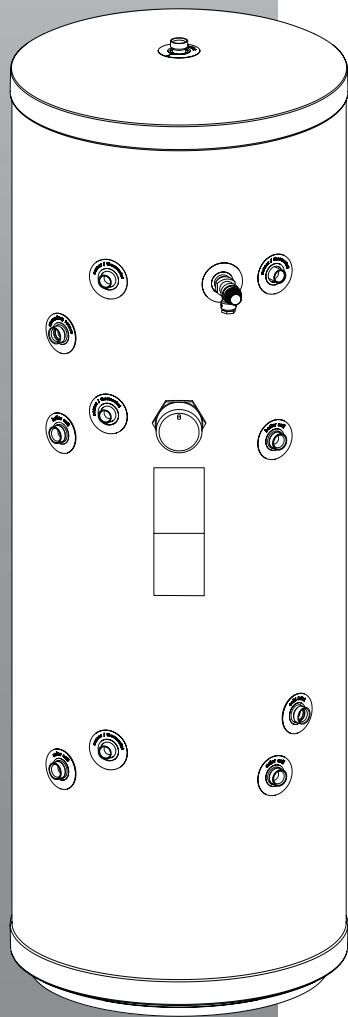


Installation and maintenance instructions

Twin Coil Indirect Unvented Hot Water Cylinder

Greenstore TC Cylinder Series

150/180/210/250/300 litre



001 001 7047-001



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End User

Precautions should be taken when working on hot or cold water system that is connected to an unvented hot water cylinder. Advice should always be sought from your installer or professional to prevent potential damage to the cylinder or associated equipment.


1 Explanation of symbols and safety instructions


1.1 Explanation of symbols


Warnings

In warnings, signal words at the beginning of a warning are used to indicate the type and seriousness of the ensuing risk if measures for minimising danger are not taken.

The following signal words are defined and can be used in this document:


 **DANGER:**
DANGER indicates that severe or life-threatening personal injury will occur.

 **WARNING:**
WARNING indicates that severe to life-threatening personal injury may occur.

 **CAUTION:**
CAUTION indicates that minor to medium personal injury may occur.

NOTICE:
NOTICE indicates that material damage may occur.

Important information

 The info symbol indicates important information where there is no risk to people or property.

Additional symbols

Symbol	Meaning
▶	a step in an action sequence
→	a reference to a related part in the document
•	a list entry
–	a list entry (second level)

Table 1



Benchmark places responsibilities on both manufacturers and installers. The purpose is to ensure that customers are provided with the correct equipment for their needs, that it is installed, commissioned and serviced in accordance with the manufacturer's instructions by competent persons and that it meets the requirements of the appropriate Building Regulations. The Benchmark Checklist can be used to demonstrate compliance with Building Regulations and should be provided to the customer for future reference.

Installers are required to carry out installation, commissioning and servicing work in accordance with the Benchmark Code of Practice which is available from the Heating and Hotwater Industry Council who manage and promote the scheme.

Visit centralheating.co.uk for more information.



As a member of the HWA, Worcester adhere to the following statements.

- ▶ To supply fit for purpose products clearly and honestly described,
- ▶ To supply products that meet, or exceed appropriate standards and building and water regulations,
- ▶ To provide pre and post sales technical support,
- ▶ To provide clear and concise warranty details to customers.

Hot Water Association (HWA)

Camden House, Warwick Road,
Kenilworth, CV8 1TH
Tel: 01926 513777
Fax: 01926 855017
www.hotwater.org.uk

1.2 General safety instructions

Installation, conversion

- ▶ Only competent installers must install, commission, and maintain this equipment.
- ▶ Only use the cylinder for heating domestic hot water.

Function

- ▶ Observe these installation and maintenance instructions to ensure correct operation.
- ▶ Never switch the electric immersion heater on if the cylinder is not full of water.
- ▶ **Never restrict the outlets of the safety valves.**

Thermal disinfection

▶ Risk of scalding!

Caution should be taken at periods of thermal disinfection due to the possibility of domestic hot water temperatures being in excess of 60 °C .

Maintenance

- ▶ **Recommendation for the customer:** Arrange a maintenance and inspection contract with a competent person. Have the heating appliance and the DHW cylinder serviced annually.
- ▶ Always switch the mains off when servicing the system.
- ▶ Only use genuine spare parts!

⚠ Decommissioning or draining down

- ▶ Please observe best practice guidelines when draining down the system for routine maintenance or to decommission the cylinder. Advice is given throughout this document.



WARNING:

- ▶ If the cold water main is isolated internally or externally for either emergency or maintenance reasons, precautions should be taken to prevent damage to the cylinder. The hot water isolation valve located at the cylinder outlet should be closed off or the cylinder should be drained down as per the recommended procedure stated within this manual.
- ▶ If the unvented hot water cylinder is fitted at a height (eg, loft), then there will be a potential of damage to the cylinder if the correct method of draining the cylinder is not followed.
- ▶ In certain circumstance it is recommended that a WRAS approved automatic air vent is fitted on the hot water outlet at the highest point.

2 Product Information

2.1 Usage

These cylinders are designed to accept input from two heat sources, the most common being a solar input supported by a controlled appliance such as a gas or oil boiler. The maximum cylinder heat input must not exceed the following values:

Cylinder	Max. cylinder heat input
TC-150	31.9 kW
TC-180	
TC-210	39.4 kW
TC-250	
TC-300	

Table 2

Where the combined heat input exceeds the maximum input stated, precautions must be taken to limit the heating appliances to the appropriate input (see installation instructions of the heating appliance).

Correctly commissioned input reduces the cycling of the heating appliance and reduces the cylinder heat-up time.

2.2 Intended use

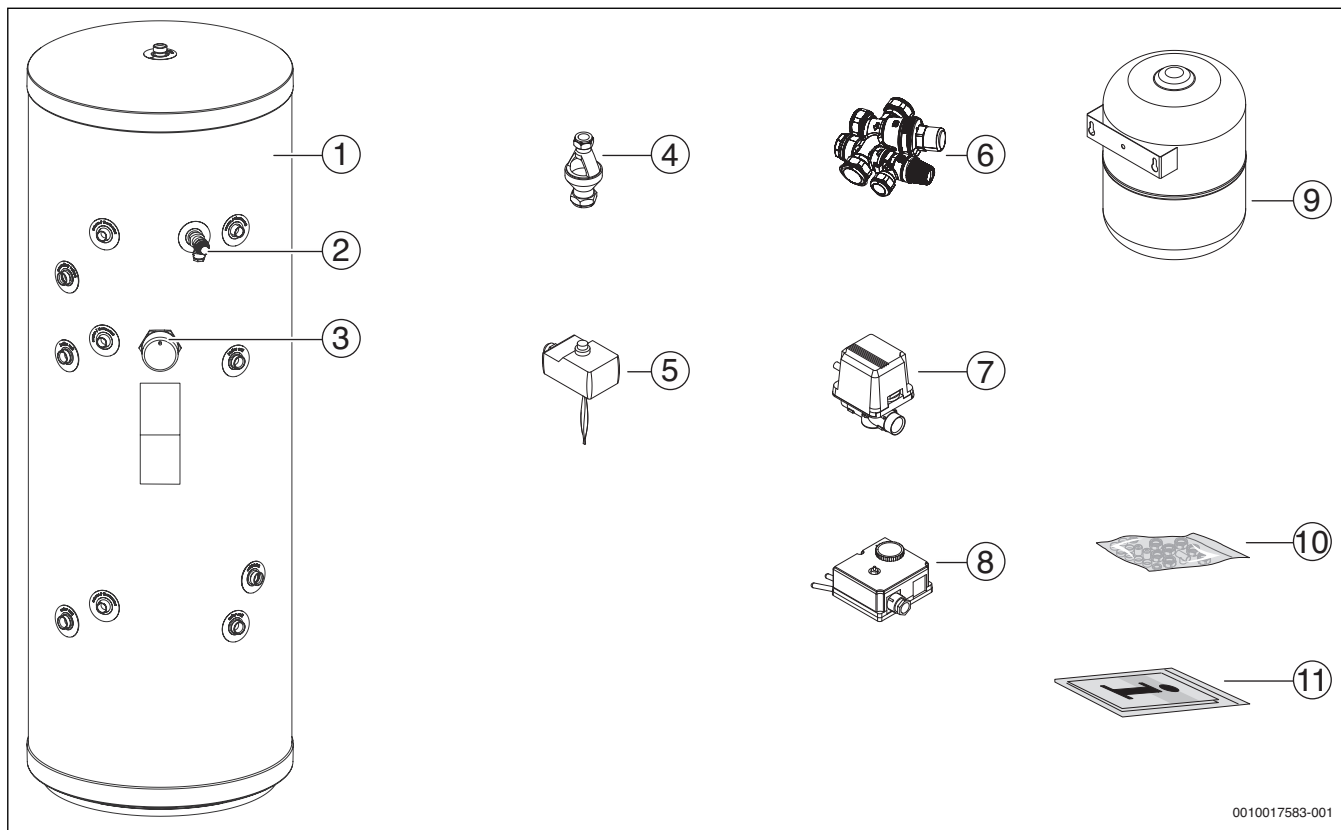
- ▶ Only use the cylinder for heating domestic hot water.

Any other application will be considered incorrect use. No liability for any losses resulting from such use is accepted.

2.3 Cylinder Equipment Specification

- 4x sensor pockets internal $\varnothing = 20.4$ mm
- Upper indirect coil for heating by the secondary heating appliance
- Lower indirect coil for heating using the primary heat source, including solar input.
- PU foaming insulation.
- Duplex stainless steel cylinder
- Immersion heater, 3 kW

2.4 Standard delivery



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Fig. 1

- [1] Twin coil DHW cylinder
- [2] Temperature and pressure relief valve
- [3] Immersion heater, 3 kW
- [4] Tundish Ø 15/22 mm
- [5] Solar high limit thermostat
- [6] Cold water inlet control group
- [7] 2-port valve
- [8] Dual cylinder thermostat
- [9] DHW expansion vessel incorporating fixing bracket
- [10] Connection set
- [11] Set of printed documents for the appliance and ErP label



WARNING:

► Only use the G3 kits from Table 3 with the compatible cylinders.

Cylinder	G3 kit		
	7-716-842-515 (12 litres)	7-716-842-516 (18 litres)	7-716-842-517 (25 litres)
7-716-842-483 TC-150	x		
7-716-842-484 TC-180		x	
7-716-842-485 TC-210		x	
7-716-842-486 TC-250		x	
7-716-842-487 TC-300			x

Table 3 G3 kits with compatible cylinders

2.5 Scaling/Corrosion protection

The cylinder is made from corrosion-resistant Duplex stainless steel.

The cylinder can be used with all mains water supplies.

Scaling: In cases where the water hardness is very high (over 450 ppm) a water softener must be used to protect the cylinder against rapid development of scale.

Corrosion protection: Any water softener shall be installed, commissioned and maintained to ensure the water hardness after the softener is never below 150 ppm.

2.6 Description of function

- If there is insufficient heat input available via the primary (lower) coil, the secondary heating appliance will heat the upper coil.
- Due to temperature stratification only the upper section of the cylinder will be heated.
- When hot water is being drawn off, the cylinder temperature in the upper section drops by approximately 8 °C to 10 °C before the heat source reheats the cylinder.

2.7 Physical and connection dimensions

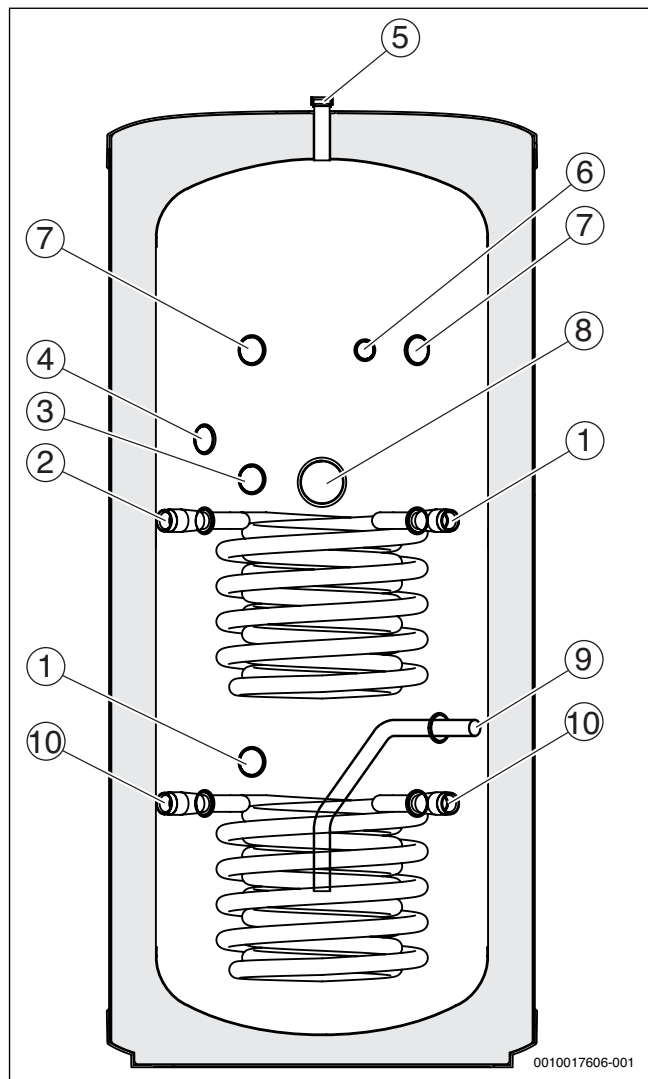


Fig. 2 Overview of connections

- [1] Sensor pocket, bottom (internal Ø 20.4 mm)
- [2] Cylinder flow / return - secondary appliance (Ø 22 mm)
- [3] Sensor pocket, centre (internal Ø 20.4 mm)
- [4] DHW secondary circulation connection (Ø 22 mm)
- [5] DHW outlet (Ø 22 mm)
- [6] Temperature and Pressure Relief valve (1/2")
- [7] Sensor pockets, top (x2, internal Ø 20.4 mm)
- [8] Immersion heater (Rp 1½ female)
- [9] Cold water inlet (Ø 22 mm)
- [10] Cylinder flow / return - primary appliance/solar (Ø 22 mm)

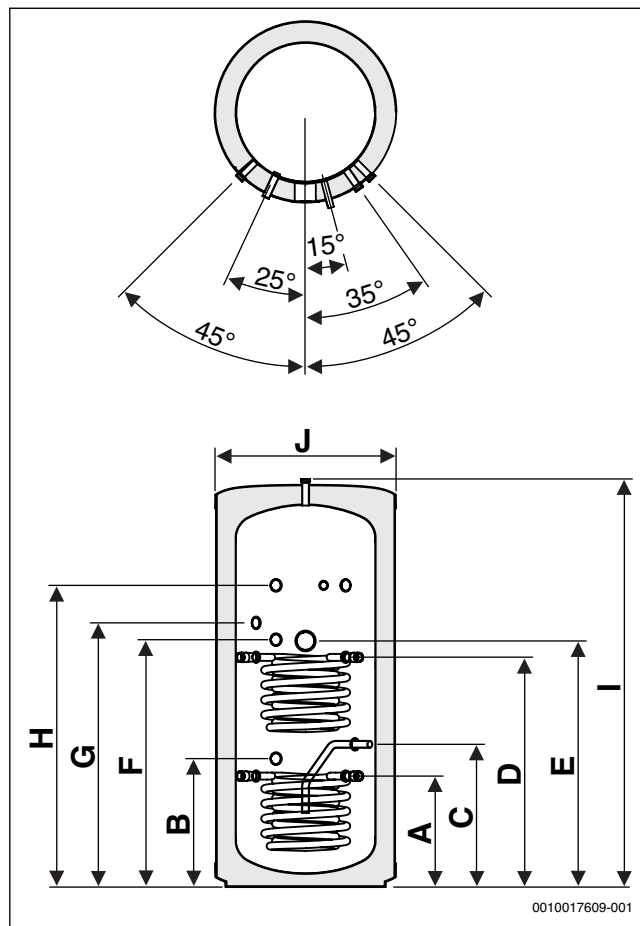


Fig. 3 Physical and connection dimensions

Cylinder	Part number	A/mm	B/mm	C/mm	D/mm	E/mm	F/mm	G/mm	H/mm	I/mm	J/mm
TC-150	7 716 842 558	338.5	393.5	438.5	713	764	768	821	939	1274	570
TC-180	7 716 842 559	338.5	393.5	438.5	713	764	768	1021	1139	1479	570
TC-210	7 716 842 560	413.5	468.5	513.5	1017	1068	1072	1196	1314	1654	570
TC-250	7 716 842 561	413.5	468.5	513.5	1101	1152	1156	1396	1514	1849	570
TC-300	7 716 842 562	413.5	468.5	513.5	1101	1152	1156	1696	1814	2144	570

Table 4

Clearance dimensions

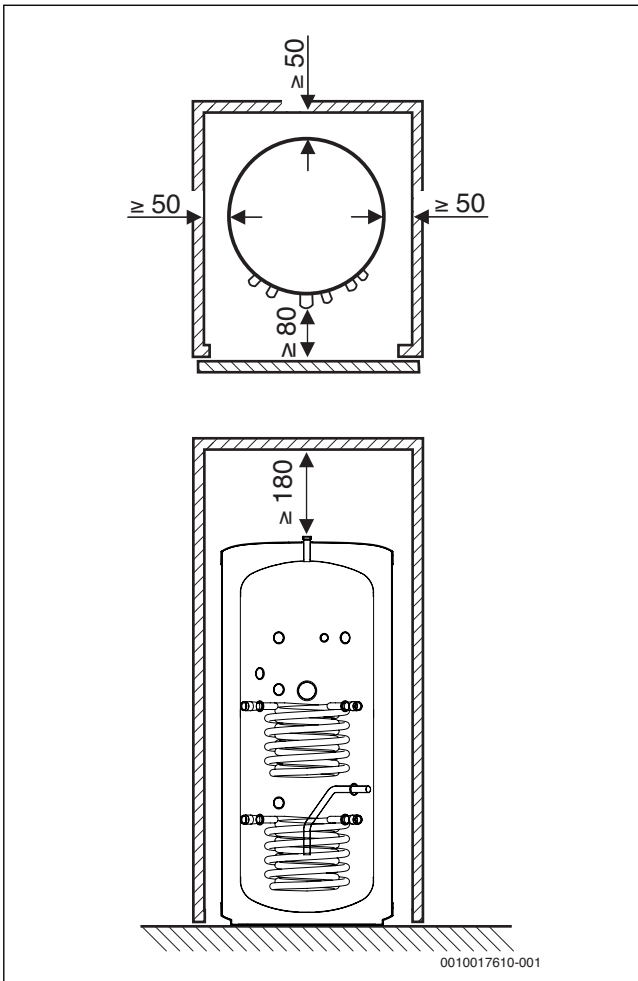


Fig. 4 Recommended minimum wall clearances
(all dimensions in mm)

2.8 Specification

Cylinder type Greenstore		TC-150	TC-180	TC-210	TC-250	TC-300
WRAS No.		1606704	1606704	1606704	1606704	1606704
WRc No.		171679	171679	171679	171679	171679
General characteristics						
Dual thermostat setting	°C	10/70	10/70	10/70	10/70	10/70
Dual thermostat high limit/Solar high limit thermostat	°C	85	85	85	85	85
Temperature and Pressure relief valve	°C	90	90	90	90	90
Temperature and Pressure relief valve	bar	7	7	7	7	7
Maximum operating pressure	bar	5.5	5.5	5.5	5.5	5.5
Minimum operating cold mains pressure	bar	1.5	1.5	1.5	1.5	1.5
Expansion valve setting	bar	6	6	6	6	6
Nominal volume according to EN 13831	l	12	18	18	18	25
Expansion vessel charge pressure	bar	3	3	3	3	3
Weight (dry, excl. packaging)	kg	44	49	53	57	64
Packaged weight	kg	54	59	64	68	75
Weight full of water	kg	208	242	272	306	359
Standby heat loss (24 h)	kWh/d	1.200	1.368	1.496	1.637	1.824
Cylinder capacity						
Available capacity						
- total	l	157	187	211	241	287
- excl. solar heating	l	92	122	106	126	172
Dedicated solar volume	l	65	65	105	115	115
Upper indirect coil (secondary heat source)						
Heating water content	l	3.1	3.1	3.9	3.9	3.9
Heat exchanger surface	m ²	0.657	0.657	0.845	0.845	0.845
Maximum heating water temperature	°C	120	120	120	120	120
Maximum operating pressure inside the upper indirect coil	bar	6	6	6	6	6
Heat exchanger power (80-60 °C / 10-40 °C)	kW	31.9	31.9	39.4	39.4	39.4
Heat-up time 100% (15-60 °C)	min	14	17	12	13	24
Primary flow rate	l/h	1375	1375	1698	1698	1698
Pressure drop	mbar	150	150	300	300	300
Lower indirect coil (primary heat source/solar)						
Heating water content	l	3.1	3.1	3.9	3.9	3.9
Heat exchanger surface	m ²	0.657	0.657	0.845	0.845	0.845
Maximum solar fluid temperature	°C	130	130	130	130	130
Maximum operating pressure inside the lower indirect coil	bar	6	6	6	6	6
Heat exchanger power (80-60 °C / 10-40 °C)	kW	31.9	31.9	39.4	39.4	39.4
Primary flow rate	l/h	1375	1375	1698	1698	1698
Pressure drop	mbar	150	150	300	300	300
Immersion heater (BS225) (EN60335-2.73)						
Electrical power supply		230 V - 50 Hz	230 V - 50 Hz	230 V - 50 Hz	230 V - 50 Hz	230 V - 50 Hz
Maximum current drawn	A	13	13	13	13	13
Electrical power	W	3000	3000	3000	3000	3000
Minimum breaking capacity	A	13	13	13	13	13
Protection index	IP	21	21	21	21	21
Volume heated by immersion heater	l	59.5	89.7	70.2	87.7	133.9
Heat up time to 60°C	min	80	124	86	138	180
Length of the immersion heater	mm	375	375	375	375	375

Table 5

Flow rates through our inlet control group

Inlet pressure (bar)	0.1	0.2	0.3	0.4	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Flow rates (litres/min)	12.4	18.3	22.5	25.4	28.3	39.7	50.1	55.4	60.2	64.5	67.7	69.6	71.3	72.2

Table 6

Constant DHW output

The constant DHW output shown in the specification refers to the following:

- Flow temperature 85 °C
- Outlet temperature 45 °C
- Cold water inlet temperature 10 °C
- Maximum heat input (heat source input at least the same as the cylinder coil output)

Reducing the specified heat input will result in a reduction in the constant DHW output and the performance factor (N_L).

Pressure drop, internal indirect coil (in mbar)



When calculating the pressure drop in the solar circuit:

- Take the influence of the antifreeze used and the manufacturer's details into account.

Example:

With a water/propylene-glycol mixture of 55/45 (frost protection down to approximately - 30 °C), the pressure drop is approximately 1.3 times the value for tap water.



Pressure drop values resulting from the mains are not taken into account in the diagram.

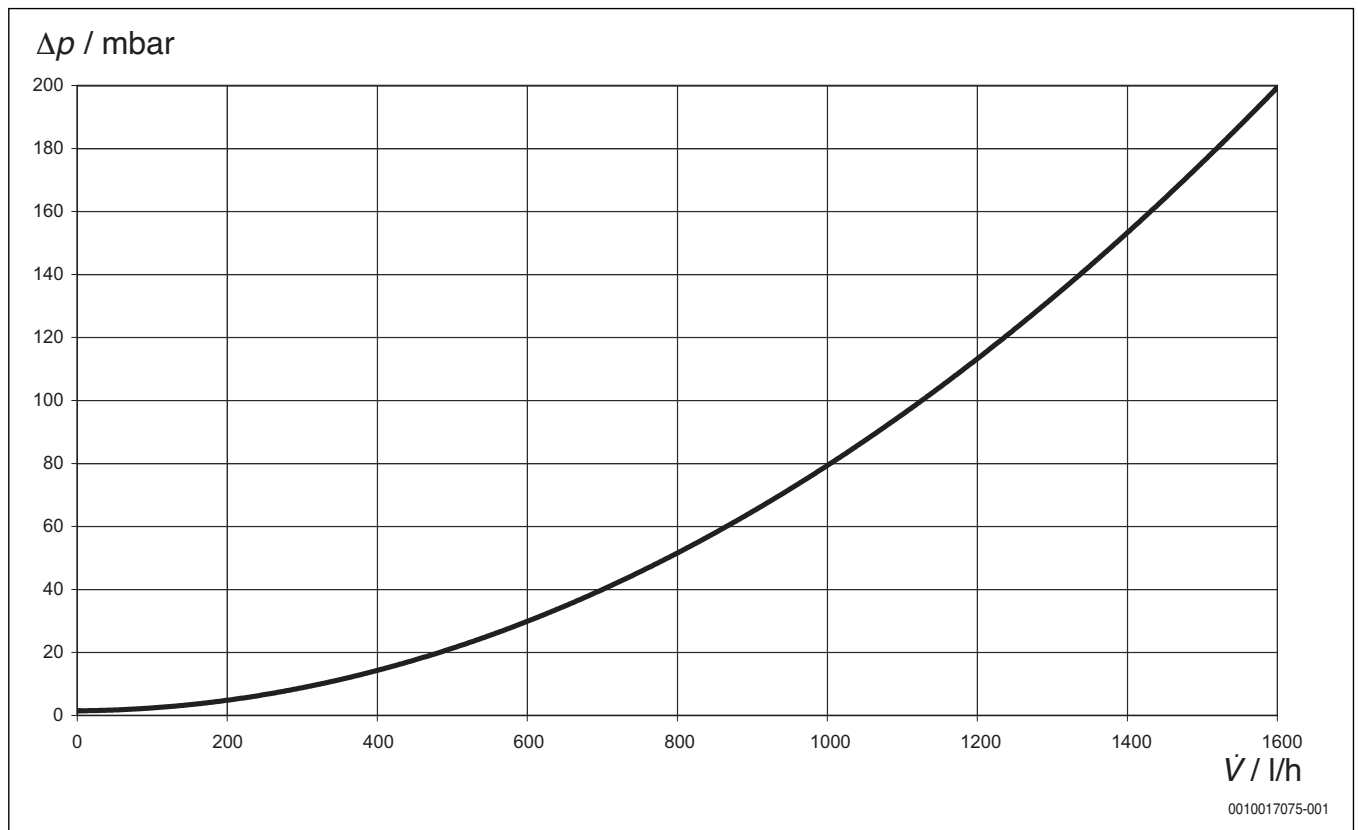


Fig. 5 TC-150 and TC-180

- Δp Pressure drop
- \dot{V} Heating water volume

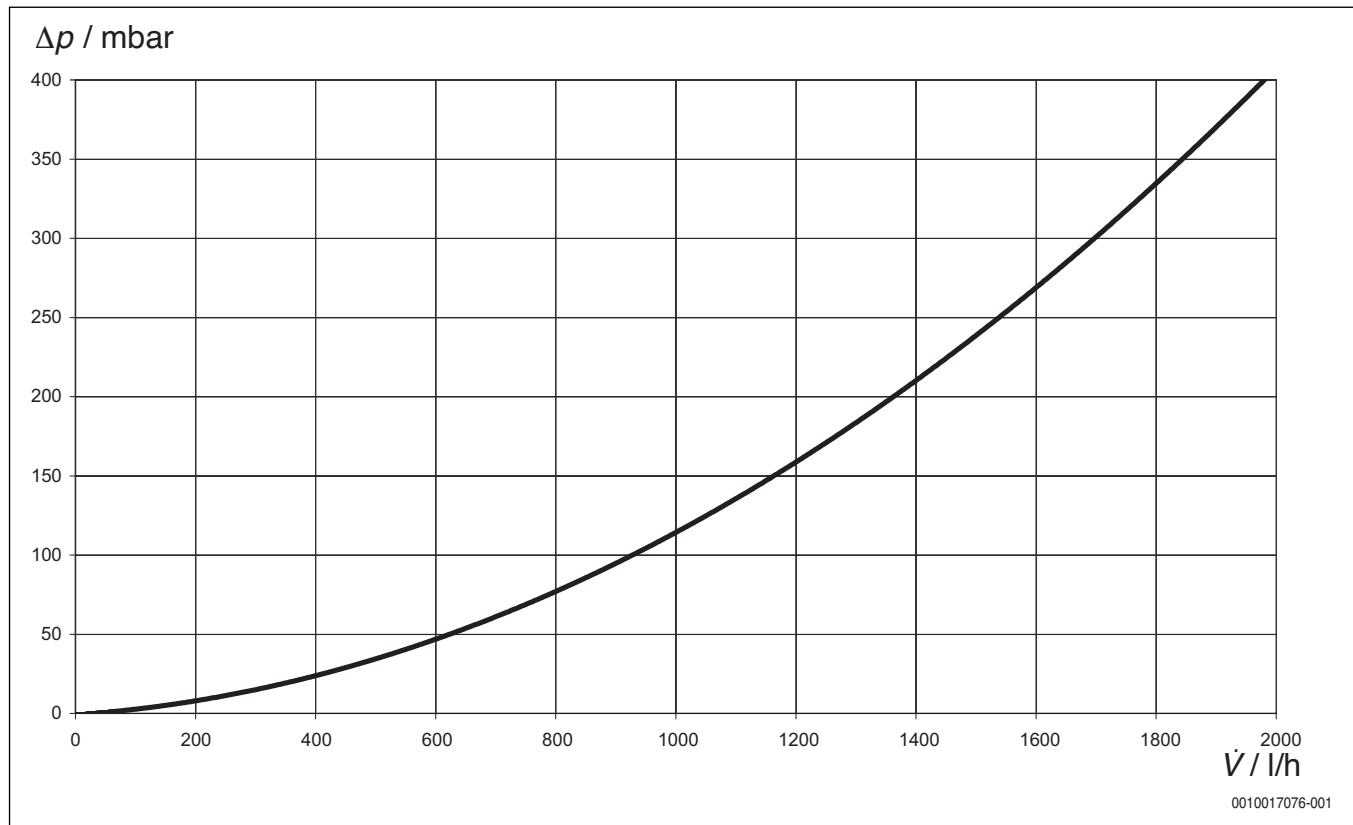


Fig. 6 TC-210, TC-250 and TC-300

Δp Pressure drop
V̇ Heating water volume

2.9 Energy efficiency

The following product data comply with the requirements of EU Regulations No. 811/2013, No. 812/2013, No. 813/2013 and No. 814/2013 as supplement to the Directive 2010/30/EU.

Cylinder description	Part number	Standing loss (S) (Watts)	Storage volume (V) (litres)	Storage volume (V) (m ³)	ErP - energy efficiency class
TC-150	7 716 842 558	50	157.0	0.157	B
TC-180	7 716 842 559	57	187.0	0.187	B
TC-210	7 716 842 560	62	211.0	0.211	B
TC-250	7 716 842 561	68	241.0	0.241	C
TC-300	7 716 842 562	76	287.0	0.287	C

Table 7 Energy efficiency

3 Installation

3.1 Regulations

This System has been approved to the Building Regulations for unvented hot water storage systems and the Local Authority must be notified of the intention to install. Therefore the installation must be carried out by a person competent to install unvented hot water systems.

The installation must be carried out in accordance with the following recommendations:

- All current Building Regulations issued by the Department of the Environment, i.e. Approved Document L1 Building Standards (Scotland) (Consolidation) Regulations issued by the Scottish Development Department UK Water Regulations/Byelaws (Scotland)
- Health & Safety Document No. 635 (The Electricity At Work Regulations 1989)
- EU Regulations No. 812/2013 - Energy Labelling

The installation should also be in accordance with the following British Standard Codes of Practice:

- BS 5449:1990 Forced circulation hot water systems
- BS 5546:2000 Installation of hot water supplies for domestic purposes
- BS 5918:1989 Solar heating systems for domestic hot water
- BS EN 806-1:2000 Specifications for installations inside buildings conveying water for human consumption. General.
- BS EN 806-2:2005 Specifications for installations inside buildings conveying water for human consumption. Design.
- BS EN 806-3:2006 Specifications for installations inside buildings conveying water for human consumption. Pipe sizing. Simplified method.
- BS EN 806-4:2010 Specifications for installations inside buildings conveying water for human consumption. Installation.
- BS EN 806-5:2012 Specifications for installations inside buildings conveying water for human consumption. Operation and maintenance.
- BS 8558:2011 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806

Failure to install this appliance correctly could lead to prosecution and will invalidate the guarantee. It is in your own interest and that of safety to ensure that the law is complied with.

Manufacturer's instructions must NOT be taken in anyway as over-riding statutory obligations.

This appliance meets the requirements of IPX4D, i.e. degree of protection against moisture.

Reference should be made to Criteria for gas fired combination boilers used as after heaters in solar thermal systems and BRE Solar heating UK:1981.

3.2 Handling

- ▶ Never set the cylinder down hard during handling.
- ▶ Only remove the cylinder from the packaging at the installation location.

3.3 Installation location



CAUTION:

Damage through stress cracks.

- ▶ Install the cylinder in a room that is free from the risk of frost.
- ▶ Maintain the minimum clearances (→ Fig. 4 on page 7).
- ▶ Install the cylinder on a level floor with sufficient load-bearing capacity.
- ▶ If installing the cylinder in wet rooms, position it on a suitable platform.

Caution:

If the difference in height between the lowest outlet (which may be a drain point) and the top of the Greenstore cylinder exceeds 15 metres, an anti-vacuum valve must be installed on the cold water inlet as close to the cylinder as possible

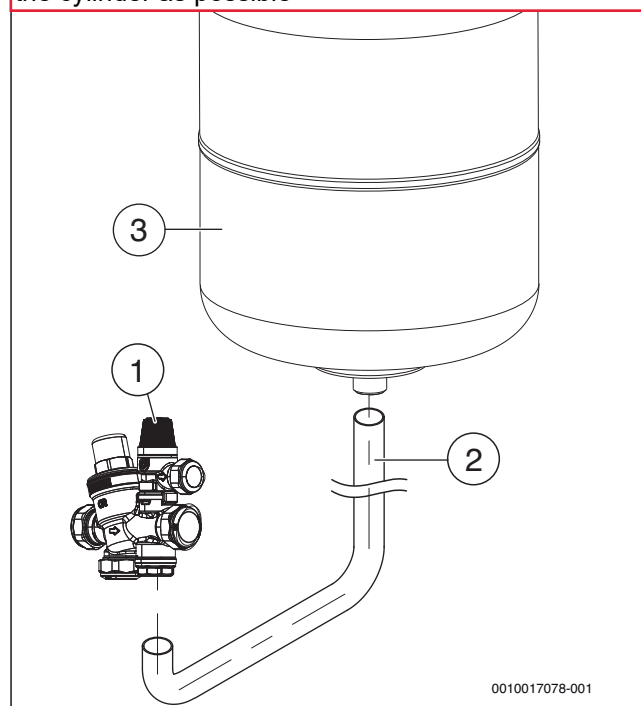


Fig. 7

- [1] Inlet control group
- [2] Rigid connection, eg copper pipe
- [3] Expansion vessel

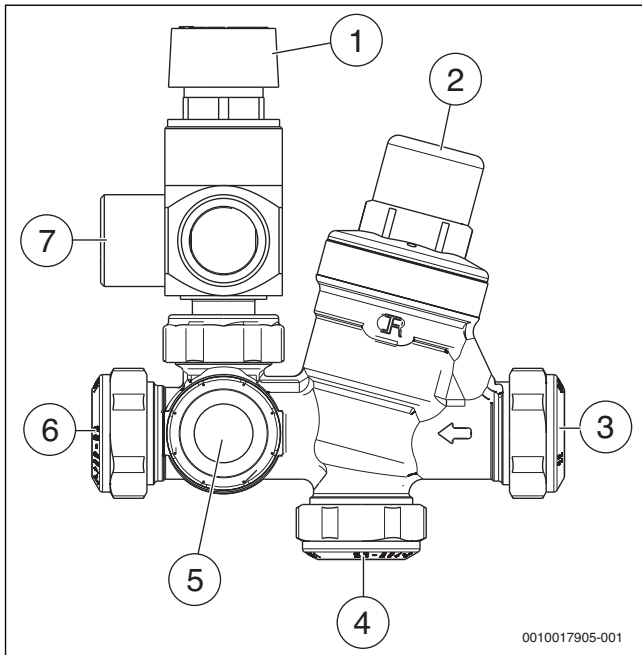


Fig. 8 Cold water inlet control group **with anti-vacuum valve**

- [1] Expansion relief valve / Anti-vac valve
- [2] Pressure reducing valve
- [3] Cold Mains in
- [4] Balanced cold take off connections
- [5] Expansion vessel connection
- [6] Cold supply to cylinder
- [7] Discharge to tundish

Information:

The cold water inlet control group **with anti-vacuum valve** (fig.8) is compatible with these cylinder part numbers:

TC-150	7716842040	7716842558
TC-180	7716842041	7716842559
TC-210	7716842042	7716842560
TC-250	7716842043	7716842561
TC-300	7716842044	7716842562

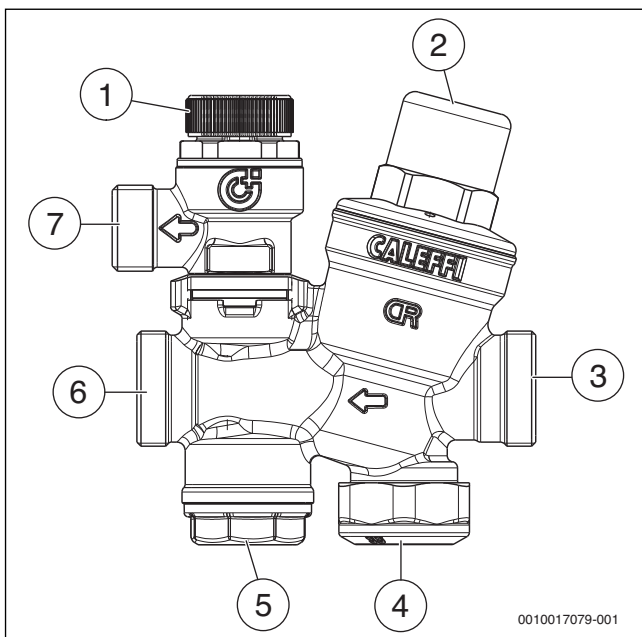


Fig. 9 Cold water inlet control group **without anti-vacuum valve**

- [1] Expansion relief valve
- [2] Pressure reducing valve
- [3] Cold Mains in
- [4] Balanced cold take off connections
- [5] Expansion vessel connection
- [6] Cold supply to cylinder
- [7] Discharge to tundish

Information:

The cold water inlet control group **without anti-vacuum valve** (fig.9) is compatible with these cylinder part numbers:

TC-150	7716842558
TC-180	7716842559
TC-210	7716842560
TC-250	7716842561
TC-300	7716842562

3.5 Solar connection diagram

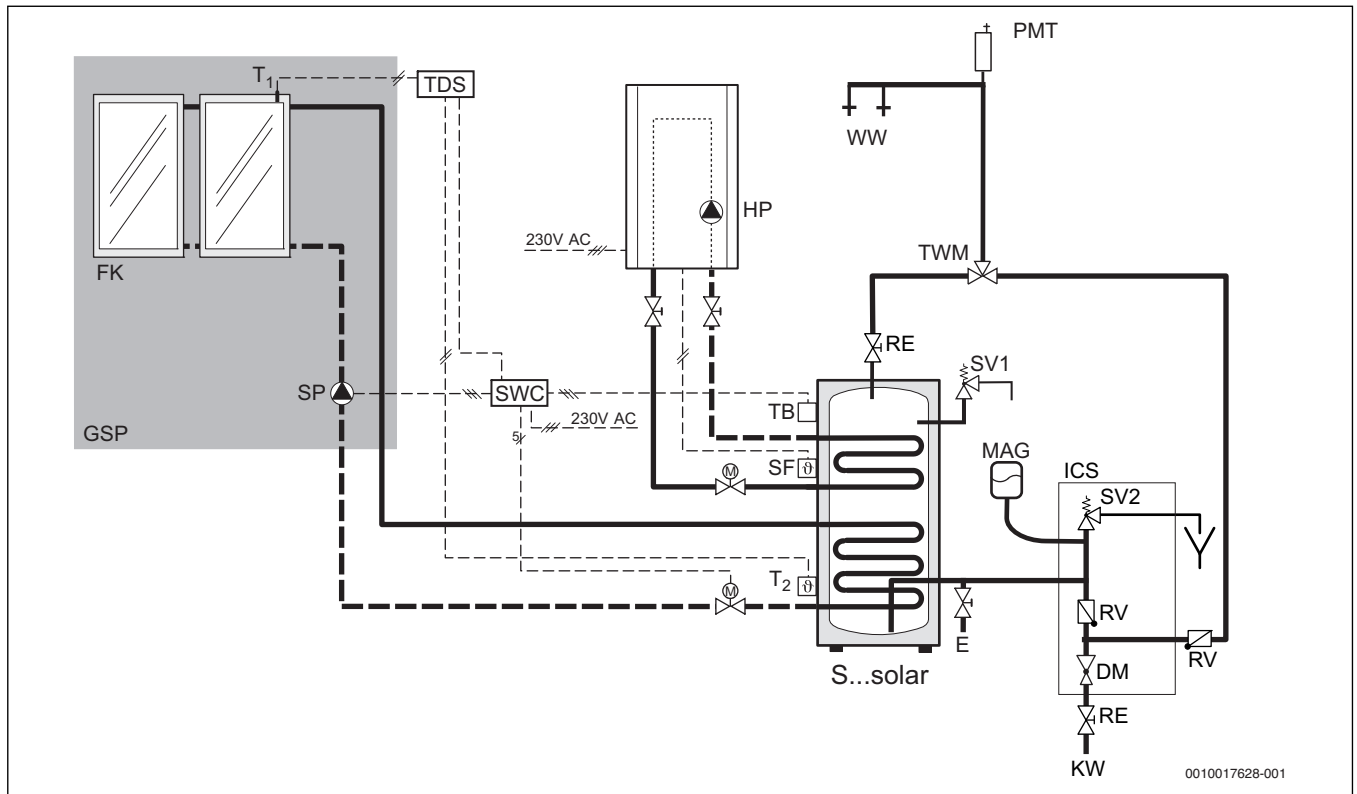


Fig. 10

- DM Pressure reducing valve (G3 kit supplied)
- E Drain valve
- FK Solar collector (optional accessory)
- GSP Greenskies solar package (optional accessory)
- HP Circulation pump (heating circuit/cylinder heating)
- ICS Inlet control set
- KW Cold water inlet
- MAG Expansion vessel (G3 kit supplied)
- RE Isolating valve
- RV Non-return valve
- SF Cylinder temperature sensor - secondary heat source
- SP Solar circuit pump (optional accessory)
- SV1 Temperature and Pressure relief valve
- SV2 Expansion relief valve (G3 kit supplied)
- SWC Terminal box
- S...solar Twin coil cylinder
- TB Solar system high limit thermostat (G3 kit supplied)
- T₁ Temperature sensor, solar collector (optional accessory)
- T₂ Cylinder temperature sensor - solar
- TDS Solar controller (optional accessory)
- TWM Thermostatic DHW mixer (optional accessory)
- WW DHW connection
- PMT WRAS approval automatic air vent (optional)

3.6 Installing the temperature sensors

The temperature sensors and safety equipment are fitted in different locations on the cylinder, subject to system.

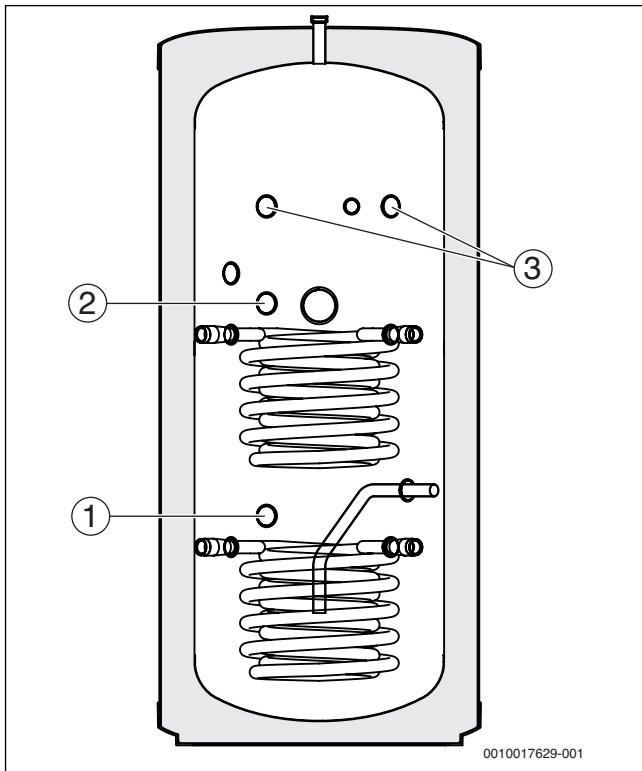


Fig. 11 Overview of connections

- [1] Lower sensor pocket
- [2] Center sensor pocket
- [3] Upper sensor pocket

Solar thermal system?	yes		no	
	S-plan or Y-plan	with internal three-way valve	S-plan or Y-plan	with internal three-way valve
Upper sensor pocket 1	Solar high limit thermostat	Solar high limit thermostat and 2nd solar sensor ¹⁾	-	-
Upper sensor pocket 2	2nd solar sensor ¹⁾	Dual cylinder thermostat ²⁾	-	Dual cylinder thermostat ²⁾
Center sensor pocket	Dual cylinder thermostat	Cylinder temperature sensor ³⁾	Dual cylinder thermostat	Cylinder temperature sensor ³⁾
Lower sensor pocket	Solar sensor 1	Solar sensor 1	-	-

- 1) 2nd solar sensor is required for some solar installations
- 2) Only the temperature limiter will be connected
- 3) Part of the standard delivery of the internal three-way valve (heating appliance accessory)

Table 8

The temperature in the top of the cylinder may be greater than the set point of the thermostat/sensor due to stratification of the stored hot water. Positioning the cylinder thermostat or cylinder sensor (with optional diverter valve kit) in the lower sensor pocket, will only detect the water temperature in the lower section of the cylinder.

3.7 Installation



All hydraulic cylinder connections are suitable for 22 mm pipes.

- ▶ Make connections with the compression fittings supplied.
- ▶ The position of the discharge pipes, (tundishes), drain valves and motorised valves etc. shall be positioned away from any electrical components.

3.7.1 Connection of the secondary appliance

- ▶ Connect to the upper coil (→ fig. 2 [2], page 6) using the compression fittings supplied, either connection can be flow or return, performance is identical either way. The heating circuit must be positively pumped as gravity circulation is not possible.
- ▶ The heating circuit can be open vent or sealed system to a maximum pressure of 6 bar. If the heating circuit is sealed an expansion vessel, pressure gauge and pressure relief valve will be required if not already part of the heating appliance.
- ▶ The heating appliance may be gas, oil or electric but must be under effective thermostatic control. Uncontrolled heat sources such as some AGAs, back boilers and solid fuel stoves are not suitable.
- ▶ Caution must be taken to prevent an air lock at time of commissioning the unit, an air vent may be required.
- ▶ The coil must be able to be drained via a suitable valve.

3.7.2 Connection of the primary appliance or solar system

- ▶ Connect to the lower coil (→ fig. 2 [10], page 6) using the compression fittings supplied, either connection can be flow or return, performance is identical either way. The heating/solar circuit must be positively pumped as gravity circulation is not possible.
- ▶ The heating/solar circuit can be open vent or sealed system to a maximum pressure of 6 bar. If the heating/solar circuit is sealed an expansion vessel, pressure gauge and pressure relief valve will be required if not already part of the heating appliance or solar system equipment.
- ▶ The heating appliance may be gas, oil or electric but must be under effective thermostatic control. Uncontrolled heat sources such as some AGAs, back boilers and solid fuel stoves are not suitable.
- ▶ A solar system must be provided with a suitable controller and means of thermostatic control with the solar sensors being fitted as per table 8, page 14, of this manual and the control manufacturer's instructions.



In solar installations the mixing ratio of glycol & water may increase the pressure drop through the coil.

- ▶ Caution must be taken to prevent an air lock at time of commissioning the unit, an air vent may be required.
- ▶ The coil must be able to be drained via a suitable valve.

3.7.3 Connection on the water side

- ▶ Install the cold water inlet control group as close as possible to the cylinder cold water inlet, with the compression fittings supplied. The mains supply must be able to provide the minimum pressure and flow rates stated in specification table 5, page 8.
- ▶ The cold water inlet control group includes a 6 bar expansion relief valve. A discharge pipe must be installed and routed via a tundish in accordance with current regulations.

NOTICE:

- ▶ If the cold water main is isolated internally or externally for either emergency or maintenance reasons, precautions should be taken to prevent damage to the cylinder. The hot water isolation valve located at the cylinder outlet should be closed off or the cylinder should be drained down as per the recommended procedure stated within this manual.



CAUTION:

Damage through excess pressure.

- ▶ Never restrict the outlets of any safety valves.
- ▶ Install a drain valve at the cold water inlet.

3.7.4 DHW secondary circulation

Cylinders are equipped with a DHW secondary return connection.

- ▶ If no DHW secondary circulation is required, blank off and ensure a water tight seal (→ fig. 2 [4], page 6). Seal and insulate the connection.
- ▶ When connecting DHW secondary circulation: Install a DHW circulation pump approved for potable water and a suitable non-return valve.



Due to the possibility of heat losses, DHW secondary circulation is only recommended in conjunction with a DHW secondary circulation pump that is time or temperature-controlled. The circulation circuit must be properly insulated.



To ensure safe DHW outlet temperatures thermostatic mixing valves may be required. Guidance must be taken from current regulations.

Thermal disinfection

Guidance must be taken from current regulations to ensure the risk of Legionella bacteria growth is prevented.

3.7.5 DHW expansion vessel

- ▶ Connect the expansion vessel using a rigid pipe connections (e.g. copper) to the cold water inlet control group.

For DHW systems with a large volume:

- ▶ Check whether the expansion vessel supplied (12, 18 or 25 litres) is adequate and if required, install an additional expansion vessel in parallel to the one supplied, ensuring the air charge of each is identical.

3.7.6 Installing the discharge pipe work from the safety valves supplied



WARNING:

Risk of scalding!

Hot water can lead to severe scalding.

- ▶ Route the discharge pipe work so that any discharged hot water or steam cannot create a risk.
-
- ▶ Locate the cold water inlet control group so that any water flowing from the expansion relief valve will be drained together with any water discharged from the temperature and pressure relief valve.
 - ▶ Route the discharge pipework in accordance with part G3, schedule 1 of the Building Regulations (the following includes the most important requirements of the Building Regulations).
 - ▶ Install the tundish vertically in direct proximity to the cylinder (maximum distance between safety valves and tundish 600 mm).
 - ▶ The discharge pipe work must be of a material capable of withstanding the potential temperatures and pressures.
 - ▶ The following applies for the discharge pipe work downstream of the tundish:
 - Minimum 300 mm vertical drop before the first bend.
 - Must be at least one pipe size larger than the inlet of the tundish.
 - Route the discharge pipe work with a constant fall.

3.7.7 Discharge Arrangement

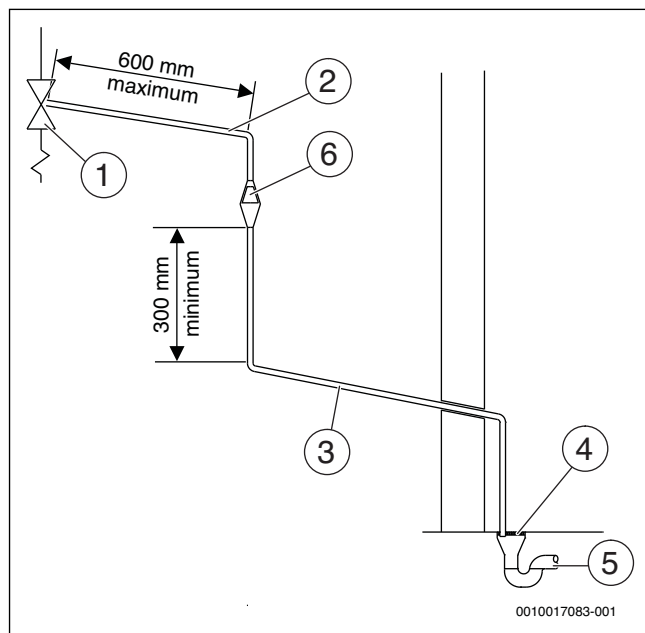


Fig. 12 Diagram of a typical discharge pipe arrangement (extract from Building Regulation G3)

- [1] Safety device (e.g. temperature relief valve)
- [2] Metal discharge pipe (D1) from temperature relief valve to tundish
- [3] Discharge pipe (D2) from tundish with continuous fall
- [4] Fixed grating
- [5] Trapped gully
- [6] Tundish

Position the inlet control group so that the discharge from both the two safety valves can be joined together via a 15 mm end feed Tee. Connect the Tundish and route the discharge pipe. The discharge pipework must be routed in accordance with Part G3 of schedule 1 of the Building Regulations. The information that follows is not exhaustive and if you are in doubt you should seek advice.

The two safety valves will only discharge water under fault conditions. When operating normally water will not be discharged.

The tundish should be vertical, located in the same space as the unvented hot water storage system and be fitted as close as possible and within 600 mm of the safety device e.g. the temperature relief valve.

The discharge pipe (D2) from the tundish should terminate in a safe place where there is no risk to persons in the vicinity of the discharge and:

- Be at least one pipe size larger than the nominal outlet size of the safety device unless its total equivalent hydraulic resistance exceeds that of a straight pipe 9 m long i.e. discharge pipes between 9 m and 18 m equivalent resistance length should be at least two sizes larger than the nominal outlet size of the safety device, between 18 and 27 m at least 3 sizes larger, and so on. Bends must be taken into account in calculating the flow resistance. Refer to Fig. 12, Table 9 and the worked example.
- An alternative approach for sizing discharge pipes would be to follow British specification standards for design installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- Have a vertical section of pipe at least 300 mm long, below the tundish before any elbows or bends in the pipework.
 - Be installed with a continuous fall.
 - It is preferable for the discharge to be visible at both the tundish and the final point of discharge but where this is not possible or practically difficult there should be clear visibility at one or other of these locations. Examples of acceptable discharge arrangements are:
 - Ideally below the fixed grating and above the water seal in a trapped gully.
 - Downward discharges at a low level; i.e. up to 100 mm above external surfaces such as car parks, hard standing, grassed areas etc. are acceptable providing that where children play or otherwise come into contact with discharges, a wire cage or similar guard is positioned to prevent contact whilst maintaining visibility.
 - Discharges at a high level; e.g. in to metal hopper and metal down pipe with the end of the discharge pipe clearly visible (tundish visible or not) or onto a roof capable of withstanding high temperature discharges of water and 3 m from any plastic guttering systems that would collect such discharges (tundish available).
 - Where a single pipe serves a number of discharges, such as in blocks of flats, the number served should be limited to not more than 6 systems so that any installation can be traced reasonably easily. The single common discharge pipe should be at least one pipe size larger than the largest individual discharge pipe to be connected. If unvented hot water storage systems are installed where discharges from safety devices may not be apparent i.e. in dwellings occupied by blind, infirm or disabled people, consideration should be given to the installation of an electronically operated device to warn when discharge takes place.

NOTICE:

- ▶ The discharge may consist of scalding water and steam. Asphalt, roofing felt and non-metallic rainwater goods may be damaged by such discharges.
- ▶ It is only acceptable to discharge into a soil pipe if certain conditions stipulated in the G3 regulations are met.

The table below is based on copper tube. Plastic pipes may be of different bore and resistance. Sizes and maximum lengths of plastic should be calculated using data prepared for the type of pipe being used.

Valve outlet size	Minimum size of discharge pipe D1 ¹⁾	Minimum size of discharge pipe D2 ¹⁾ from tundish	Maximum resistance allowed, expressed as a length of straight pipe (i. e. no elbows or bends)	Resistance created by each elbow or bend
G1/2	15 mm	22 mm	up to 9 m	0.8 m
		28 mm	up to 18 m	1.0 m
		35 mm	up to 27 m	1.4 m
G3/4	22 mm	28 mm	up to 9 m	1.0 m
		35 mm	up to 18 m	1.4 m
		42 mm	up to 27 m	1.7 m
G1	28 mm	35 mm	up to 9 m	1.4 m
		42 mm	up to 18 m	1.7 m
		54 mm	up to 27 m	2.3 m

1) see Fig. 12

Table 9 Sizing of copper discharge pipe "D2" for common temperature relief valve outlet sizes

Worked example:

The example below is for a G1/2 temperature relief valve with a discharge pipe (D2) having 4 No. 22 mm elbows and length of 7 m from the tundish to the point of discharge.

From Table 9:

Maximum resistance allowed for a straight length of 22 mm copper discharge pipe (D2) from a G1/2 temperature relief valve is: 9.0 m

Subtract the resistance for 4 No. 22 mm elbows at 0.8 m each = 3.2 m

Therefore the maximum permitted length equates to 5.8 m which, is less than the actual length of 7 m therefore calculate the next largest size of discharge pipe (D2).

Maximum resistance allowed for a straight length of 28 mm copper discharge pipe (D2) from a G1/2 temperature relief valve is: 18 m

Subtract the resistance for 4 No. 28 mm elbows at 1.0 m each = 4 m

Therefore the maximum permitted length equates to: 14 m

As the actual length is 7 m, a 28 mm (D2) copper pipe will be satisfactory.

3.8 Electrical connections

⚠ DANGER:

Risk of electric shock!

- ▶ Before making any electrical connections, disconnect the power supply (230 V AC) to the heating system.
- ▶ Make sure all terminal screws are properly tightened before commissioning especially on immersion heater line.

Connecting the indirect controls

The indirect thermal controls should be wired into a suitable indirect control system to ensure optimum control of the cylinder and boiler. All electrical work must conform to current IEE Wiring Regulation (BS 3456).

For more in depth wiring instructions and diagrams reference must be made to the appropriate manufacturers installation instructions for the products installed along side this unit.

Products must be wired to meet all current regulations with regards to G3.

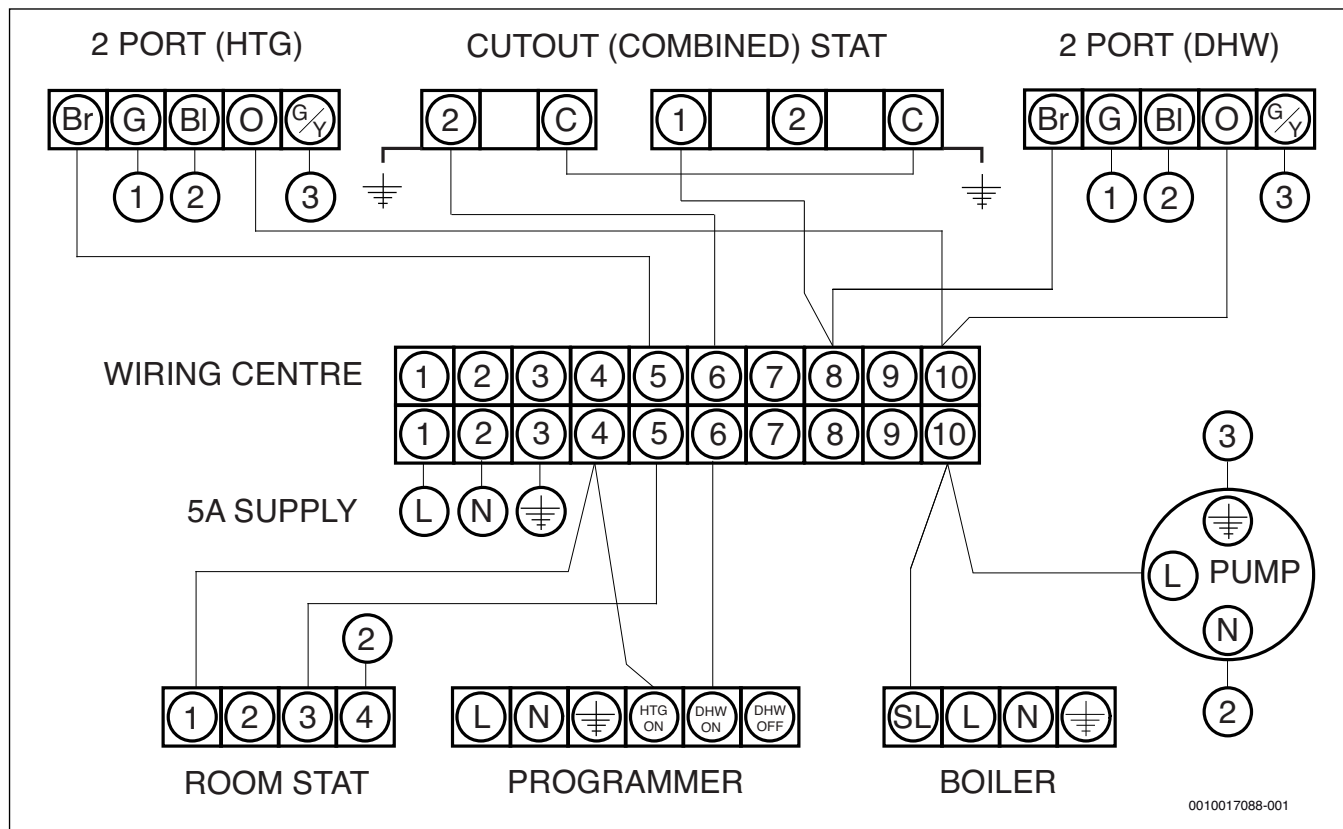


Fig. 13 Variant dual thermostat wiring: wiring diagram 2 port zone valve (S-plan)

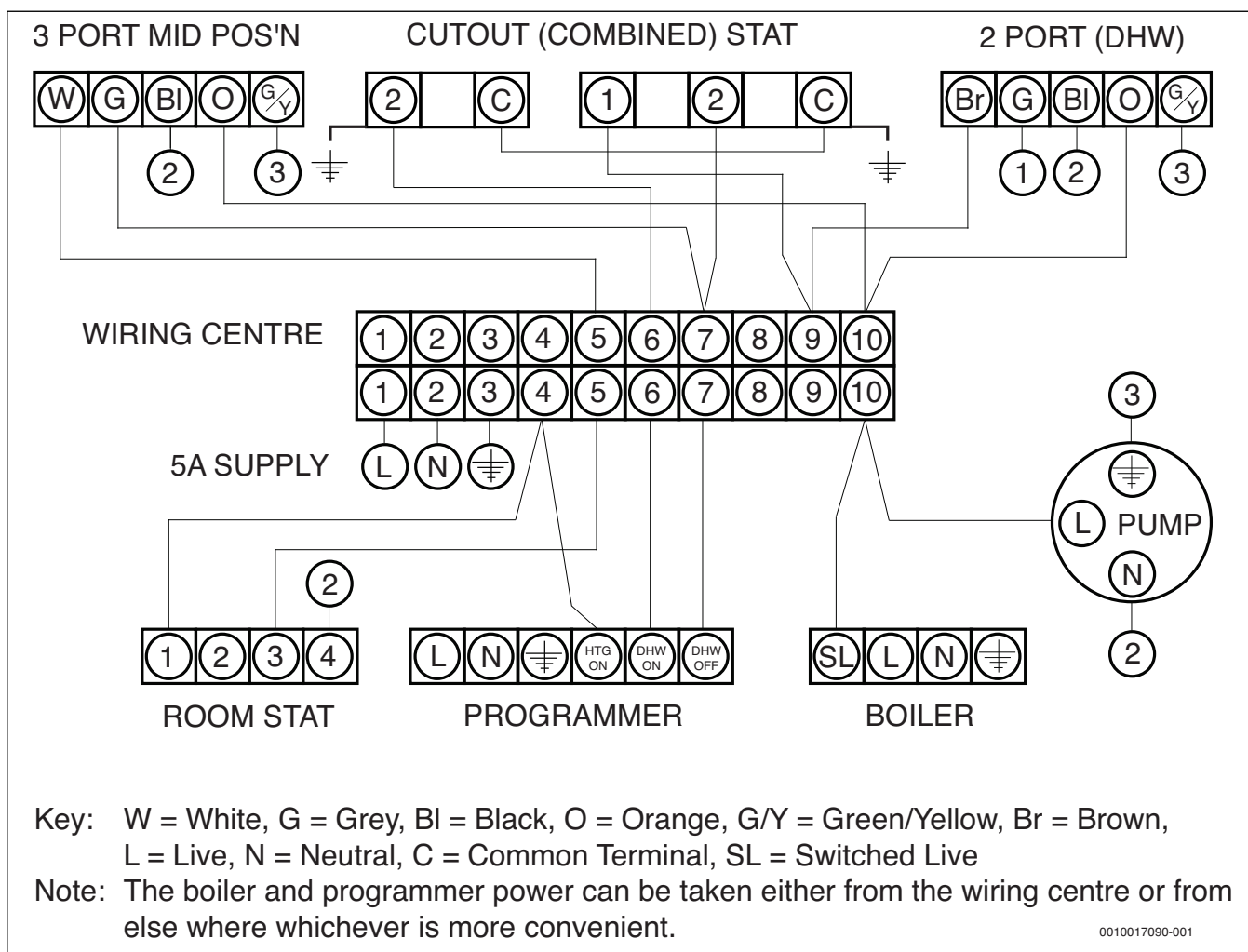


Fig. 14 Variant dual thermostat wiring: wiring diagram 3 port mid position valve (Y-plan) + 2 port valve

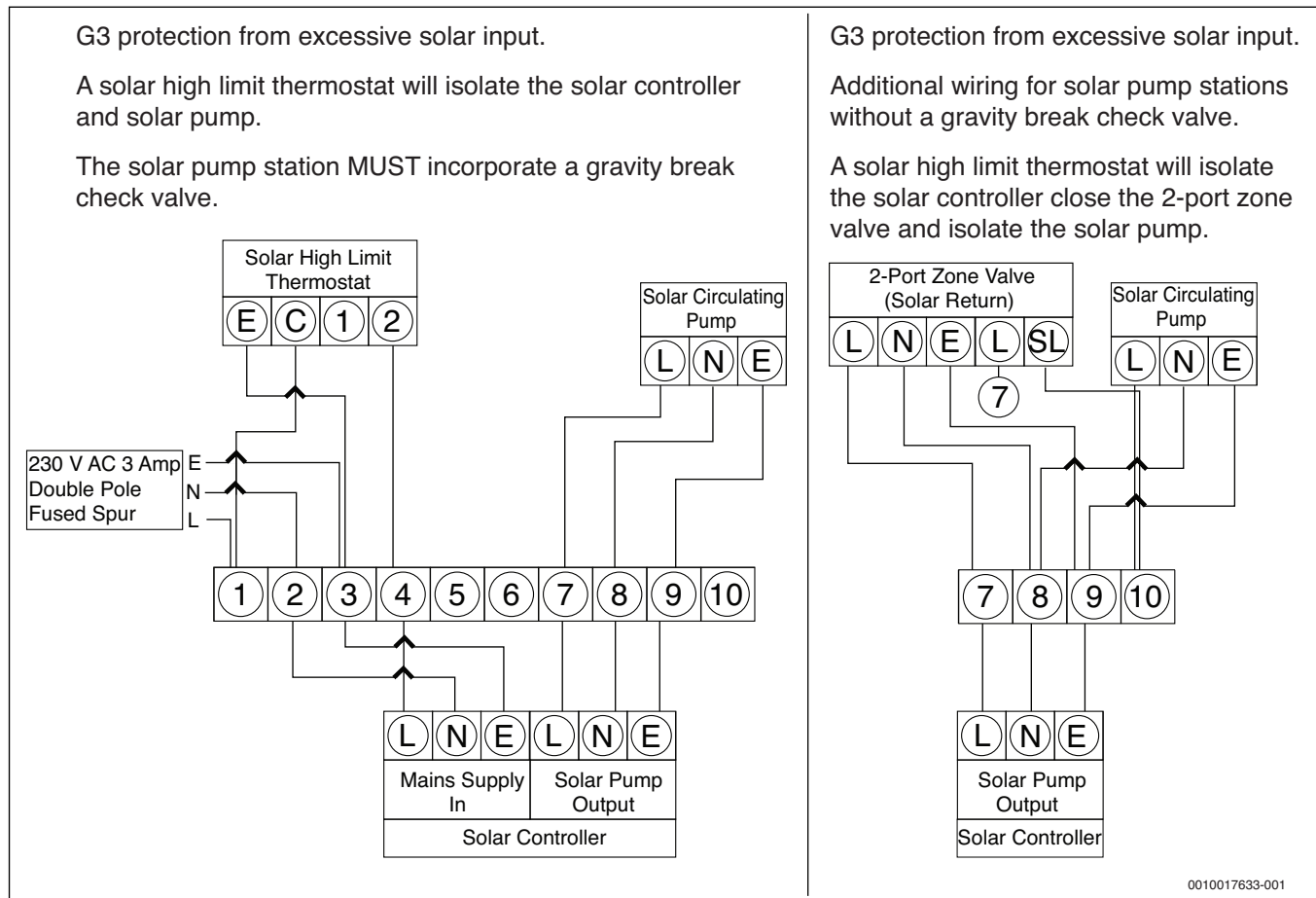


Fig. 15 Wiring diagram solar high limit control

Using the Worcester optional Internal Diverter valve

- The installation will use the cylinder sensor supplied with the Integral Diverter Valve kit to control the hot water temperature.
- The installation, therefore, will NOT need to use the hot water control thermostat of the cylinder's dual thermostat.
- The installation may require altered wiring of the dual thermostat (depending on cylinder and thermostat manufacturer) to only use the high limit thermal cut-out of the dual thermostat.
- The high limit thermal cut out of the dual thermostat MUST be wired to interrupt the permanent live to the Greenstar i System or CDi Classic System boiler.
- The 2-port valve supplied with the unvented cylinder will NOT be used. If it is already physically installed in the pipe work it should be removed and electrically disconnected from the wiring centre.

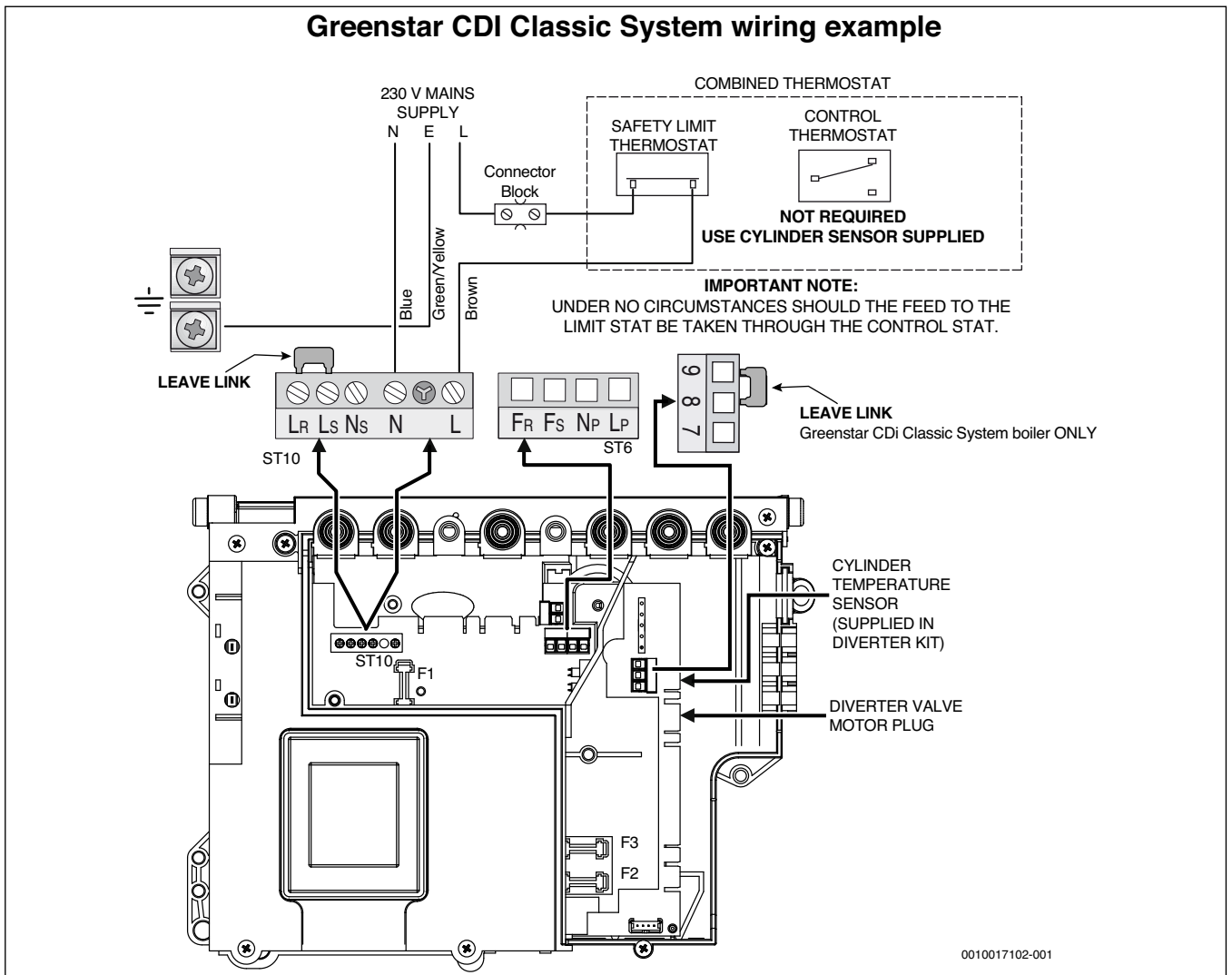


Fig. 16 Wiring to protect an unvented hot water cylinder from potentially dangerous high temperatures from the boiler circuit

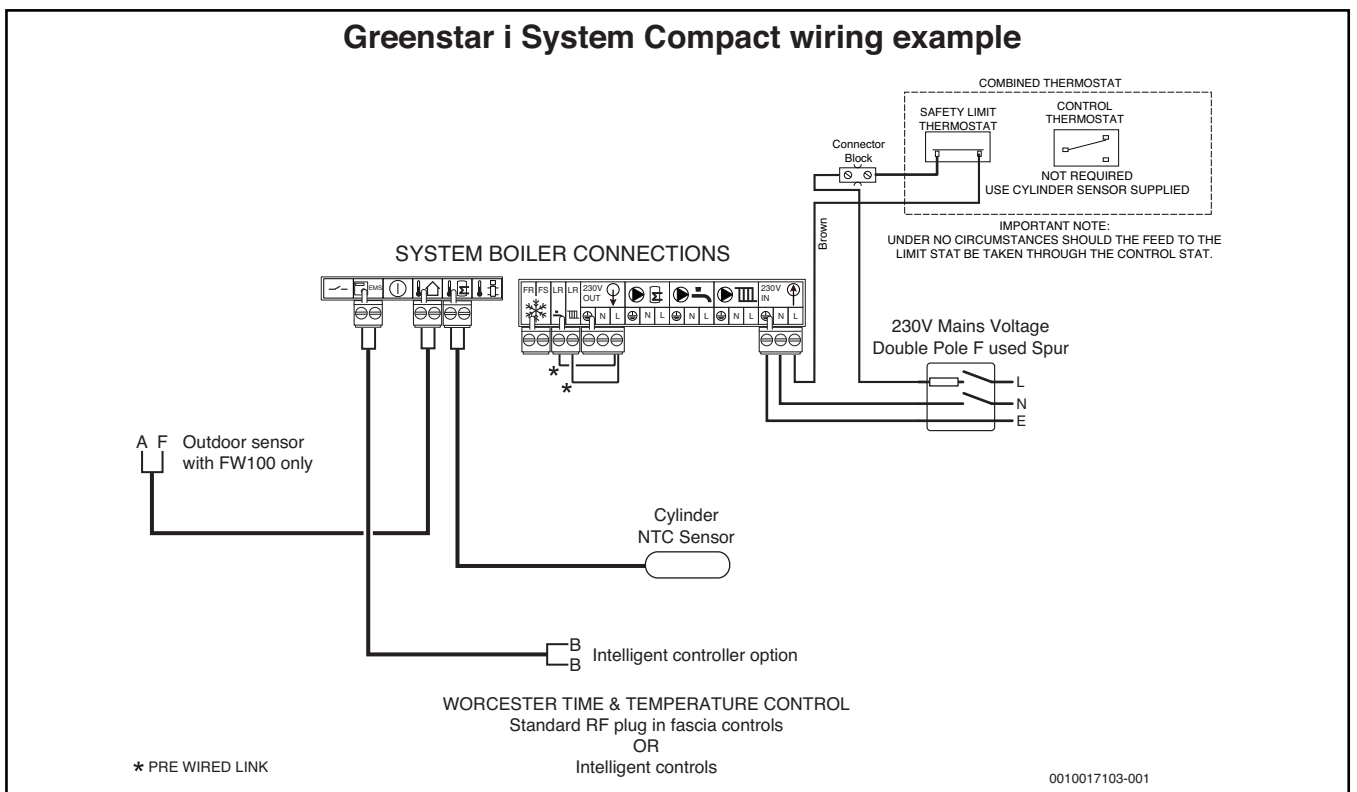


Fig. 17 Greenstar i System Compact wiring example

Connecting the immersion heater (Heaters conform to EN60335.2.73)

- ! DANGER:**
- ▶ Ensure the mains voltage corresponds to the voltage rating of the heater as shown on the rating label on the terminal cover.
 - ▶ Only use rigid wires 1.5 mm² for main supply. Flexible wire may cause poor electrical connection to the heater, resulting in overheating.
 - ▶ When connecting the thermostat please ensure the male pins are securely located within the female sockets.
 - ▶ Immersion heater must not be fitted without thermal cut-outs.
 - ▶ Accessories (washers, cable grip, screws...) delivered in the plastic bag under the terminal cover of the heater have to be used to complete the connection to the earth and to fix the rigid cable.

It is essential that the water level within the tank or cylinder is such that water fully covers the heating elements to a depth of at least 100 mm. Under no circumstances must the heater be permitted to run dry - serious damage may result to the heater in addition to danger of personal injury & damage to property.

Check the heater for possible leakage before wiring. See below for schematic wiring diagram.

Wire the heater through a double-pole fused spur, having contact separation of at least 3 mm, with a minimum breaking capacity of 13 Amps.

Use a rigid cable, 2 m long max, with 1.5 mm² cross-section and a temperature resistance of at least 85°C. Rubber Insulated HOFR Sheathed, complying with BS6141 Table 8. It must be fully earthed. Ensure all terminal connections are securely made. Do not however use excessive force when tightening the terminal screws.

NEMKO Approval will only apply to this heater if the Thermowatt RTS plus thermostat is used.

Immersion heater conforms with EEC Directive 76/889 for Radio Interference and comply with BS800: 1977.

WIRING THE IMMERSION HEATER:

- ! DANGER:**
- Risk of electric shock!**
- ▶ Isolate from mains supply.

- ▶ Remove the terminal cover from the immersion heater. Use the accessories supplied in the plastic bag located under the cover of the immersion heater to complete the wiring.

- ! DANGER:**
- ▶ This heater must be earthed.

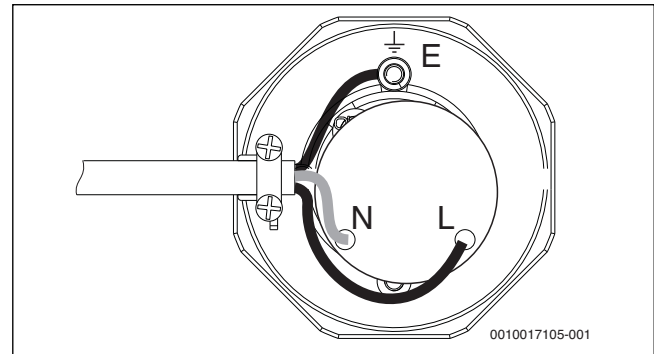


Fig. 18 Wiring diagram

- E Earth (Green/Yellow)
- N Neutral (Blue)
- L Live (Brown)

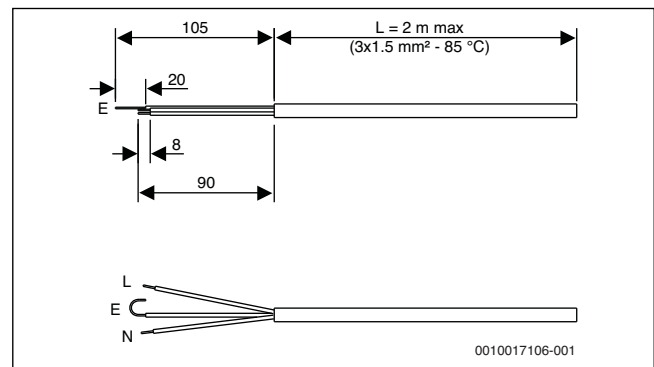


Fig. 19 Rigid cable end preparation

- E Earth (Green/Yellow)
 - N Neutral (Blue)
 - L Live (Brown)
- ▶ Provide 90 mm length for the Live (L) and Neutral (N) cables and bare the end of each cable 8 mm minimum.
 - ▶ Provide 105 mm length for the Earth cable (E) and bare the end of the cable 20 mm minimum. Make a circle with the end of the Earth cable (E) to turn around the earth stud (1) to ensure a full contact between the cup washer (6) and the plain washer (4) (refer to the fitment of earth cable to stud).

- Fit the Live and Neutral cables on the thermostat.

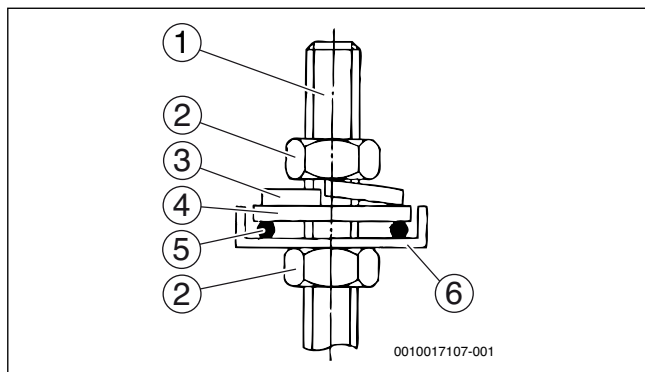


Fig. 20 Fitment of earth cable to stud

- [1] Earth stud
- [2] Nuts (x2)¹⁾
- [3] Shake-proof washer¹⁾
- [4] Plain washer¹⁾
- [5] Earth cable
- [6] Cup washer¹⁾

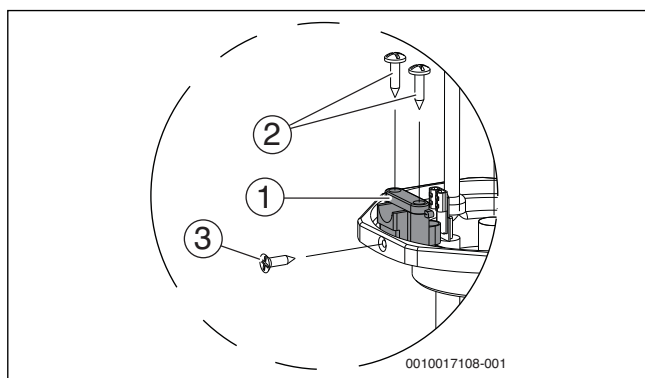


Fig. 21 Cable grip assembly

- [1] Cable grip moulding²⁾
- [2] Pan head screws (x 2)²⁾
- [3] Head posi-drive screw²⁾

- Fit two pan head screws into cable clamp on grip and secure with self tapping screw in the location hole in brass head of the immersion heater.

4 Commissioning

4.1 User information from the system installer

Explain to the customer how the boiler and the cylinder work and how to operate them.

- Complete the Benchmark mains pressure hot water storage system commissioning checklist at the back of this manual.
- Advise the user regarding the need for regular maintenance, on which function and service life depend.
- When there is a risk of frost and the cylinder is taken out of use, drain the cylinder completely, including its lower section.
- Give the user all documentation.
- This appliance must only be operated by a responsible adult who has been instructed in, understands, and is aware of the appliance's operating conditions and effects.

4.2 Preparing for use

4.2.1 General

Only a competent person must commission the system.

- Commission the heating appliance and solar thermal system in accordance with manufacturer's instructions or the appropriate installation and operating instructions.

4.2.2 Filling the cylinder

Prior to filling the cylinder:

- Check the pre-charge pressure of the expansion vessel (3 bar); top-up if required.
- Flush the pipework as well as the cylinder with tap water.
- Fill the cylinder whilst a DHW draw-off point is fully open, until water flows steadily from it.
- Check all connections and the immersion heater fitting for tightness.

4.3 Setting the cylinder temperature

- Set the required cylinder temperature at the cylinder thermostat.
-or-, on heating appliances with internal three-way valve,
- Set the required cylinder temperature in accordance with the operating instructions of the heating appliance.



WARNING:

Risk of scalding!

- In normal operation, do not set the temperature higher than 60 °C.

1) supplied in the plastic bag
2) supplied in the plastic bag

5 Shutting down

NOTICE:

- ▶ When draining either the domestic hot water system or the cylinder ensure the cold water supply is isolated and that at least two hot water draw off points are opened. One of these hot water draw off points **must be the one closest to the cylinder in height terms**. The drain valve installed at the cold water supply inlet to the cylinder should be used, where practicable.

5.1 Taking the cylinder out of use

- ▶ Disable DHW heating in accordance with the operating instructions of the heating appliance (frost protection).
- ▶ Shut down the solar thermal system if fitted, in accordance with the operating instructions of the solar controller.
- ▶ When there is a risk of frost and the cylinder is taken out of use, drain the cylinder completely, including its lower section.

5.2 Draining the cylinder

To drain either the domestic water system or the cylinder:

- ▶ Ensure all connected heat source(s) and the electrical immersion heater are isolated to prevent damage occurring as a result of heating the cylinder while it is drained down.
- ▶ Isolate the cold water supply.
- ▶ Open all hot water draw off points.
- ▶ Attach a hose to the drain valve. The drain valve installed at the cold water supply inlet to the cylinder must be used where practicable.
- ▶ Drain the cylinder.
- ▶ **IMPORTANT** after draining the cylinder do not close the hot water draw off points until the cylinder has fully cooled. Failure to observe this instruction may result in damage to the cylinder that is not covered by the guarantee.

6 Environmental protection/disposal

Environmental protection is a fundamental corporate strategy of the Bosch Group.

The quality of our products, their economy and environmental safety are all of equal importance to us and all environmental protection legislation and regulations are strictly observed.

We use the best possible technology and materials for protecting the environment taking into account of economic considerations.

Packaging

Where packaging is concerned, we participate in country-specific recycling processes that ensure optimum recycling. All of our packaging materials are environmentally compatible and can be recycled.

Used appliances

Used appliances contain valuable materials that can be recycled. The various assemblies can be easily dismantled. Synthetic materials are marked accordingly. Assemblies can therefore be sorted by composition and passed on for recycling or disposal.

7 Inspection and maintenance

7.1 Recommendations for users

- ▶ Arrange a maintenance and inspection contract with a competent person. Have the heating appliance and the DHW cylinder serviced annually.
- ▶ After each service, the service interval record sheet at the rear of this manual, must be completed.



CAUTION:

A safety valve malfunction can result in excessive pressure levels.

- ▶ Check the function of the expansion relief valve in the cold water inlet control group and the temperature and pressure relief valve, and flush several times by cracking them open.

7.2 Maintenance and repair



DANGER:

Risk of electric shock!

- ▶ Ensure all electrical supplies are isolated before carrying out any maintenance on the cylinder.

- ▶ Only use genuine spare parts!

7.2.1 Draining the cylinder

NOTICE:

- ▶ When draining either the domestic water system or the cylinder ensure the cold water supply is isolated and that all hot water draw off points are opened. The drain valve installed at the cold water supply inlet to the cylinder should be used, where practicable.

To drain either the domestic water system or the cylinder:

- ▶ Ensure all connected heat source(s) and the electrical immersion heater are isolated to prevent damage occurring as a result of heating the cylinder while it is drained down.
- ▶ Isolate the cold water supply.
- ▶ Open all hot water draw off points.
- ▶ Attach a hose to the drain valve. The drain valve installed at the cold water supply inlet to the cylinder must be used where practicable.
- ▶ Drain the cylinder.
- ▶ **IMPORTANT** after draining the cylinder do not close the hot water draw off points until the cylinder has fully cooled. Failure to observe this instruction may result in damage to the cylinder that is not covered by the guarantee.

7.2.2 Descaling / cleaning

In hard water areas

The level of scale build-up depends on the time in use, the operating temperature and the water hardness. Scaled-up internal indirect coils reduce the water content, lower the heat-up output, increase the energy consumption and extend the heat-up time.

- ▶ Subject to the level of scaling, descale the cylinder regularly.

When water hardness is over 450 ppm water treatment has to be considered (or annual service with descaling)

In soft water areas

- ▶ Check the inside of the cylinder regularly and clean out any sludge.

7.2.3 Immersion heater

If the thermal cut-out operates contact a competent installer to investigate and identify the cause of the fault. If the fault re-occurs after this investigation the immersion heater will need to be replaced.

When refitting an immersion heater, ensure the O-ring is positioned correctly on the head of the immersion heater and lubricate before fitting. Fit it by hand until almost home then tighten gently as the O-rings will seal easily.

7.2.4 Re-commissioning

- ▶ Flush the cylinder thoroughly after cleaning or repair.
- ▶ Vent the heating and DHW sides.

8 Spare parts list

TT no.	Designation
8-716-855-320	High flow rate inlet control set (pressure reducing valve, strainer and expansion relief valve), series 533112
8-716-113-408-0	Temperature and pressure relief valve 7 bar
8-716-113-409-0	Tundish (22mm x 15mm)
8-716-113-410-0	2 port valve
8-716-113-411-0	Dual thermostat
8-716-113-412-0	Immersion heater (same on all models)
8-716-855-363	12 litre expansion vessel (TC-150)
8-716-855-364	18 litre expansion vessel (TC-180, TC-210 & TC-250)
8-716-855-365	25 litre expansion vessel (TC-300)
8-716-113-522-0	Solar high limit thermostat
8-716-842-371-0	Connection set
8-716-855-386	6 bar expansion relief valve
8-716-855-322	Instruction manual

Table 10



WARNING:

- ▶ Only use these spare parts:
 - 8-716-855-320: Inlet control set
 - 8-716-855-386: 6 bar expansion relief valve
- With these cylinders:
 - 7-716-842-483: TC-150
 - 7-716-842-484: TC-180
 - 7-716-842-485: TC-210
 - 7-716-842-486: TC-250
 - 7-716-842-487: TC-300

9 The Guarantee

The Greenstore stainless steel cylinder carries a fully transferable 25 year guarantee against faulty material or manufacture subject to Terms & Conditions. To read the full Terms & Conditions please visit us online at www.worcester-bosch.co.uk/guarantee. The Guarantee Registration form is available on the same page and can be completed and submitted electronically. Alternatively please telephone one of our Guarantee Registration advisors on 0330 123 2552. Your statutory rights are not affected by the manufacturers guarantee.

10 Mains Pressure Hot Water Storage System Commissioning Checklist

This Commissioning Checklist is to be completed in full by the competent person who commissioned the storage system as a means of demonstrating compliance with the appropriate Building Regulations and then handed to the customer to keep for future reference.

Failure to install and commission this equipment to the manufacturer's instructions may invalidate the warranty but does not affect statutory rights.

Customer name:	Telephone number:
Address:	
Cylinder make and model	
Cylinder serial number:	
Commissioned by (print name):	Registered operative ID number:
Company name:	Telephone number:
Company address:	
Commissioning date:	

To be completed by the customer on receipt of a Building Regulations Compliance Certificate*

Building Regulations Notification Number (if applicable):

All SYSTEMS PRIMARY SETTINGS (indirect heating only)

Is the primary circuit a sealed or open vented system?	<input type="checkbox"/> Sealed	<input type="checkbox"/> Open	
What is the maximum primary flow temperature?	.....	°C	

ALL SYSTEMS

What is the incoming static cold water pressure at the inlet to the system?			bar
Has a strainer been cleaned of installation debris (if fitted)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Is the installation in a hard water area (above 200ppm)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, has a water scale reducer been fitted?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
What type of scale reducer has been fitted?			
What is the hot water thermostat set temperature?	.....	°C	
What is the maximum hot water flow rate at set thermostat temperature (measured at high flow outlet)?	.....	l/min	
Time and temperature controls have been fitted in compliance with Part L of the Building Regulations?		<input type="checkbox"/> Yes	
Type of control system (if applicable)	<input type="checkbox"/> Y Plan	<input type="checkbox"/> S Plan	<input type="checkbox"/> Other
Is the cylinder solar (or other renewable) compatible?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
What is the hot water temperature at the nearest outlet?	.....	°C	
All appropriate pipes have been insulated up to 1 metre or the point where they become concealed.		<input type="checkbox"/> Yes	

UNVENTED SYSTEMS ONLY

Where is the pressure reducing valve situated (if fitted)?			
What is the pressure reducing valve setting?	.....	bar	
Has a combined temperature and pressure relief valve and expansion valve been fitted and discharge tested?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
The tundish and discharge pipework have been connected and terminated to Part G of the Building Regulations.		<input type="checkbox"/> Yes	
Are all energy sources fitted with a cut out device?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Has the expansion vessel or internal air space been checked?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

THERMAL STORES ONLY

What store temperature is achievable?			°C
What is the maximum hot water temperature?	.....	°C	

All INSTALLATIONS

The hot water system complies with the appropriate Building Regulations.			<input type="checkbox"/> Yes
The system has been installed and commissioned in accordance with the manufacturer's instructions.			<input type="checkbox"/> Yes
The system controls have been demonstrated to and understood by the customer.			<input type="checkbox"/> Yes
The manufacturer's literature, including Benchmark Checklist and Service Record, has been explained and left with the customer.			<input type="checkbox"/> Yes

Commissioning Engineer's Signature	
Customer's Signature (To confirm satisfactory demonstration and receipt of manufacturer's literature)	

* All installations in England and Wales must be notified to Local Authority Building Control (LABC) either directly or through a Competent Persons Scheme.
A Building Regulations Compliance Certificate will then be issued to the customer.



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11 Service Record

It is recommended that your heating system is serviced annually and that the Service record is completed.

Service Provider

Before completing the Service record below, please ensure that you have carried out the service as described in the manufacturer's instructions.

Always use the manufacturer's recommended spare parts.

SERVICE 01 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:	SERVICE 02 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:
SERVICE 03 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:	SERVICE 04 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:
SERVICE 05 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:	SERVICE 06 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:
SERVICE 07 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:	SERVICE 08 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:
SERVICE 09 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:	SERVICE 10 Date: Engineer name: Company name: Telephone No: Gas safe register No: Comments: Signature:

Worcester, Bosch Group
Cotswold Way, Warndon, Worcester WR4 9SW.
Tel. 0330 123 9559

Worcester, Bosch Group is a brand name of Bosch Thermotechnology Ltd.
worcester-bosch.co.uk

6720882506

WORCESTER, BOSCH GROUP:

TECHNICAL SUPPORT: 0330 123 3366
CONTROLS AND
CONNECTIVITY TEAM: 0330 123 3641
APPOINTMENTS: 0330 123 9339
SPARES: 0330 123 9779
LITERATURE: 0330 123 9119
TRAINING: 0330 123 0166
SALES: 0330 123 9669

