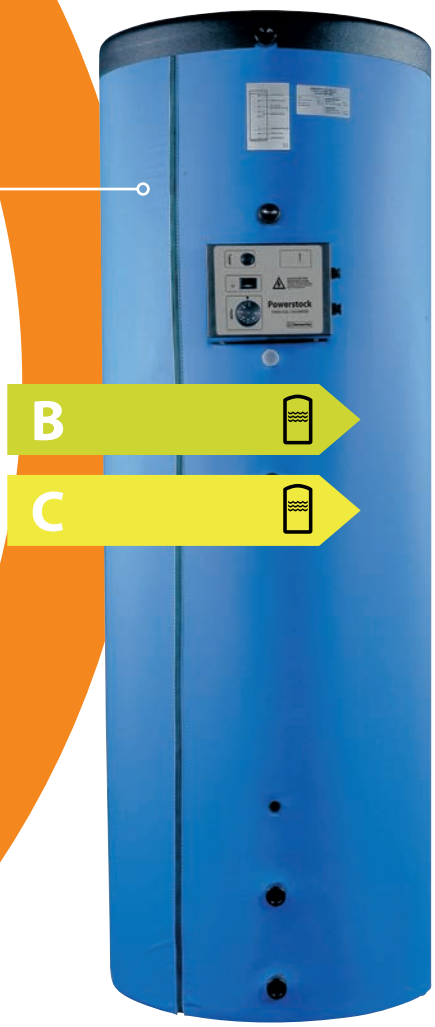
Hamworthy

Heating *at work.*

Powerstock

- Indirectly heated glass lined calorifier
- Single and twin coil
- Water storage solutions

QUICK RECOVERY



CONTINUOUS OUTPUTS 501 - 1635 L/H
STORAGE CAPACITIES 300 - 981 LITRES

2 Yr Warranty

ErP Part L Compliant

BIM Objects

CONTENTS

Simple **and flexible**

To give you a choice in your approach to indirect hot water and storage, Powerstock calorifiers can be easily coupled to any heating boiler or renewable energy source to provide highly efficient domestic hot water.

They are simple to install without the need for a direct gas supply connection and no requirements for flues.

Twin coil for two heat sources

The popular Hamworthy Powerstock calorifier range consists of 7 models with continuous outputs from 501 litres/hour up to 1635 litres/hour. Storage capacities are from 157 litres to 972 litres. All but the smallest models (501 and 600l/h) have twin coil heat exchangers which can be connected in series if using a single heat source, or connected separately to two different heat sources (such as a heating system and solar thermal system).

Calorifiers are often selected over direct fired, standalone water heater units due to their low cost, simple installation and high efficiency.

Our customers say *"I'm always impressed with the heat recovery on these units."*

Powerstock storage tanks are also part of the range and can be used to maximise energy efficiency or increase system security. The storage tanks are available with capacities from 301 litres to 981 litres to suit a variety of applications.

Storage tanks can be used with any direct or indirect water heater system to supplement storage volumes to suit large demand applications.

Key benefits

- Twin coils give control & choice in configuration
- Easy access for service and maintenance
- Quick heat recovery
- Smaller models fit through standard doorway
- Insulating jacket reduces standing losses
- Magnesium anode corrosion protection for long life

Key features:

- Glass lined calorifiers and storage tanks.
- 2 models of calorifier with a single coil with continuous outputs (@50°C ΔT) of 501 and 600 l/h.
- 5 models of calorifier with twin coils with continuous outputs (coils connected in series) (@50°C ΔT) of 1032, 1285, 1549 1432 and 1635 l/h.
- 4 storage tank models with storage capacities of: 301, 478, 750 and 981 litres.
- Recovery times with both coils in series 17-36 minutes.

Optional kits (Page 9)

- Unvented supply kit
- Top-to-bottom pump recirculation kit
- Electrical anode protection
- Electric immersion heater kits (4kW or 9kW)

Controls (Page 14)

- Control panel provided for each cylinder Includes:
  - Pre wired control and limit thermostats
  - Additional terminals for wiring the electrical anode and top to bottom circulating pump
- External controls - provision to accommodate additional temperature sensors within the vessel pockets at high and low level

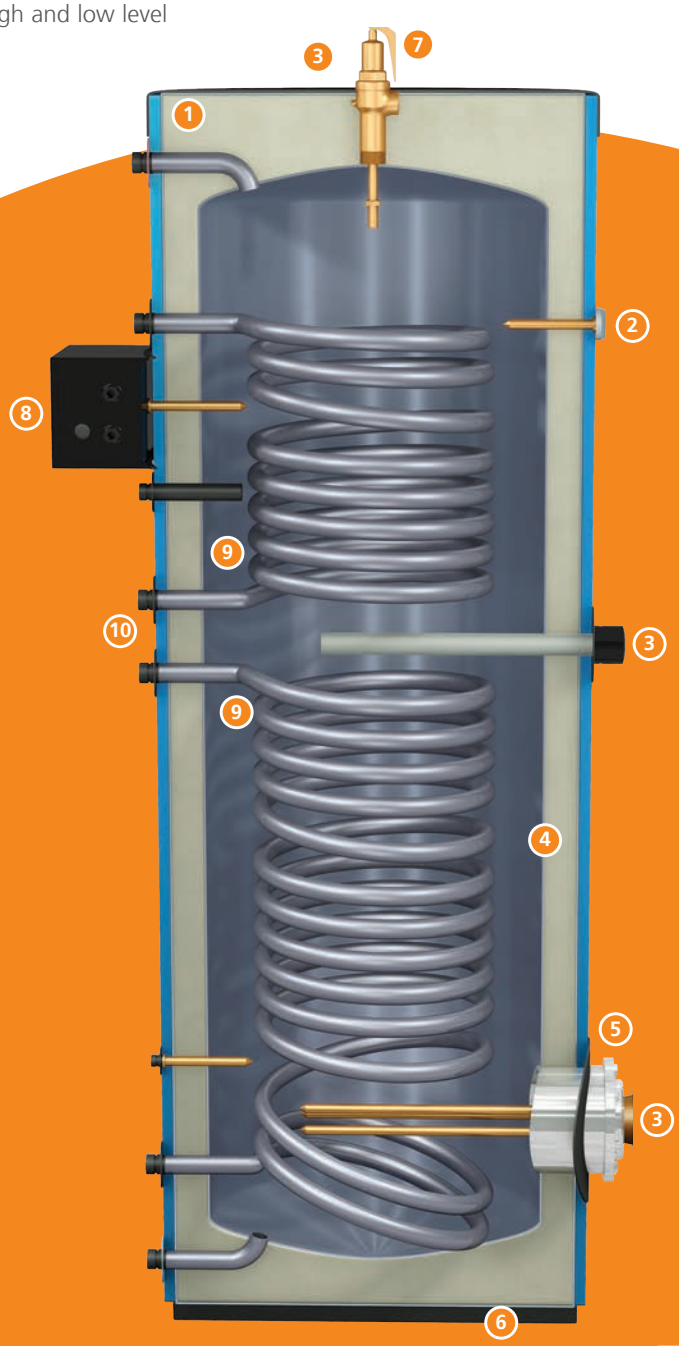
Service & Warranty (Page 23)

- Range of service options
- 2-year warranty

Anatomy of the Powerstock calorifier

1. Insulation
2. Thermometer
3. Anode position (dependent on model)
4. Vitreous enamel lining
5. Clean out door
6. Adjustable feet
7. P&T relief valve (optional)
8. Control panel
9. Twin coil construction*
10. Series connection kit*

*Only on the five larger models



7 MODELS

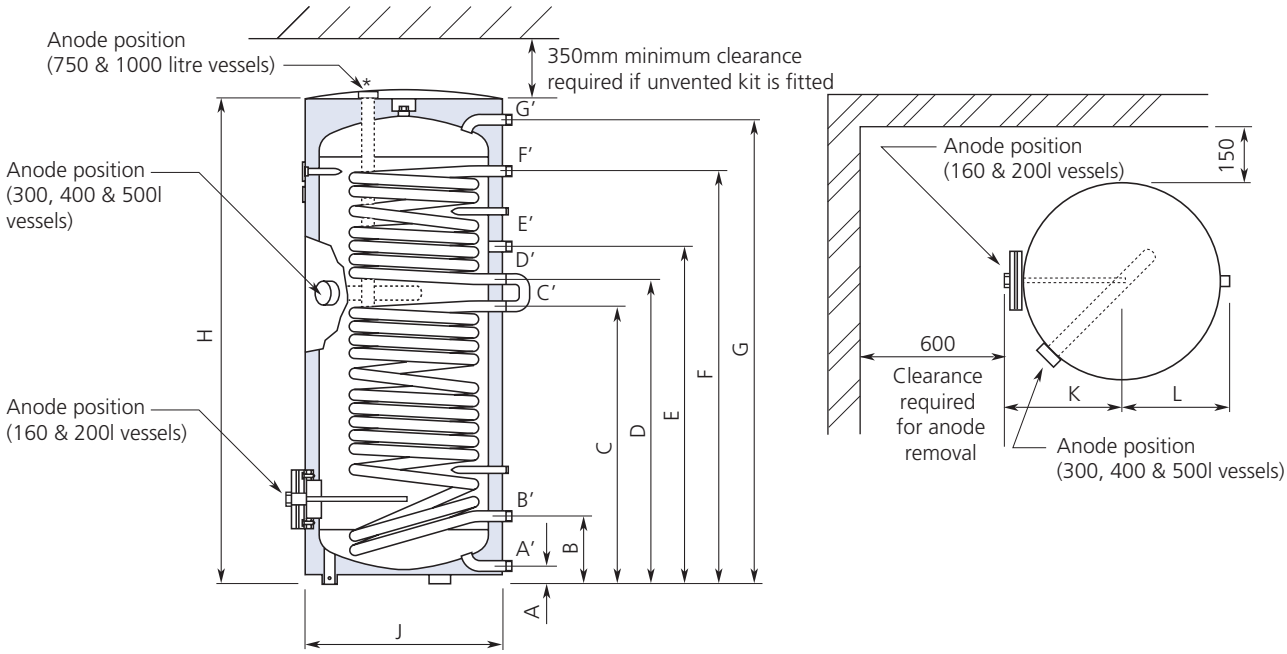
CONTINUOUS OUTPUTS
501-1635 LITRES/HOUR

Technical data & dimensions

Powerstock calorifiers all models

	Calorifier model	Units	PS160	PS200	PS300	PS400	PS500	PS750	PS1000
General data	ErP class		B	C	C	C	C	C	C
	Storage capacity	l	157	196	299	382	474	750	972
	Top coil surface area	m^2	N/A	N/A	0.8	1.05	1.3	1.17	1.12
	Top coil volume	l	N/A	N/A	6.6	7.0	8.9	8.2	7.9
	Bottom coil surface area	m^2	0.75	0.95	1.55	1.8	1.9	1.93	2.45
	Bottom coil volume	l	4.9	6.2	10.4	12.2	13.2	13.5	17.1
	Maximum operating pressure (primary - coil)	bar	10	10	10	10	10	10	10
	Maximum operating pressure (secondary - storage)	bar	10	10	10	10	10	10	10
	Maximum operating temperature (primary - coil)	°C	110	110	110	110	110	110	110
	Maximum operating temperature (secondary - storage)	°C	70	70	70	70	70	70	70
	Weight empty	kg	70	80	130	185	215	253	312
	Standby losses	kW/24hr	1.44	1.92	2.4	2.9	3.12	3.6	4.8
Bottom coil only in operation	Continuous output*	l/h	501	600	816	976	1109	1062	1281
		l/min	8.35	10	13.6	16.2	18.48	17.7	21.35
	Heat input	kW	29.2	35.6	48.4	57.9	65.7	63.0	76.0
	10 min peak output*	l	250	362	448	615	771	1100	1197
	Recovery time	min	20	20	22	24	26	42	46
Top and bottom coil connected in series	Continuous output*	l/h	N/A	N/A	1032	1285	1549	1432	1635
	Heat input	kW	N/A	N/A	61.2	76.2	91.8	85	97
	10 min peak output*	l	N/A	N/A	567	889	1077	1319	1483
	Recovery time	min	N/A	N/A	17	18	18	31	36
Electrical	Destratification pump power supply		230V 50Hz 1 Phase						
	Destratification pump power consumption	W	60	60	60	60	60	60	60
	Destratification pump current	A	0.35	0.35	0.35	0.35	0.35	0.35	0.35
	Electric anode power supply		230V 50Hz 1 Phase						
	Electric anode power consumption	W	23	23	23	23	23	23	23
	Electric anode current	A	0.1	0.1	0.1	0.1	0.1	0.1	0.1

**Calorifier performance is based on a DHW flow temperature of 60°C, with a cold water inlet temperature of 10°C, and a primary inlet temperature of 80°C. For details of pressure loss and flow rates at different temperatures, please refer to page 6.*



Notes:

1. Where insufficient clearance will prevent replacement of standard magnesium sacrificial anodes, the optional electrical anode protection kit may be fitted.

2. Clearance required above for anode removal, 750 & 1000 litre vessels - 1300mm.

Model	Dimensions (mm)										
	A	B	C	D	E	F	G	H	J	K	L
PS160	55	193	598	N/A	734	N/A	1110	1184	540	312	295
PS200	55	193	688	N/A	901	N/A	1370	1445	540	312	295
PS300	90	254	964	1064	1179	1424	1725	1794	600	352	335
PS400	55	221	909	1007	1112	1355	1526	1591	700	392	375
PS500	55	220	965	1114	1264	1604	1853	1921	700	392	375
PS750	105	293	835	1156	1246	1471	1890	2030	950	507	515
PS1000	106	297	884	1153	1243	1423	1905	2030	1050	557	565

Model	Connections diameter (inches)						
	A'	B'	C'	D'	E'	F'	G'
	Cold water feed	Lower primary coil outlet	Lower primary coil inlet	Upper primary coil outlet	Recirculation connection	Upper primary coil inlet	Hot water outlet
PS160	R ¾"	R 1"	R 1"	N/A	R ¾"	N/A	R ¾"
PS200	R ¾"	R 1"	R 1"	N/A	R ¾"	N/A	R ¾"
PS300	R 1"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1"
PS400	R 1"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1"
PS500	R 1"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1"
PS750	R 1¼"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1¼"
PS1000	R 1¼"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1¼"

*Note: All dimensions in mm unless otherwise stated.

Pressure loss and flow rates

Powerstock PS160 – single coil calorifier

Coil (Δt °C)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	29.2	0.64	27
15	29.2	0.47	15
20	29.2	0.35	8

Powerstock PS200 – single coil calorifier

Coil (Δt °C)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	35.6	0.77	51
15	35.6	0.57	28
20	35.6	0.43	16

Powerstock PS300 – twin coil calorifier

Coil (Δt °C)	Bottom coil only			Top coil only			Top & bottom coil		
	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	48.4	1.05	151	12.8	0.28	6	61.2	1.33	375
15	48.4	0.77	81	12.8	0.20	3	61.2	0.98	201
20	48.4	0.58	46	12.8	0.15	2	61.2	0.73	113

Powerstock PS400 – twin coil calorifier

Coil (Δt °C)	Bottom coil only			Top coil only			Top & bottom coil		
	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	57.9	1.26	247	18.3	0.40	14	76.2	1.66	672
15	57.9	0.92	133	18.3	0.29	8	76.2	1.22	361
20	57.9	0.69	75	18.3	0.22	4	76.2	0.91	203

Powerstock PS500 – twin coil calorifier

Coil (Δt °C)	Bottom coil only			Top coil only			Top & bottom coil		
	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	65.7	1.43	342	26.1	0.57	37	91.8	2.00	1121
15	65.7	1.05	184	26.1	0.42	20	91.8	1.46	603
20	65.7	0.79	104	26.1	0.31	11	91.8	1.10	339

Powerstock PS750 – twin coil calorifier

Coil (Δt °C)	Bottom coil only			Top coil only			Top & bottom coil		
	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	63.0	1.37	301	22.0	0.48	22	85.0	1.85	880
15	63.0	1.00	162	22.0	0.35	12	85.0	1.36	473
20	63.0	0.75	91	22.0	0.26	7	85.0	1.02	266

Powerstock PS1000 – twin coil calorifier

Coil (Δt °C)	Bottom coil only			Top coil only			Top & bottom coil		
	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)	Heat input (kW)	Flow rate (l/sec)	Coil pressure loss (mbar)
11	76.0	1.65	533	21.0	0.46	19	97.0	2.11	1276
15	76.0	1.21	287	21.0	0.33	10	97.0	1.55	686
20	76.0	0.91	161	21.0	0.25	6	97.0	1.16	386

STORAGE CAPACITY

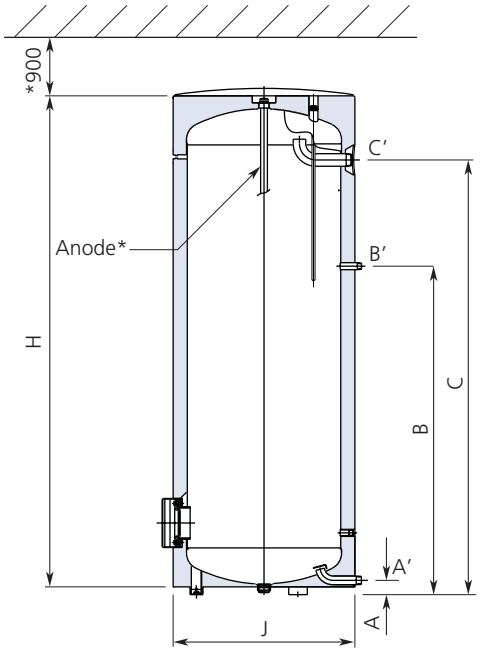
2 MODELS

300-478 LITRES

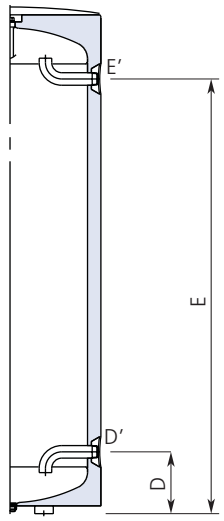
Technical data & dimensions

Storage tanks ST300 & ST500

	Storage tank model	Units	ST300	ST500
General data	ErP class		C	C
	Storage capacity	l	300	478
	Maximum operating pressure	bar	10	10
	Maximum operating temperature	°C	95	95
	Weight empty	kg	87	111
	Standby losses	kW/24h	1.85	2.26
Electrical	Destratification pump power supply		230V 50Hz 1 Phase	
	Destratification pump power consumption	W	60	60
	Destratification pump current	A	0.35	0.35
	Electric anode power supply		230V 50Hz 1 Phase	
	Electric anode power consumption	W	23	23
	Electric anode current	A	0.1	0.1



Section x-x Front view



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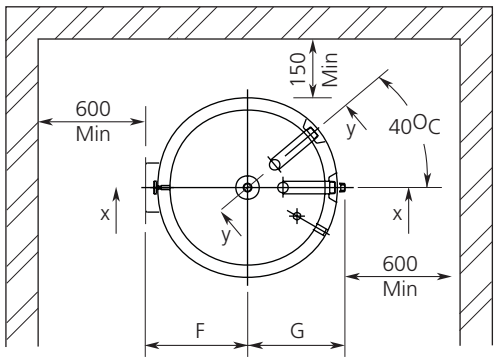


Plan view

**Note: Where insufficient clearance will prevent anode replacement using standard magnesium anodes, the optional electrical anode protection may be fitted, but only after complete removal of all magnesium anodes.*

*Note: All dimensions in mm unless otherwise stated.

Model	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
ST300	90	1180	1546	272	1546	340	327	1794	600
ST500	55	1265	1674	238	1674	392	375	1921	700

Model	Connections diameter (inches)				
	A'	B'	C'	D'	E'
	Cold water inlet	Hot water inlet (from DHW circulation return)	Hot water outlet (to DHW outlets)	Tank charging outlet (to calorifier)*	Tank charging inlet (from calorifier)*
ST300	R 1"	R 3/4"	R 1½"	R 1½"	R 1½"
ST500	R 1"	R 3/4"	R 1½"	R 1½"	R 1½"

**Note: The charging inlet and outlet are the supply and recirculation connections respectively from and to a separate heating source such as a calorifier, direct-fired water heater or plate heat exchanger.*

STORAGE CAPACITY

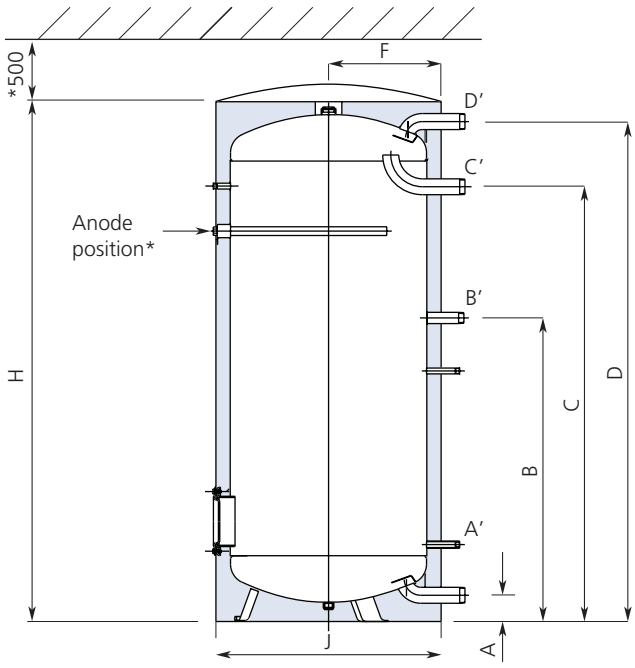
2 MODELS

750-981 LITRES

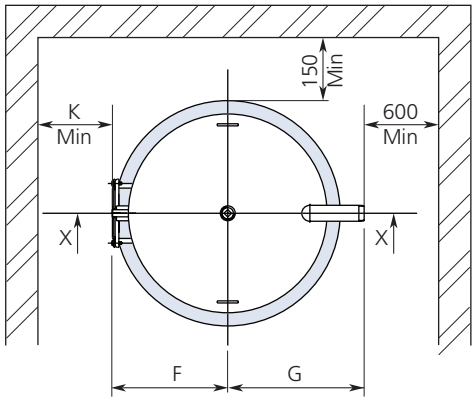
Technical data & dimensions

Storage tanks ST750 & ST1000

	Storage tank model	Units	ST750	ST1000
General data	ErP class		C	C
	Storage capacity	l	750	981
	Maximum operating pressure	bar	10	10
	Maximum operating temperature	°C	95	95
	Weight empty	kg	217	283
	Standby losses	kW/24h	3.1	3.41
Electrical	Destratification pump power supply		230V 50Hz 1 Phase	
	Destratification pump power consumption	W	60	60
	Destratification pump current	A	0.35	0.35
	Electric anode power supply		230V 50Hz 1 Phase	
	Electric anode power consumption	W	23	23
	Electric anode current	A	0.1	0.1



Section x-x
Front view



Plan view

**Note: Where insufficient clearance will prevent replacement of standard magnesium sacrificial anodes, the optional electrical anode protection kit may be fitted.*

*Note: All dimensions in mm unless otherwise stated.

Model	Dimensions (mm)								
	A	B	C	D	F	G	H	J	K
ST750	100	1147	1642	1893	507	515	2030	950	600
ST1000	100	1155	1650	1910	557	565	2030	1050	700

Model	Connections diameter (inches)			
	A'	B'	C'	D'
	Tank charging outlet (to calorifier)*	Hot water inlet (from DHW circulation return)	Hot water outlet (to DHW outlets)	Tank charging inlet (from calorifier)*
ST750	R 2"	R 1¼"	R 2"	R 2"
ST1000	R 2"	R 1¼"	R 2"	R 2"

**Note: The charging inlet and outlet are the supply and recirculation connections respectively from and to a separate heating source such as a calorifier, direct-fired water heater or plate heat exchanger.*

Optional kits

Immersion heaters

To provide a back-up heat source, a single electrical immersion heater can be specified, with ratings of either 4kW or 9kW output. Replacing the standard clean out door with a specially machined stainless steel flange allows fitting of the immersion heater to the cylinder. Immersion heaters can be wired for either single phase 230 volts power supply, or for three phase 415 volts supply.

For details of immersion heater wiring, please refer to pages 10 and 11.

Immersion heater kit

Hamworthy can supply an electrical immersion heater kit to be used for back up only. The kit consists of a replacement stainless steel clean out door and either 4kW or 9kW immersion heater. The kit is supplied loose for fitting on site in place of the standard clean out door. As the immersion heater cannot provide the same power input as the heating coil, heat up times will be extended when relying on the immersion heater alone.

It should be noted that with calorifier models PS160 and PS200 it is not possible to have an immersion heater when using the unvented system kit, because the anode is relocated to the clean out door position.

The immersion heater can be wired for either single phase 230 volts power supply, or for three phase 415 volts supply. For recommended wiring see pages 10 and 11.

Heat up times for immersion heaters

Where an immersion heater is used for auxiliary heating, or for anti-legionella purge cycles, it is important that any controls provide adequate time for the heater to raise the contents of the calorifier or storage tank from cold to hot.

Heater size	Heat up time Δ T 50°C - minutes						
	PS 160	PS 200	PS/ST 300	PS 400	PS/ST 500	PS/ST 750	PS/ST 1000
4 kW	139	174	261	348	435	653	871
9 kW	54	67	101	135	169	253	337

Electrical anode protection

In areas of the country that have particularly soft water and therefore poor conductivity of the water, less than 200 micro-siemens per cm, such as Scotland, Devon and Cornwall, then magnesium sacrificial anodes may not be fully effective in providing protection against corrosion.

The optional electrical anode protection system is effective in providing protection in most water conditions. It is essential that if the electrical anode protection system is fitted to a calorifier or storage tank, then an uninterrupted 24-hour power supply must be maintained to ensure proper protection of the unit.

Top to bottom pump recirculation

In order to prevent stratification within the cylinder, a top to bottom recirculation kit can be specified. It is possible to control the pump recirculation according to the control strategy deployed on site.

Full time operation of the top to bottom recirculation pump may be considered where a single heat source is used and a uniform water temperature is required throughout the cylinder.

Alternatively, intermittent use of the pump may be considered where dual heat sources are used and deliberate stratification within the cylinder is desirable. For efficient operation with some renewable energy sources, the top to bottom recirculation pump should only operate to coincide with the timed raising of the water temperature as part of the anti-legionella regime. This should be controlled via an external time clock (not HHL supply).

Unvented supply kit

All Powerstock calorifiers and storage tanks are suitable for installation in direct unvented systems. The unvented system kit allows the cylinder to be fed directly from the mains cold water supply, or from a booster pump set, without the need for feed and expansion tanks.

An individual unvented supply kit is required for each calorifier and storage tank.

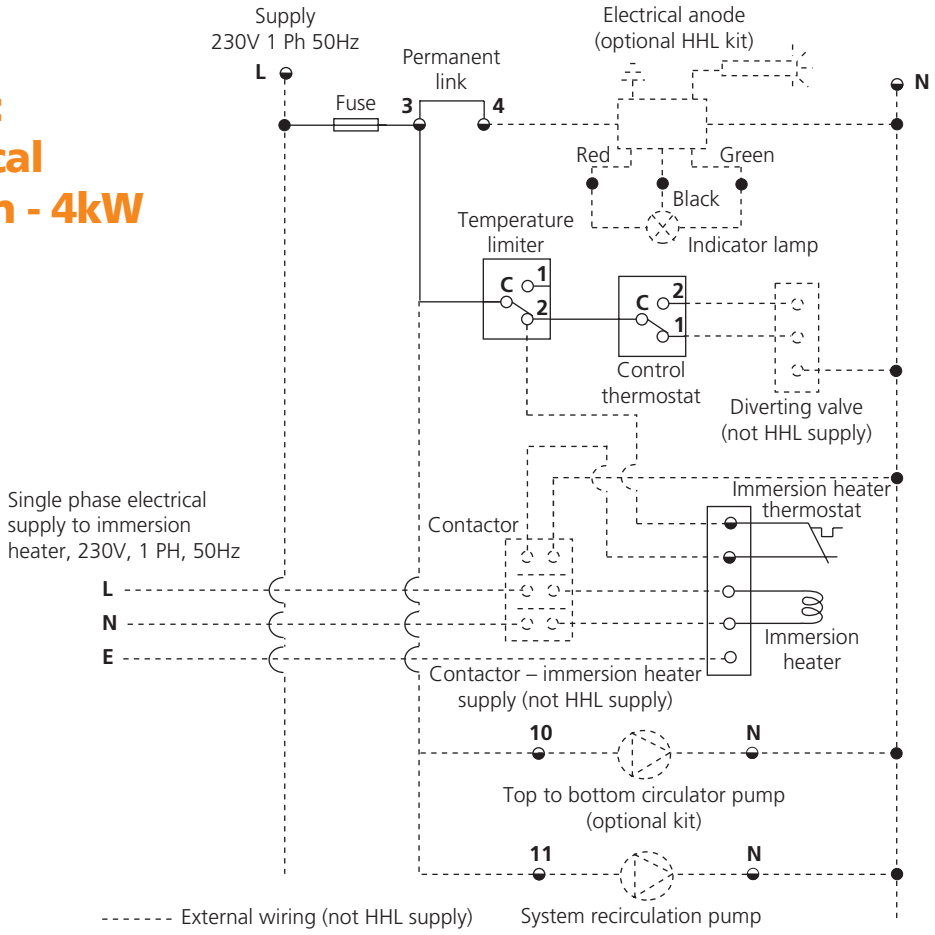
Electrical connections

Electrical details

Powerstock calorifiers and storage tanks are supplied with a control panel housing the control and limit thermostats. Thermostats are rated for voltages up to 230 volts and can be used to control diverting valves, primary pumps and loading pumps, as required to control the heat source and maintain the required storage temperature. Maximum switching load for the thermostats is 2 amps.

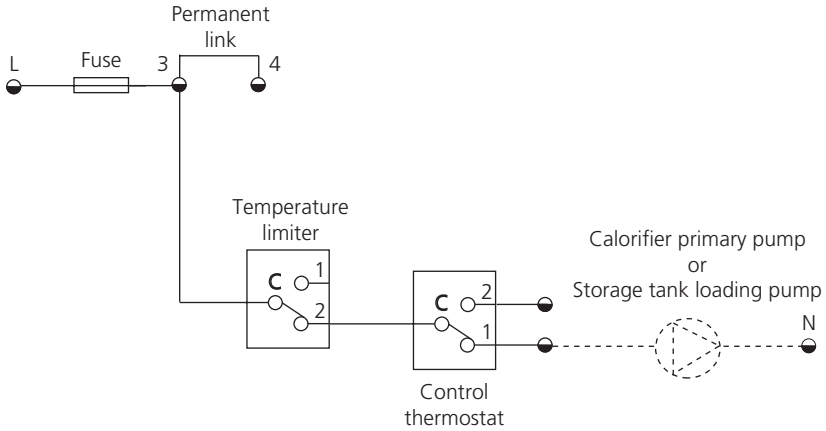
Electrical schematic: single phase electrical supply to immersion - 4kW

Notes: An uninterrupted permanent power supply is required for electrical anode applications. Wiring connections from terminal 3 to terminals 10 and 11 should be made using suitably rated cable. If an optional immersion heater is fitted, a separate power supply and connection via the temperature limiter must be provided.



Electrical schematic: calorifier primary pump/storage tank loading pump

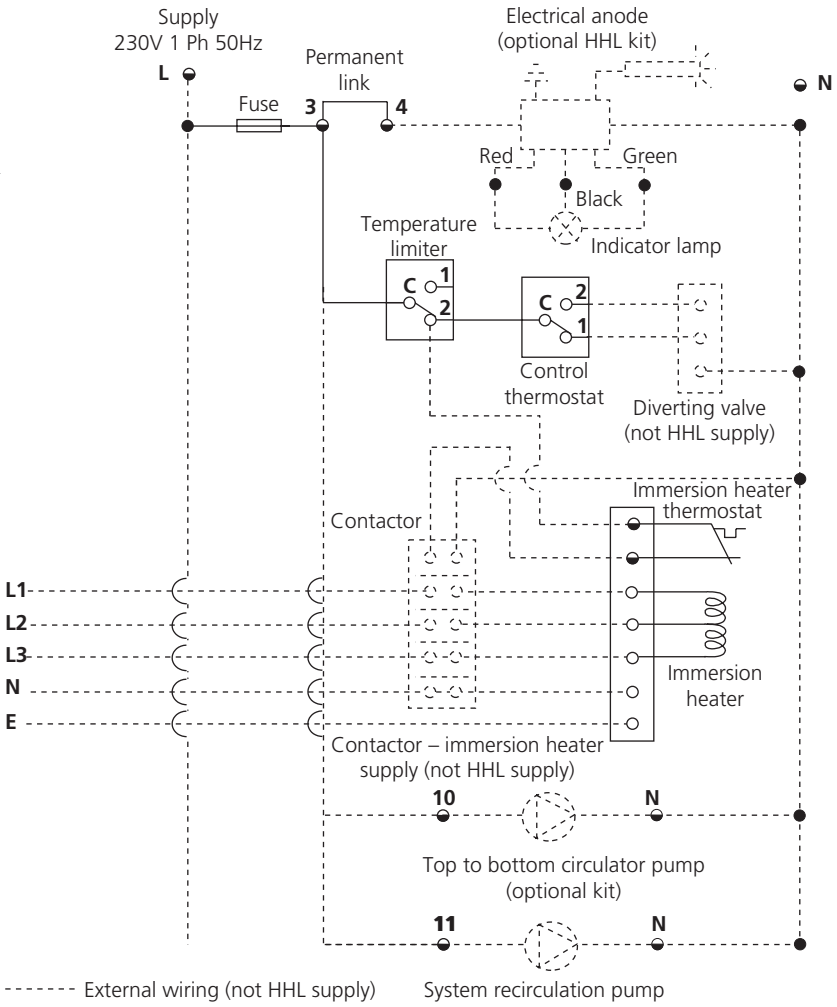
Note: All other wiring should be in accordance with the general wiring diagram.



Electrical connections

Electrical schematic: 3-phase electrical supply for immersion - 9kW

Notes: An uninterrupted permanent power supply is required for electrical anode applications. Wiring connections from terminal 3 to terminals 10 and 11 should be made using suitably rated cable. If an optional immersion heater is fitted, a separate power supply and connection via the temperature limiter must be provided.



Specification

Construction (1)

Powerstock products are manufactured to the highest standards using the latest production technology to ensure a high quality long lasting finish in every unit. Compliance is assured with stringent controls in accordance with the European Standards for CE marking.

Cylinders are constructed from high grade steel with a high quality vitreous enamel lining. The fabrication of the cylinder and welding is completed fully before the glass lining is applied, ensuring that the integrity of the lining is not affected during manufacture. On completion of the fabrication, the cylinder undergoes a precise glass coating process to ensure an even coating is applied throughout. Surplus material is drained before the unit is baked to complete the adhesion of the lining to all internal surfaces of the cylinder, providing a long lasting finish.

Each cylinder is finished with an insulating jacket ensuring that standing losses are kept to a minimum. Most calorifiers can be carried through single doorways as supplied. To aid installation of the larger PS750 and PS1000 models, their foam-lined insulation jackets can be unzipped and temporarily removed. This will reduce their effective width by 160mm.

All Powerstock models are supplied as standard with a pre-wired control panel with a temperature control thermostat and a limit thermostat.

Calorifier heat exchanger (2)

The smaller PS160 and PS200 models have a single high capacity heating coil whilst the larger models, PS300 to PS1000, each have two heating coils that can be connected to two independent heat sources. Alternatively each twin coil calorifier is provided with a connection kit to join the two coils in series, creating an extended surface area single coil for high recovery and output rates.

This allows greater control of the heat input and gives the ability to utilise alternative energy sources such as a solar collector array.

All connections to the heat exchanger coils are conveniently located on the side of the cylinder providing good access for pipe work installation.

Clean out door

Powerstock models have an easily accessible clean out door that allows for the inspection and cleaning of the cylinder's interior, as required by the recommendations of the HSC for the control of Legionellosis, including Legionnaires disease.

Sacrificial anode protection (3)

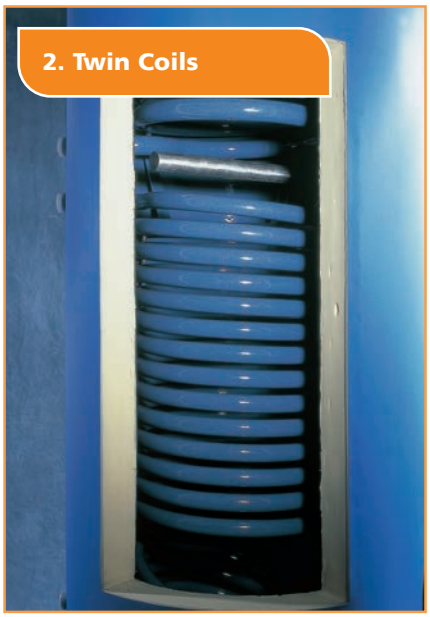
Powerstock calorifiers and storage tanks are all fitted with removable magnesium sacrificial anodes as standard, ensuring excellent protection against corrosion.

Clearance is required above or to the side of the unit for maintenance and replacement of the magnesium sacrificial anodes.

Where insufficient clearance will prevent anode replacement using standard magnesium anodes, electrical anode protection may be fitted, but only after complete removal of all magnesium anodes.

1. Construction

2. Twin Coils



3. Anodes

Specification

Controlling legionella

All Powerstock models are designed to meet the Health & Safety Commission (HSC) requirements for safe production of hot water and, in particular, the control of Legionellosis.

Legionella bacteria are common in natural water sources and therefore low concentrations may be present in many water systems. It is important that hot water services are designed and operated in such a way that these organisms are prevented from multiplying.

Water temperature is a significant factor in controlling the risk, with optimum conditions for bacterial growth occurring between 20°C and 45°C.

Regular cleaning of the system will help to avoid the build up of sediments, which may harbour or provide nutrients for the bacteria.

Water stagnation may encourage the growth of biofilm, which can provide local conditions that may promote the proliferation of Legionella bacteria.

Designed for safety

The Health and Safety Commission (HSC) approved code of practice and guidance document L8, makes it clear that if the risk of Legionella is to be minimised, then the recommendations must be observed in so far as they relate to hot & cold water systems.

Powerstock calorifiers and storage tanks conform to these requirements as follows:

- Good access for cleaning
- Generous flow and return connections
- Adequately sized drain
- Base designed to avoid sludge traps
- Provision of anodes to reduce metal corrosion
- Number of tappings correctly positioned to facilitate recirculation, destratification and to obviate stagnation areas
- Designed to meet unvented supply requirements

We're accredited with CIBSE to deliver approved Continuing Professional Development (CPD) courses.

It's our opportunity to share our knowledge with you. More than 3,000 people have attended our CPD seminars and 95% rated them as good or excellent.

Hamworthy CPD seminars are free to attend and our flexible approach means that we are able to tailor our training to suit your business. Lots of our customers choose to run these online at lunchtime or at their own premises so that there is minimal disruption to the working day.

"Very good session with lots of very detailed and relevant information. Would highly recommend!"

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Controls

A control panel is provided for each cylinder housing a control thermostat, with a range 0°C to 120°C, pre-set at 60°C, and a high limit thermostat pre-set at 85°C, non-adjustable.

The control thermostat can be used to operate a primary pump or diverting valve for the purpose of preventing further heat transfer once the cylinder has reached the temperature set point. Should for any reason the cylinder continue to warm up once the temperature set-point has been reached, the limit thermostat will trip.

The limit thermostat should be interlocked to isolate all heat sources once the limit temperature is reached.

Additional terminals are provided within the control panel for wiring the electrical anode and top to bottom circulating pump. Where these items are specified, a separate permanent electrical supply will need to be connected to the control panel.

External controls

Where Powerstock calorifiers and storage tanks are required to work with external controls such as BMS, advanced boiler controls and solar controllers, there is adequate provision to accommodate additional temperature sensors within the vessel pockets at high and low level.

Application and water system

Installation must be in accordance with the relevant requirements of the Building regulations, IET Regulations and the Water Supply (Water Fittings) Regulations. It should also be in accordance with any relevant requirements of the Local Authority and the relevant recommendations.

The British Standard Codes of Practice and additional publications have relevant recommendations regarding the installation of Powerstock calorifiers and storage tanks.

Location and layout

The location must provide adequate space for servicing and air circulation around each unit. This includes any electrical trunking laid along the floor and to the appliance.

Calorifiers and storage tanks should be positioned on a level non combustible surface that is capable of supporting the weight of the unit when full of water, plus any additional ancillary equipment.

Adequate space to enable installation and servicing must be provided, with due consideration to ensuring access to the clean out door and for removal of the anodes.

Primary circuit design

Where the calorifiers are supplied by a single heat source such as boilers, then the twin coil calorifiers can have the upper and lower coil connected using the series connector kit, supplied as standard with each calorifier, creating a larger heat transfer surface.

It is recommended that connection to the boiler circuit is made using a low loss header with a separate pump for the calorifier circuit. The calorifier pump can then be selected to suit the flow and pressure loss conditions for the calorifier. Refer to technical details on page 6.

The primary circuit flows through the coil during the heat up cycle. Having reached the temperature set at the calorifier control thermostat, the primary flow through the coil can be stopped either using a diverting valve or by stopping the calorifier pump.

A diverting valve circuit should use a regulating valve installed in the by-pass pipe. This valve should be set to ensure adequate resistance for the pump when the circuit is diverting flow away from the calorifier.

The preferred method, stopping the pump when the calorifier has reached the temperature set point, reduces electrical energy consumption, reduces wear and tear on the pump and removes the need for a diverting valve.

When two heat sources are used, for instance a boiler heat supply and an alternative energy heat supply, it is usual to connect the boiler circuit to the upper coil and the alternative energy source to the lower coil.

HSE anti-legionella recommendations

HSE HSG274 Part 2: The Control of Legionella Bacteria in Hot and Cold Water Systems, recommends as follows:

Maintaining a supply temperature of at least 60°C from the calorifier.

The secondary circuit design must ensure that water temperatures returning to the hot water storage plant do not fall below 50°C.

Hot water temperature at outlets or thermostatic mixing valves must achieve 50°C within 1 minute of that outlet being opened.

As part of the anti-legionella regime, the entire contents of the a calorifier or storage tank including that at its base must be heated at least 60°C for one hour each day. Top to bottom circulation pump operation should coincide with the anti-legionella heating cycle.

Secondary hot water circulation

Hot water should be circulated throughout the domestic hot water system using a bronze pump. This pump should be located after all draw off points to ensure hot water flow to fittings is not impeded by pump capacity.

The system recirculation circuit returns water to the calorifier using the recirculation connection located mid-way on the cylinder. This ensures that when the returning water is cooler than the mid-position temperature, it descends to the bottom of the calorifier, aiding stratification when the application is appropriate; for instance, with systems including solar thermal energy.

Maintenance

Installed cylinders will experience a wide variation in operating conditions that can occur due to differing patterns of usage and the variable chemical nature of distributed water supplies. It is therefore recommended that cylinders are drained and inspected within 3 months of the initial commissioning. Once the level of calcium deposition and the rate of anode decay are established, a suitable maintenance schedule can be implemented, however as a minimum all cylinders should be inspected annually.

Application and water system

Normally, the alternative energy source should have priority over the boilers, to ensure the most effective use of the alternative energy.

Temperature and pump control for the lower coil should be in accordance with recommendations provided by the supplier of the alternative heat source.

Powerstock calorifiers have adequate provision of pockets at the top and bottom of the cylinder to allow fitting of additional temperature sensors.

DHW distribution system

Hamworthy Powerstock calorifiers and storage tanks are designed to meet a wide variety of hot water loads and applications, and may be connected either to an open vented feed and expansion tank or directly to the mains cold water supply using unvented systems kits.

Open vented systems

Feed and expansion tanks should be sized to ensure that make up water is at least equivalent to or exceeding the maximum draw off rate from the calorifier installation, as well as any other system requirements.

Some applications may stipulate a water storage capacity sufficient to meet the building requirements for a set period of time.

Open vented systems must be installed using correctly sized cold feed and open vent pipes as well as a ¾" pressure relief valve fitted to the flow pipe from each calorifier, before any isolating valve.

CIBSE recommendations				
Calorifier rating kW	Ball valve size	Cold feed size	Open vent size	Over flow size
30	15	20	25	32
45	15	20	25	32
60	15	20	25	32
75	15	25	32	32
150	15	25	32	32
225	20	32	40	40
300	20	32	40	40

The maximum working pressure for Powerstock calorifiers and storage tanks is 10 barg, which is equivalent to a maximum static height of 102 metres.

Unvented systems

Powerstock calorifiers and storage tanks are suitable for installation in direct unvented systems. The unvented system kit allows the calorifier to be fed directly from the mains cold water supply, or from a booster pump set, without the need for feed and expansion tanks.

The Hamworthy unvented system kit contains all the essential components to comply with the Water Supply (Water Fittings) Regulations 1999, including a suitably sized pressure and temperature relief valve, which locates directly into the cylinder.

A separate unvented system kit is required for each calorifier and storage tank.

Unvented system kit - expansion vessel sizing

Each unvented system kit is supplied with expansion vessel(s) sized to accommodate the expansion from the stored water volume and approximately 30 metres of associated pipe work. Where longer pipe runs are present, additional expansion vessel volume will be required to accommodate the additional water expansion.

All Hamworthy Burstock expansion vessels are WRAS approved so suitable for Domestic Hot Water applications.

Standard kit expansion vessel volumes for each vessel size	
Calorifier/storage tank model	Expansion vessel (litres)
PS 160	25
PS 200	25
PS/ST 300	2 x 25
PS 400	2 x 25
PS/ST 500	60
PS/ST 750	80
PS/ST 1000	100

Hamworthy can supply a range of expansion vessels up to 1000 litres capacity, suitable for potable hot water systems, to suit most system requirements.

Expansion vessel calculations

Expansion volume can be calculated using the following formula:

$$V_2 = \frac{\Sigma \times V_1}{1 - PC/PW}$$

Where:

V_2 = Required expansion vessel, in litres

V_1 = Total system volume (cylinder plus pipe work), in litres

Σ = Water expansion factor, no units

Pc = Expansion vessel cushion pressure (absolute) + 1 bar, in bar

Pw = Working pressure (absolute) = Expansion valve setting + 1 bar, in bar

Temp °C	Expansion factor Σ
50	0.0118
55	0.0142
60	0.0168
65	0.0196
70	0.0225

Safety relief valves

Discharge pipes from combined temperature and pressure relief valves, expansion relief valves and pressure relief valves must in accordance with Building Regulation G3: 'Ensure that any discharge from safety devices is conveyed to where it is visible but will not cause a danger to persons in or about the building'.

Application and water system

Dead legs

Dead legs to water draw off points should be as short as possible, and not exceed the lengths laid down in the Water Supply (Water Fittings) Regulations 1999.

These regulations state that the maximum length of uninsulated pipes supplying a hot water draw off tap measured along the axis of the pipe from the heater, cylinder or tank or from a secondary circuit should be no longer than the lengths given in the following table:

Pipe outside dia. (mm)	Max dead leg length (m)
≤ 12	20
12-22	12
22-28	8
>28	3

WRAS recommends all hot water pipes, including those forming part of any secondary circulation system, should be thermally insulated.

Safety and secondary hot water temperature control

Powerstock calorifiers and storage tanks are provided with a control thermostat that may be used to control the primary heat source to achieve the stored water temperature set point. For systems which utilise solar energy to contribute to the heat source, there may be occasions when the desired stored water temperature will be exceeded.

Suitably applied thermostatic mixing valves must be fitted at all hot water outlets to ensure that the risk of scalding is reduced. Depending on application, these will need to be either TMV2 or TMV3 standard. Further information relating to application requirements can be found at the Thermostatic Mixing Valve Manufacturers Association website – www.beama.org.uk

Secondary hot water temperature control - open-vented primary systems

Low pressure open vented primary systems are specified as being those where the primary circuit pressures are less than 5 metres head at the top of the boiler and/or less than 2.5 metres head at the mid-point of the calorifier primary coils. Low pressure open vented systems are classified by their design as preventing the primary temperature exceeding 100°C in the event of primary circuit temperature control failure. In these systems the calorifier temperature controls can be connected to divert the primary flow or stop the primary pump to prevent excessive heating of the calorifier content.

In non low pressure open vented primary systems where the primary circuit pressures are greater than 5 metres head at the top of the boiler and/or greater than 2.5 metres head at the midpoint of the calorifier coil, the primary temperature is deemed as capable of exceeding 100°C due to operating under pressure. In these systems, additional temperature control measures are required to prevent the calorifier content exceeding 100°C in the event of primary circuit temperature control failure.

Overheat protection in open-vented primary systems

To achieve safe primary circuit isolation in open-vented primary systems, an additional spring-return, normally-closed, motorised valve is recommended to be fitted in the primary flow to the cylinder coils. This valve is to be controlled by the cylinder high limit thermostat, such that in the event of an overheat situation developing, system temperatures would not be allowed to rise to dangerous levels. Where multiple heat sources are used, all sources of heat must be interrupted via the limit thermostat.

Alternatively, for open vented primary with open vented secondary hot water systems only, an appropriate safety device, for example, a temperature relief valve or a combined temperature and pressure relief valve may be installed directly in the cylinder, to safely discharge water in the event of significant overheating.

Where the secondary hot water system of a calorifier is unvented, the inclusion of a combined temperature and pressure relief valve, directly installed in the cylinder, is a mandatory requirement in addition to the requirement for primary circuit isolation via the high limit thermostat.

Secondary hot water temperature control – sealed primary systems

Sealed primary systems operate at pressures where the temperature within the primary system could easily exceed 100°C in the event of primary circuit temperature control failure. In these systems additional measures are required to prevent the calorifier content exceeding 100°C in the event of primary circuit temperature control failure.

Overheat protection in sealed primary systems

To achieve safe primary circuit isolation in sealed primary systems an additional spring-return, normally-closed motorised valve is recommended to be fitted in the primary flow to the cylinder coils. This valve is to be controlled by the cylinder high limit thermostat. In the event of an overheat situation developing, system temperatures would not be allowed to rise to dangerous levels. Where multiple heat sources are used, all sources of heat must be interrupted via the limit thermostat.

Alternatively, for sealed primary with open vented secondary hot water systems only, an appropriate safety device, for example, a temperature relief valve or a combined temperature and pressure relief valve may be installed directly in the cylinder, to safely discharge water in the event of significant overheating.

Where the secondary hot water system of a calorifier is unvented, the inclusion of a combined temperature and pressure relief valve directly installed in the cylinder is mandatory in addition to the primary circuit isolation requirement via the high limit thermostat.

Sizing guide

When you have established the number of appliances, the usage, and the quantity of hot water required, the outputs of the heaters must be related to the hot water storage temperature. Any decrease in the cold water supply temperature or increase in the hot water storage temperature will result in a decreased output from the heater.

The output figures given are based on a rise in the temperature of 44°C (i.e. with a storage temperature of 60°C the cold water supply must be at 16°C). The following table indicates the continuous output of the heater with various temperature rises across the heaters.

The normal maximum storage temperature is 60°C and hence 55°C is the maximum rise expected across the heater with a cold water supply temperature of 5°C. It is possible, however, that for certain applications a higher storage temperature will be required, in which case, assuming the cold water supply temperature remains at 5°C, as the required storage temperature setting increases, there will be a proportional increase in required temperature rise across the calorifier and a proportional fall in calorifier continuous output rating (table below).

Various factors need to be taken in to account to determine appropriate storage capacity requirements of the application, and how much additional storage, if any, may be required. These include general consumption throughout the day, recovery times, peak period duration, and whether a larger storage buffer than the calorifier's own storage is required to guard against the possibility of high flow rates at peak times.

Where the installation requires the use of large volumes of hot water over short periods and a storage tank is specified, a loading pump will be required to transfer hot water from the calorifier into the storage tank. This should be a bronze pump and sized to suit the continuous output of the water heater under design temperature conditions.

It is important that cold water supply capacities and pressures as well as pipe work layouts are suitable for high volume draw off at peak times to ensure satisfactory hot water delivery to draw off points.

One or more storage tanks may be used in conjunction with Powerstock calorifiers to satisfy hot water demand.

Model	Number of coils	Units	Temperature rise across calorifier (hot water temperature)			
			44°C	50°C	56°C	60°C
PS160	Single coil only	l/h	569	501	447	417
PS200	Single coil only	l/h	682	600	536	500
PS300	Bottom coil only	l/h	927	816	729	680
	Top and bottom coil	l/h	1173	1032	921	860
PS400	Bottom coil only	l/h	1109	976	871	813
	Top and bottom coil	l/h	1460	1285	1147	1071
PS500	Bottom coil only	l/h	1260	1109	990	924
	Top and bottom coil	l/h	1760	1549	1383	1291
PS750	Bottom coil only	l/h	1207	1062	948	885
	Top and bottom coil	l/h	1627	1432	1279	1193
PS1000	Bottom coil only	l/h	1456	1281	1144	1067
	Top and bottom coil	l/h	1858	1635	1460	1362

Hydraulic schemes

The following system schemes are typical and should be considered for general guidance only.

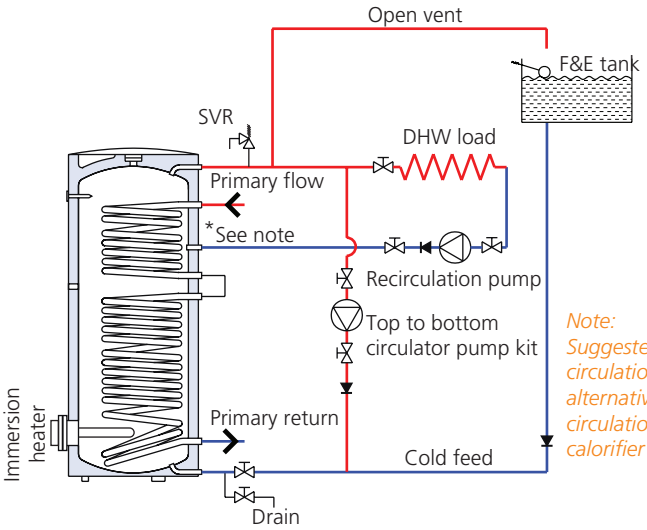
Refer to the specification pages of this brochure for full details of product configurations.

Scheme 1

Calorifier supplied from a feed and expansion tank.

Features:

- Single heat source
- Twin coils connected in series
- Top to bottom pump recirculation
- DHW secondary circuit pump
- Electric immersion heater



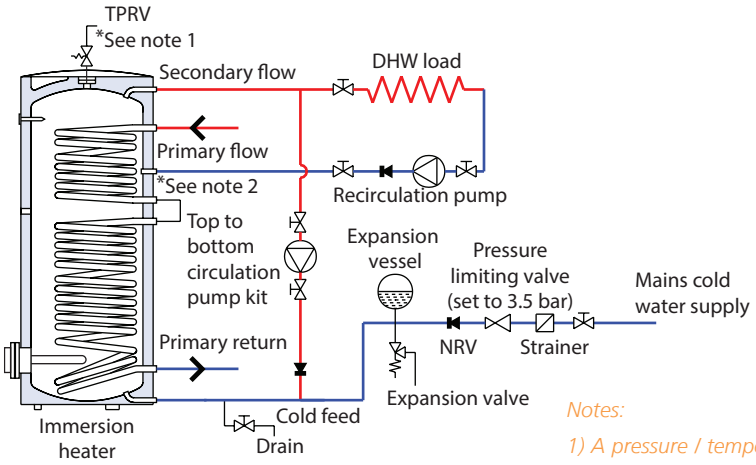
Note:
Suggested position for circulation return, alternatively connect circulation return to the calorifier cold feed inlet.

Scheme 2

Calorifier supplied directly from a mains water supply.

Features:

- Single heat source
- Twin coils connected in series
- Top to bottom pump recirculation
- DHW secondary circuit pump
- Electric immersion heater*
- Unvented supply kit
- Temperature and pressure relief valve in cylinder



Notes:

1) A pressure / temperature safety relief valve must be fitted to the vessel at this location.

2) Suggested position for circulation return, alternatively connect circulation return to the vessels cold feed inlet.

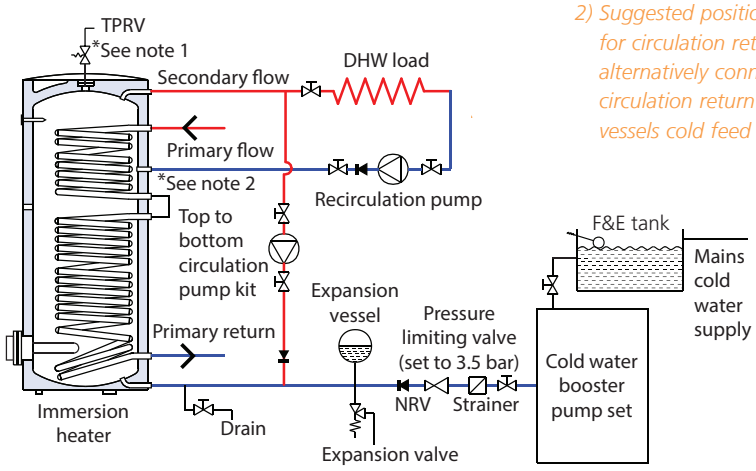
Scheme 3

Calorifier supplied directly from a cold water booster pump set.

Features:

- Single heat source
- Twin coils connected in series
- Top to bottom pump recirculation
- DHW secondary circuit pump
- Electric immersion heater*
- Unvented supply kit
- Temperature and pressure relief valve in cylinder

*The immersion heater can only be used with models PS300 to PS1000 in this configuration.



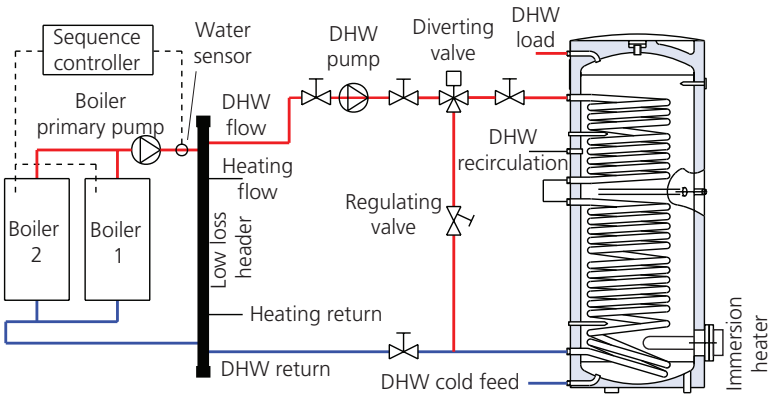
Hydraulic schemes

Scheme 4

A single primary heat source to a single calorifier installation.

Features:

- Low loss header in boiler primary circuit
- Hot water and space heating circuits from low loss header
- Twin coils connected in series
- Diverter valve and regulating valve in by-pass pipe work
- Electric immersion heater on open vented systems
- Electric immersion heater on unvented systems*

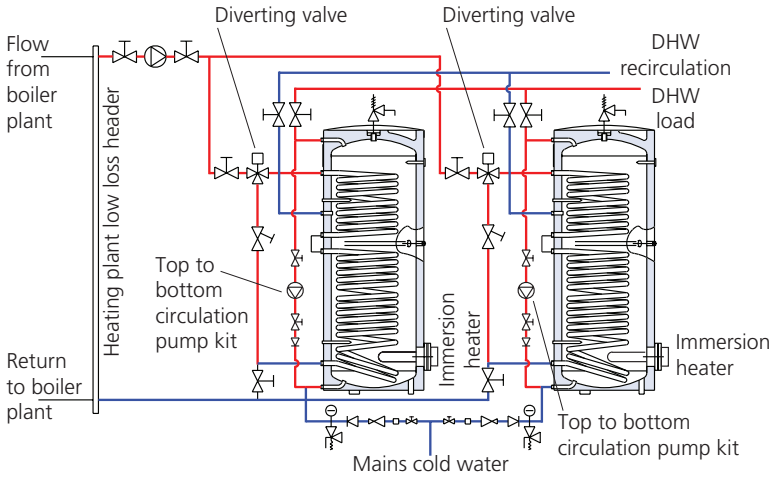


Scheme 5

Multiple calorifiers with a single primary heat source and unvented DHW circuit.

Features:

- Single heat source
- Twin coils connected in series
- Unvented supply kits
- Calorifiers connected in reverse return arrangement
- Temperature and pressure relief valve in cylinder
- Electric immersion heater*
- Diverter valve and regulating valve in by-pass pipe work.

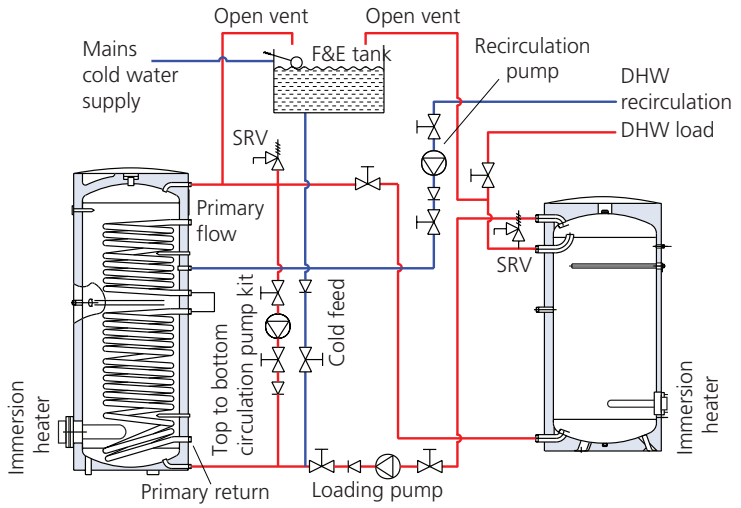


Scheme 6

Calorifier and storage vessel supplied from a feed and expansion tank.

Features:

- Single heat source
- Twin coils connected in series
- Top to bottom pump recirculation
- Storage tank loading pump
- DHW secondary circuit pump
- Electric immersion heater*



*The immersion heater can only be used with models PS300 to PS1000.

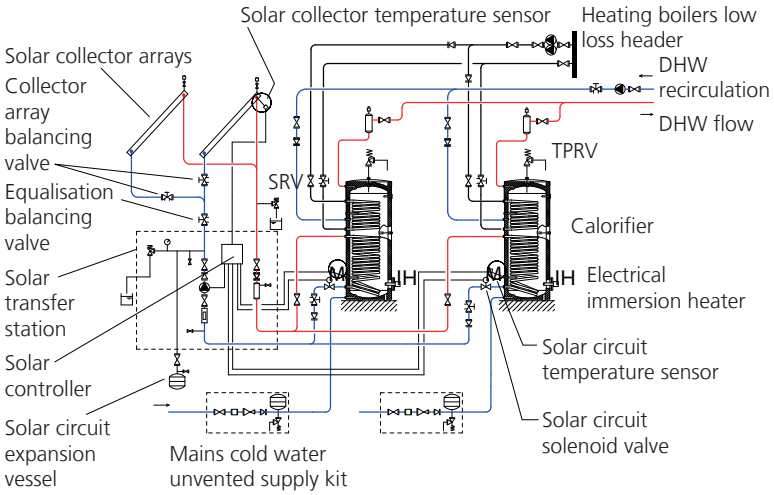
Hydraulic schemes

Scheme 7

Solar primary heat source with boiler back-up to multiple twin-coil calorifiers, with unvented DHW circuit.

Features:

- Solar collector arrays
- Low loss header in boiler primary circuit
- Solar transfer station and pump
- Unvented supply kits
- Individual tank overheat protection, solenoid valve closes off one tank's solar coil but allows solar heating to continue to heat other tank's coil.
- Top to bottom pump recirculation for anti-legionella cycle
- Electric immersion heater

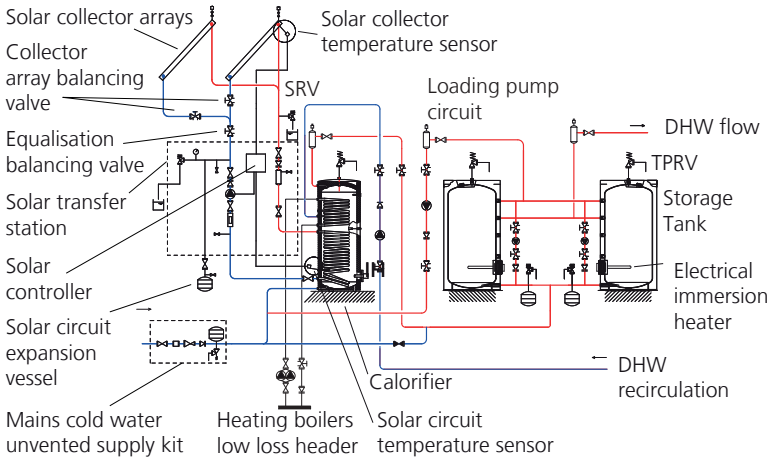


Scheme 8

Twin coil calorifier and multiple storage vessels with solar and boiler heat sources, and unvented DHW circuit.

Features:

- Two heat sources
- Unvented supply kits
- Storage tank loading pump
- DHW secondary circuit pump
- Temperature and pressure relief valve in each cylinder
- Electric immersion heater



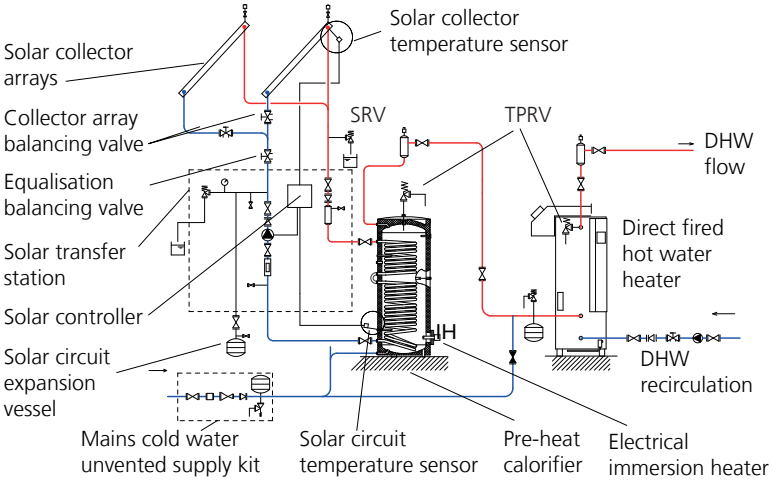
Scheme 9

Solar energy pre-heating via an unvented calorifier to a direct fired water heater.

Features:

- Single heat source
- Twin coils connected in series
- Unvented supply kits
- DHW secondary circuit pump
- Electric immersion heater*

*The immersion heater can only be used with models PS300 to PS1000.



Case study

St. Paul's Cathedral, London

St. Paul's Cathedral

Project

- Grade 1 listed building refurbishment

Products

- Wessex ModuMax mk3 condensing boilers
- Powerstock calorifiers

The challenge:

The cathedral's existing heating system consisted of three steel shell boilers fitted in the 1960s which received a burner upgrade in the 1980s. Problems on the equipment occurred and were fixed until the boilers finally started leaking and could not be repaired anymore.
At this point, Robin Bunton from Bunton M&E Services advised replacement boilers were necessary. Together with Mike Crouch, Hamworthy's agent for the area, and Nick Coates from Blue Print Building Services Design, he worked on the specification for the cathedral's heating and hot water refurbishment project with Clerk of Works Martin Fletcher.

The solution:

The cathedral was seeking reliable and energy efficient boilers to meet its high heating and hot water demand while keeping the running costs down. Due to the popularity of St Paul's Cathedral, the summer months are a challenge in terms of an extremely high peak demand for domestic hot water. Two Hamworthy Powerstock PS500 glass-lined calorifiers with a capacity of 500 litres each and a recovery time of 18 minutes were chosen to meet the requirements. The heat to the indirect-fired water heaters is supplied by Wessex ModuMax mk3 condensing modular boilers.

Two Powerstock PS500 calorifiers provide DHW for the cathedral.

Robin commented:
"The speed of heat up has greatly improved. Previously it would take a week to heat the cathedral up from cold, but now it only takes one day, the heating runs 24/7 on weather compensation."

To avoid changing the flues, they initially planned to replace the older system with pressure jet steel shell boilers. Robin, however, recommended Hamworthy's Wessex ModuMax mk3 condensing modular boilers as replacements to meet the reliability and energy efficiency requirements, as well as compliance with current legislation to eliminate inefficient boilers.

Two Wessex ModuMax mk3 WM254/508V modular condensing boilers were chosen. This combination consists of two stacks with two boiler modules in each, delivering a total output of up to 1,016kW and a turndown ratio of 20:1.

Robin added:
"We have used the Wessex boilers since they were introduced and we know they are a very reliable product. They are space saving, great in refurbishment projects and buildings where you can't change the building fabric, such as St Paul's Hamworthy also has an excellent after sales and spares service, with their own engineers, which is why I prefer working with them."

Tom Fletcher, works manager at St Paul's Cathedral said:
"Once we understood we needed to replace the Cathedral's heating and hot water plant, we were set a target of reducing gas usage by 10% once the project was complete in line with the Cathedral's sustainability ambitions. In discussions with our M&E consultant, our engineer and examining the constraints of the building, we elected to use the Hamworthy boilers because they offered efficiency as well as significantly reduced disruption to the building during the project because of their small modular form. We have since found that we have managed to reduce gas consumption by close to 40%. This means that we have not only reduced our carbon footprint but have also benefited from significant savings on our gas bill, well above our initial project target."

Services and warranty

Service

Installed water heaters will experience a wide variation in operating conditions that can occur due to differing patterns of usage and the variable chemical nature of distributed water supplies. It is therefore strongly recommended that water heaters be drained and inspected within 3 months of the initial commissioning. Once the levels of calcium deposition are established a suitable maintenance schedule can be implemented, however, as a minimum all water heaters should be serviced annually.

To maintain your water heaters, we have a range of servicing options that can be tailored to your requirements. For more information on commissioning and service please contact Hamworthy Heating Service Department.

Warranty

The Powerstock comes with a 2-year warranty (except for consumables in line with our Terms and Conditions). Where the product is commissioned by Hamworthy service engineers within 6 months of delivery date, then the two-year warranty covers parts and labour from date of commissioning. We offer tailored packages to suit individual customer requirements, many of which include extended warranty benefits. Full details of warranty terms and conditions are available on request.

2 Yr Warranty

Spares

Essential to any maintenance and service regime is the availability of quality spare parts.

By coming to us, you can be assured of genuine spare parts and may also benefit from technological improvements. We have a long-term commitment to spare parts for our products.

Delivery

Powerstock calorifiers and storage tanks are supplied securely mounted on a wooden pallet wrapped in a protective polythene. The packaging identifies the unit model.

The control panel is packaged separately in a carton for fitting on site.

Standard delivery for all Hamworthy products is free of charge.

Deliveries are closely co-ordinated with the customer, to suit the site construction programme. Products are delivered to ground level and it is the responsibility of the customer to arrange movement of products from there to the required location on site.

To enquire about special delivery services including FORS and time critical deliveries (additional charges apply) please contact our customer services team.

Service

Tel: **01202 662555**

Email: **service@hamworthy-heating.com**

Spares

Tel: **01202 662525** Fax: **01202 662551**

Email: **spares@hamworthy-heating.com**

Complete your system

As well as calorifiers and storage tanks, we supply commercial boilers and supporting equipment to help complete your system.

Burstock expansion vessel

Trigon solar thermal system

System equipment

Trigon solar thermal system

A complete solar hot water system including solar collectors, transfer stations, and controllers that can be combined with a solar water heater.

A Trigon solar circuit is completed by connecting a field of collectors, via a transfer station, to a solar coil heat exchanger in a Powerstock calorifier. This forms the closed loop circuit around which propylene glycol solar fluid is pumped, transferring solar energy captured at the collector to the Powerstock's stored water via the coil.

Burstock expansion vessel

Floor standing expansions vessels for use with sealed heating and hot water systems. Available in 10 models from 25 to 1000 litres.

Boilers

Upton

Purewell Variheat mk2

Stratton mk2

Wessex ModuMax mk3

Ensbury LT

Floor standing condensing boilers

We have an extensive range of floor standing modular boilers with outputs from 70kW up to 1050kW. With natural gas and LPG options available they can be used across the UK.

The Upton and Wessex ModuMax mk3 boilers are designed as vertically stacking modular boilers to fit in the smallest of plant rooms – offering over 1MW output from 1 metre squared footprint.

Purewell Variheat mk2 boilers are built around a cast iron heat exchanger for tolerance to older heating circuits, making them a perfect choice for refurbishment and replacing old atmospheric boilers.

For larger heat loads or simplified design, the Varmax boilers do not need to be installed with a primary circuit and have split temperature return connections for improved efficiency.

Wall hung condensing boilers

The Stratton mk2 wall hung boiler offers the benefits of a long life and corrosion resistance with a stainless steel heat exchanger. It can also fit into low height plant rooms thanks to a built in flue gas non return valve and low height pipework kits.

Pressure jet boilers

For higher heating demands and a greater choice of fuel options including oil and biofuel, Hamworthy can provide pressure jet/power flame boilers. With outputs from 75kW right up to 10MW, and a choice of matched burners.

About Hamworthy

Hamworthy Heating is a leading British commercial boiler manufacturer. Our energy efficient heating, hot water and renewable solutions are used in buildings across the UK.

The Hamworthy difference

British engineering excellence

Here in the UK, we design, test, manufacture and source market-leading products. We know our products inside out, back to front and from start to finish. You can trust that we know what we're talking about.

Lifetime support

From design and specification, through to commissioning, training and maintenance, as well as commitment to spares availability. We provide long term support for businesses with their commercial heating and hot water needs.

People first

It's not just our products that set us apart, it's our people. Truly excellent customer service, great technical knowledge and being easy to deal with.

That's the Hamworthy difference.






Everyone's got history, we've got heritage

Our roots date back to 1914 when two brothers in Poole set up Hamworthy Engineering. Decades of experience go in to every nut, screw and bolt. Every phone call, text and email. Since 2008, we've been part of Groupe Atlantic, a company with a similar ethos to us. Groupe Atlantic was founded in 1968 by two engineers and is now one of the market leaders in the European heating and hot water industry. We're now part of their growing UK, ROI and North America Divisions.

CIBSE PATRONS · BESA AFFILIATE · ICOM Energy Association · The Society of Public Health Engineers Industrial Associate

Our associations

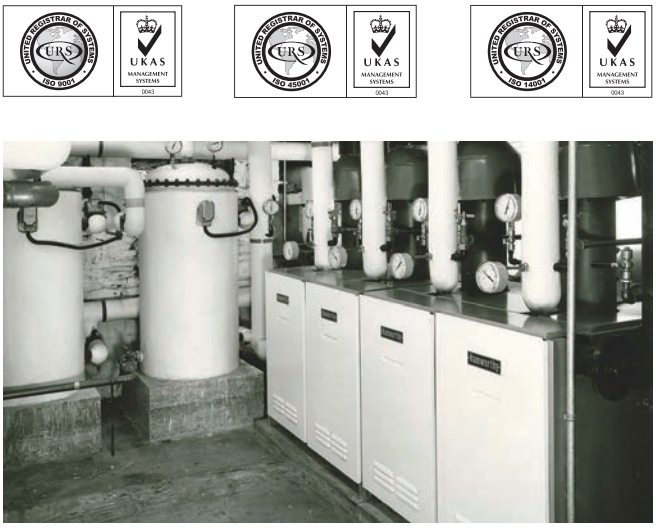
We are an active member of trade associations and professional bodies supporting the industries we work in.

Our accreditations

International Organisation for Standardisation (ISO) is the world's largest developer of voluntary International Standards. We are proud to have been awarded the following ISO accreditations:

- ISO 9001 Quality Management System
- ISO 14001 Environmental Management System
- ISO 45001 Health and Safety Management System

When you deal with Hamworthy, have confidence that we're working within a defined set of standards that are internationally recognised.



Your notes

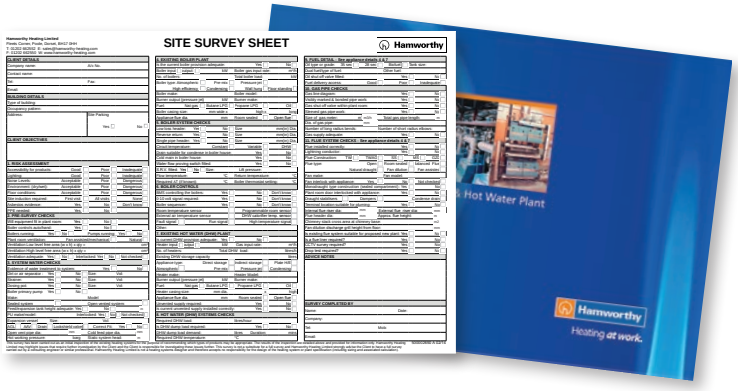
Sign up for product updates

Want to be the first to hear about new Hamworthy products? Visit our website to sign up to receive information on new and updated products.

01202 662500 • www.hamworthy-heating.com/signup

Book a free site survey

www.hamworthy-heating.com/site-survey



View our full CPD and product training offer

www.hamworthy-heating.com/cpd
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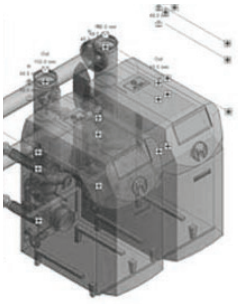
Download product literature and drawings

www.hamworthy-heating.com/technical-library

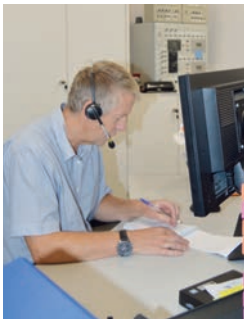


Find out who your local contact is

www.hamworthy-heating.com/find-your-local-sales-manager

Get information for discontinued products

www.hamworthy-heating.com/discontinued-products



Contact our in-house technical support team

on **01202 662505**

Your local contact is:

British engineering excellence from Hamworthy Heating; the commercial heating and hot water specialists.

Hamworthy

CE

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UK, ROI & NORTH AMERICA DIVISIONS

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ISO 14001 Environmental Management System
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