	250W

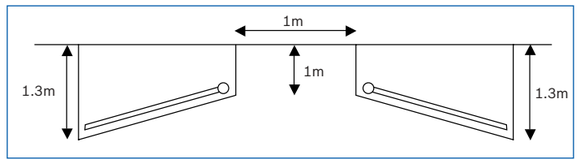
Installation requirements

Installation option 1 – no reloading available
Where no reloading is available the panels should be installed in an almost horizontal manner as shown in the diagram.



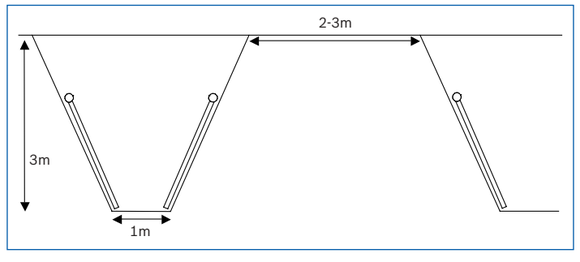
The collectors should be installed so that there is a fall from the top of the collector (where the connections from one panel to the next are made) to the bottom of the collector of 300mm, equal to 150mm per metre.

A distance of 1 metre is required between multiple rows of collectors.



Where the backfill material contains sharp stones the collector should be laid in 10cm of sand and covered with another 10 cm of sand.

Installation option 2 – reloading only
Where reloading is possible the panels can be installed in a vertical format.



Multiple rows
Compact collectors can be arranged in multiple rows. A maximum of 11 collectors per row is permissible. Each individual collector provides a flow resistance of 5kPa/h. The table below provides further details.

Multiple rows				
	6kW heat pump	7kW heat pump	9kW heat pump	11kW heat pump
With reloading				
no. of panels	9	11	14	17
no. of rows	1	1	2	2
Without reloading				
no. of panels	18	22	28	33
no. of rows	2	2	3	3

Borehole (vertical) collectors

A borehole collector allows a ground source heat pump to be installed in a property where the area of land available is insufficient for compact collectors or a horizontal collector.

Vertical collectors typically provide a higher energy yield per metre of active collector when compared to horizontal collectors.

Vertical collectors can provide between 35 and 55 Watts per metre of active collector, which depends on the heat conductivity of the rock into which the hole is drilled. A hard rock such as granite has a better conductivity that a softer rock such as limestone. For the purpose of the example below a figure of 40W per metre has been used. The actual yield will depend, amongst other factors, on the geological conditions on site.

Pipework for vertical collectors may be supplied by the borehole contractor to the specification indicated in the pipework section.

Alternatively, pipework (PEM 40x2.4 SDR 17) is available from:

Uponor Housing Solutions Ltd, Snapethorpe House, Rugby Road, Lutterworth, Leicestershire LE17 4HN
Tel: 01455 550355

Rehau Ltd, Hill Court, Walford, Ross-on-Wye, Herefordshire HR9 5QN
Tel: 01989 762537

Sizing the vertical collector to the heat pump

Heat pump capacity	= 9kW
COP	= 3.3
Energy provided by ground source	= 6.3kW (6,300W)
Energy yield per metre of collector	= 40W
6,300 ÷ 40	= 158
Collector required	= 158m

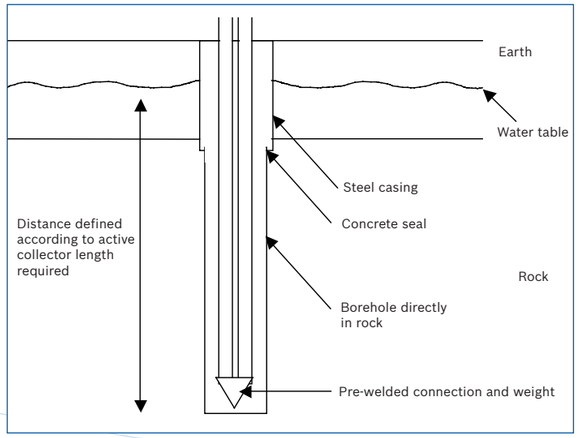
Length of active collector required (m)				
Collector yield	**6kW heat pump**	**7kW heat pump**	**9kW heat pump**	**11kW heat pump**
55 W/m	80	90	120	140
40 W/m	110	120	160	190
35 W/m	120	140	180	220

The term active collector is used to denote collector pipe that is in direct contact with the ground source, for example below the water table or in contact with a borehole filling material such as bentonite. Any part of the tube that is in contact with air will not generate a significant yield and must not be included when calculating the energy the collector will provide.

However it is a requirement when specifying the total length of tube required to include the active collector, any inactive portion in the borehole and the run from the property to the borehole and back.

It is considered good practice (and a requirement of the Environment Agency) to fill the bore hole with bentonite (a cement compound) in order to guarantee conduction of energy to the collector and to guard against disturbing rock strata or ground water layers.

The borehole collector should be filled before being lowered into the borehole with glycol mixture.



Cylinders

Hot water cylinders used with a heat pump must have sufficient surface area for heat transfer. This ensures that the lower flow temperatures and small temperature differential do not adversely affect the re-heat time of the cylinder. The heat pump operates on hot water priority so it is important to minimise the heat up time to lessen the effect on the heating.

Worcester has a range of Greenstore solar compatible cylinders which have been developed specifically for use with Greenstore System heat pumps and Worcester solar systems.

Standards

The installation of the Worcester Greenstore Ground Source Heat Pump system must be carried out in accordance with the relevant requirements for safety, current Wiring Regulations, local Building Regulations, Building Standards (Scotland), (Consolidation) Regulations and Bylaws of the local water company and Health and Safety document No. 63S (Electricity at Work Regulations 1989). It should be in accordance with the relevant recommendations of the following British Standards and Regulations:

BS EN 255 – replaced by BS EN 14511

BS EN 814

BS EN 378

The Health and Safety at Work Act 1974

The Management of Health and Safety at Work Regulations 1999

The Construction (Health, Safety and Welfare) Regulations 1996

The Construction (Design and Management) Regulations 1994

The Lifting Operations and Lifting Equipment Regulations 1998, and any other relevant regulations in force at this time.

The manufacturer's notes must not be taken in any way as overriding statutory regulations.

Electricity supply

The heat pump should be connected to 230V single phase electricity supply and wired directly into a consumer unit protected by an appropriate D characteristic miniature circuit breaker according to the table shown.

Starting current (A)			
6kW heat pump	**7kW heat pump**	**9kW heat pump**	**11kW heat pump**
22.9	23.8	30.9	34.6

Recommended fuse according to electrical output* (AaM)			
6kW electric heater			
6kW heat pump	**7kW heat pump**	**9kW heat pump**	**11kW heat pump**
40	40	50	50
9kW electric heater			
6kW heat pump	**7kW heat pump**	**9kW heat pump**	**11kW heat pump**
50	63	63	63

Heat transfer fluid

Glycol fluid

The collector side of the heat pump must be filled with a suitable glycol heat transfer fluid.

Tyfocor© L (propylene glycol) manufactured by Tyforop Chemie GmbH can be diluted with water to make it suitable for this purpose and is available from stockists of Worcester FK series of solar panels.

Tyfocor© L is supplied in a 50/50 water/glycol concentration. This needs to be diluted to achieve a ratio of 65% water 35% glycol. For every 25 litre drum of Tyfocor© L used, 12.5 litres of water should be added to the mixture.

40mm OD 35mm ID hose when filled contains one litre of liquid per metre. A single compact collector contains approximately 40 litres of liquid.

Mixing ratio in litres per metre of coil (40/35mm hose)		
Product	**Water (l)**	**Antifreeze (l)**
Bioethanol	0.71	0.29
Propylene/ethylene glycol	0.65	0.35

Mixing ratio in % by weight	
Product	**%**
Bioethanol / water	25 / 75
Propylene or ethylene glycol / water	35 / 65

Suitable antifreeze solutions are also available from:

Uponor Housing Solutions Ltd, Snapethorpe House, Rugby Road, Lutterworth, Leicestershire LE17 4HN
Tel: 01455 550355

Hydra Tech, Units 3/6 Queensway Centre, Swansea West Industrial Park, Fforestfach, Swansea SA5 4DT
Tel: 0870 7446395

Refrigerants

The refrigerant circuit in Worcester Greenstore ground source heat pumps is filled with R407C. Under normal conditions there should be no requirement for refrigerant handling. The refrigerant must only be handled by trained and accredited operatives.

Warranty

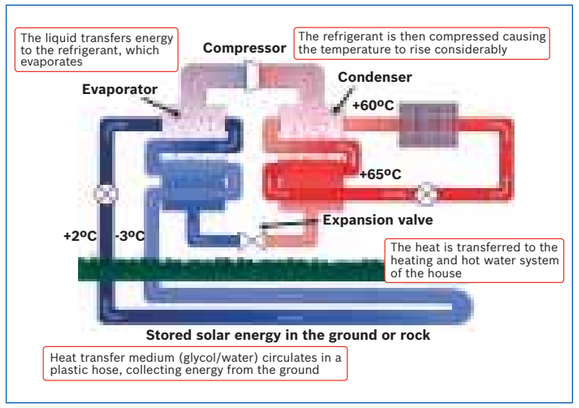
Worcester will provide a guarantee of 2 years on the heat pump provided the system has been installed by a qualified installer and the registration card is returned.

FAQs

What is sustainable energy?
Sustainable energy is best thought of as energy which can be replenished within a human lifetime and which causes no long-term damage to the environment.

Solar energy, wind energy, and geothermal energy, amongst others, are all self-sustaining. They all have sources that cannot be depleted. Extended use of these energy sources aids the conservation of other non-renewable energy sources such as fossil fuels.

How does a heat pump work?
The technology inside a heat pump works on similar principles to the way a domestic fridge works. Heat pumps take advantage of the principles of thermodynamics in order to achieve their results. The diagram below offers a pictorial explanation.



A water and glycol mixture is pumped around the collector circuit and causes the refrigerant in the evaporator to turn to gas. This refrigerant passes through the compressor, causing the temperature to rise significantly. The hot gas moves to the condenser where it condenses and the latent energy is released into the heating circuit.

How is energy collected from the ground?
There are three options to obtain the energy from the ground.

In a horizontal collector lengths of pipe are buried underground to a depth of around 1 or 2 metres. This is a good solution if the property in question has enough land to accommodate the collector.

Worcester also offers compact collectors which reduce the amount of space required for the collector.

An alternative to the horizontal collector types above is the vertical collector. A bore hole is drilled to a depth of between 60 and 200m and the collector is fed into the hole. A vertical collector minimises the amount of land required on the surface for a collector.

What is the COP?
The performance of a heat pump is often shown as the COP or Coefficient of Performance. This relates to the amount of energy that is extracted from the ground for each unit of energy used to run the pump.

A heat pump could provide between 3 and 5kW of heat for each kW invested. The return is affected by the temperature achieved from the source and the heat required from the appliance to heat the property.

As an example if 3kW is provided by the electrically driven heat pump and 9kW is provided by the ground source the COP would be 4. This equates to the total energy provided, in this case 12kW, divided by the electrical energy from the heat pump, in this case 3kW, giving the COP of 4.

Do I still need a boiler?
In contrast to solar thermal which requires a boiler back-up a heat pump, in most circumstances, should be able to provide all of the heating and water required for the home.

What heat delivery method gives the best results?
Ideally a heat pump should be used with underfloor heating to maximize the efficiency of the system.

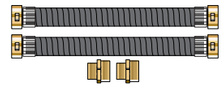
Can I keep my existing radiators?
Unless the radiators have already been oversized they will probably have to be replaced by larger ones to ensure a higher COP from the heat pump.

Is there any government funding available?
The Department of Trade and Industry is funding an initiative called the UK Microgeneration Certification Scheme which offers a grant towards the cost of a heat pump installation*. For more information visit www.dti.gov.uk

Alternatively consumers are able to benefit from a £1,700 incentive available in conjunction with energy supply company npower**. For further details visit **www.worcester-bosch.co.uk**

** From 30th April 2007*
*** Terms and conditions apply*

Greenstore ground source heat pump accessories

100 litre primary storage tank	Compact collector	Filling pump unit	Filling pump hose kit
			
Worcester Part No. 7 716 192 418	**Worcester Part No. 7 716 192 419**	**Worcester Part No. 7 716 192 420**	**Worcester Part No. 7 716 192 421**

Air compressor	Compressor connection kit	Greenstore 180 solar compatible Cylinder	Greenstore 280 solar compatible Cylinder
			
Worcester Part No. 7 716 192 422	**Worcester Part No. 7 716 181 103**	**Worcester Part No. 7 716 180 017**	**Worcester Part No. 7 716 180 018**

Notes

A complete after-sales service

As part of the worldwide Bosch Group, Worcester strives to maintain the highest possible standards of after-sales care.

In addition to the no-nonsense parts and labour warranty applicable to all Worcester boilers, you and your customers have the assurance that every Worcester boiler is manufactured to both the appropriate British and European standards.

Worcester Contact Centre

Should you require support, our fully trained Contact Centre staff, based at our head office in Worcester, are ready to take your calls. Whatever your query our contact centre operators along with our nationwide team of engineers are ready to help you.

Boiler Protection Options

If you do not offer annual service and maintenance contracts please refer your customers to the Worcester Service Centre:

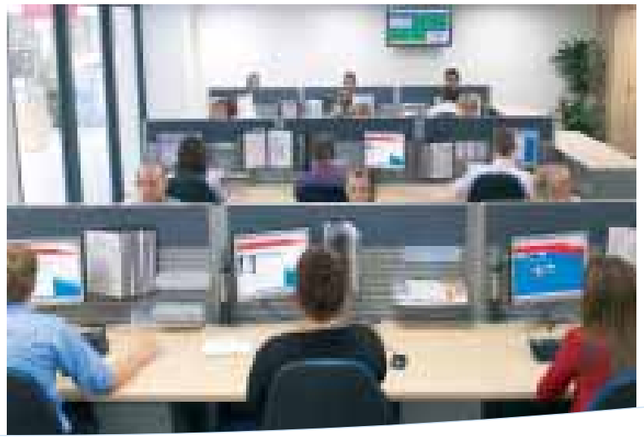
Tel: 08457 256 206
Fax: 01905 757 536

Contact Centre

Tel: 08457 256 206
Fax: 01905 754 701

Opening Times

Monday – Friday: 7.00am – 10.00pm
Saturday: 8.00am – 5.00pm
Sunday: 9.00am – 12 noon



All the technical advice you need

Spares

Genuine replacement parts for all Worcester appliances are readily available from stock, on a next day delivery basis. For more information please call your local stockist.

Customer Technical Support

The Worcester Technical Helpline is a dedicated phone line – committed to providing a comprehensive service to complement the brand name and quality of our products. Our experienced team of technical experts provide the answers to queries of a technical nature across the entire Worcester range.

Worcester also has a pre-sales department, which provides assistance in selecting a system to suit a particular application, along with full guidance on installation. As well as this we will also assist in finding a recommended installer. For more information please contact the Technical Hotline or alternatively visit our website where literature can be downloaded **www.worcester-bosch.co.uk**

Technical

Tel: 08705 266 241
Fax: 01905 752 741

Opening Times

Monday – Friday: 7.00am – 8.00pm
Saturday: 8.30am – 4.00pm

The very best training programmes from Worcester

Worcester has always placed great emphasis on technical support and training for installers and service engineers. Today this need is greater than ever. The differences between a combi, conventional and system boiler are substantial, and the technology of each continues to advance at a rapid pace.

To ensure the highest levels of competence and expertise in the installation of all Worcester products, the company runs intensive training courses for installers, commissioning engineers and engineers involved with servicing and fault finding.

Courses available

Our training facilities offer a number of courses suitable for the installer and commissioning engineers, and a more in-depth course for the servicing and fault finding engineers.

Training Centres throughout the UK

Worcester's network of regional training centres are strategically located across the country and include the 'A' Rated Training Academy at the company's headquarters. This facility has recently been extended to include an oil-fired appliance workshop and a renewable energies workshop in addition to the extensive gas-fired training facilities.

In addition to these outstanding facilities there are centres at Clay Cross in Derbyshire, Rochester in Kent and Bangor in Northern Ireland. Further 'A' Rated Academies are open at West Thurrock in Essex (from April 2007) and Bradford in West Yorkshire (from June 2007) as well as additional training opportunities available throughout the UK. Please phone 01905 752526 for more information about a course near you. Each course is run by specialist trainers and is superbly equipped to deliver a combination of classroom theory and practical hands-on experience that's second to none.

College-linked Learning

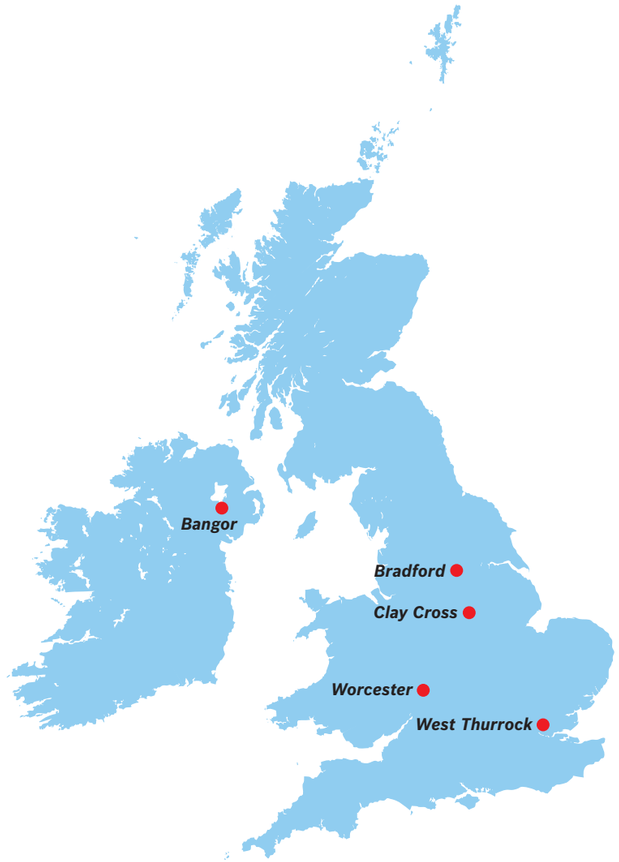
A number of the UK's leading proactive technical colleges are equipped with Worcester products and offer excellent practical tuition on a more local level.

Distance Learning

Worcester has produced a selection of Distance Learning CD ROMs/DVDs which are packed with information. Call 01905 752556 for your copies.

Get on course for a more profitable future now.

Call now for more information 01905 752526



www.worcester-bosch.co.uk

Worcester training courses

Worcester training courses	
Greenstar CDi, Highflow 440 and HE Plus gas-fired condensing combi boilers	
Models covered	Greenstar 25/30/35/40CDi Greenstar Highflow 440
Duration	1 day
Greenstar i Junior and Si gas-fired condensing combi boilers	
Models covered	Greenstar 24/28i Junior Greenstar 25/30Si
Duration	1 day
Greenstar system and regular gas-fired condensing boilers	
Models covered	Greenstar 12/15/18/24Ri Greenstar 30/40CDi Conventional Greenstar 30CDi System Greenstar 12/24i System
Duration	1 day
Standard efficiency boiler course: i/Si/CDi (non condensing)	
Models covered	24/28i Junior 24/28Si II 24/28/35CDi
Duration	1 day
Greenstar Camray high efficiency condensing oil-fired boilers	
Models covered	Greenstar Camray Greenstar Camray Utility Greenstar Camray Utility System Greenstar Camray External
Duration	1 day
Greenstar Danesmoor & Heatslave high efficiency condensing oil-fired boilers	
Models covered	Greenstar Danesmoor Greenstar Utility Greenstar Heatslave Greenstar Heatslave External
Duration	1 day
OFTEC Training	
OFTEC 101	
Covering	Domestic/Light Commercial Pressure Jet Commissioning and Servicing
Duration	3 day course (2 days training plus 1 days assessment)
OFTEC 105e	
Covering	Domestic/Light Commercial Pressure Jet Boiler Installation
Duration	1 day assessment
OFTEC 101 & 105e	
Covering	Domestic/Light Commercial Pressure Jet Installation, Commissioning and Servicing
Duration	3 day course (2 days training plus 1 days assessment comprising 2 theory and 1 practical)
OFTEC 600a	
Covering	Oil Tank Installation and Associated Controls
Duration	1 day assessment course
OFTEC 101/105e/600e	
Covering	Domestic/Light Commercial Pressure Jet Boiler Installation, Commissioning, Servicing and Oil Tank Installation and Associated Controls
Duration	4 days (2 days training and 2 days assessment)

Certificate in Energy Efficiency for Domestic Heating Course	
Covering	Key elements of energy-efficient heating and hot water systems and products, compliance with the latest Building Regulations, how condensing boilers work and how they differ to non condensing products.
Duration	1 day
Unvented Cylinder Course	
Covering	All G3 Regulations for the Installation, Servicing and Commissioning of Unvented Cylinders. The course includes recognised accreditation by Logic Certification.
Duration	1 day
Greenskies Solar System	
Covering	Installation, Commissioning and Servicing The course includes recognised accreditation by Logic Certification for eligibility of low carbon buildings programme funding.
Duration	2 days
Greenstore Heat Pumps	
Covering	Installation, Commissioning and System Design
Duration	2 days

Useful numbers

Sales
Tel: 01905 752640
Fax: 01905 456445

Service
Tel: 08457 256206
Fax: 01905 757536
Livingston (Scotland)
Fax: 01506 441687

Spare Parts
Tel: 01905 752576
Fax: 01905 754620

Training
Tel: 01905 752526
Fax: 01905 752535

Technical (Pre & Post Sales)
Tel: 08705 266241
Fax: 01905 752741

Literature Line
Tel: 01905 752556
or download instantly
from our website

www.worcester-bosch.co.uk

OFTEC Member
iphe INDUSTRIAL ASSOCIATE
In partnership with energy saving trust™
Heating & Hotwater Information Council
benchmark The mark of quality for domestic heating

Part No. 8 716 112 116 02/07

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