Hamworthy Powerstock

Calorifiers and Storage Tanks
Single and Twin Coils
Capacities 160 litres to 995 litres

Hamworthy

Heating *at work.*

CE

Powerstock

Calorifiers and Storage Tanks

The efficient generation of hot water for use in commercial buildings can be achieved using direct or indirect fired heating solutions.

The Hamworthy range of Powerstock calorifiers offers a flexible approach to indirect heating and storage of hot water, using a choice of heat generators.

High efficiency gas fired boilers are commonly used with calorifiers as the prime energy source, but with the move towards renewable energy, alternative technologies can be applied.

Indirect fired heating for hot water in commercial buildings is an increasingly popular method and at Hamworthy we advocate the integration of renewable energy sources with gas fired condensing boiler systems.

With this in mind, the Powerstock range has been extended to include larger output models and with the addition of storage tanks, create more flexibility in designing suitable hot water systems.

There are 7 models in the Powerstock calorifier range with continuous outputs from 501 litres/hour up to 1635 litres/hour. Storage capacities are from 160 litres to 995 litres. All but the smallest models have twin coil heat exchangers which can be connected in series if using a single heat source, or connected separately when using two heat sources.

Powerstock storage tanks range from 300 litres to 1000 litres capacity and can be used in variety of applications either to maximise energy efficiency or increase system security.

Powerstock calorifiers and storage tanks are all approved by the Water Regulations Advisory Service (WRAS) to comply with the requirements of the UK Water Supply (Water Fittings) Regulations and Scottish Water Byelaws, when correctly installed.

Options

- **Unvented supply kit**
- **Top to bottom pump recirculation kit**
- **Electrical anode protection**
- **Electric immersion heater kit**

BENEFITS

- **Twin coils connect to two energy sources**
- **Safe storage of hot water**
- **Integration of renewable energy sources**
- **Anode corrosion protection for longer life**
- **Adaptable to match load demand**
- **Effective use of solar energy**

The design of the Powerstock range makes it suitable for use with both conventional and renewable energy sources to generate hot water for commercial buildings.

Modular installation of Powerstock calorifiers

Specification

Powerstock Calorifiers and Storage Tanks
Typical layout of Powerstock calorifier

Insulation
Full insulating jacket reduces standing losses to a minimum and has a Global Warming Potential index of 1.

Thermometer

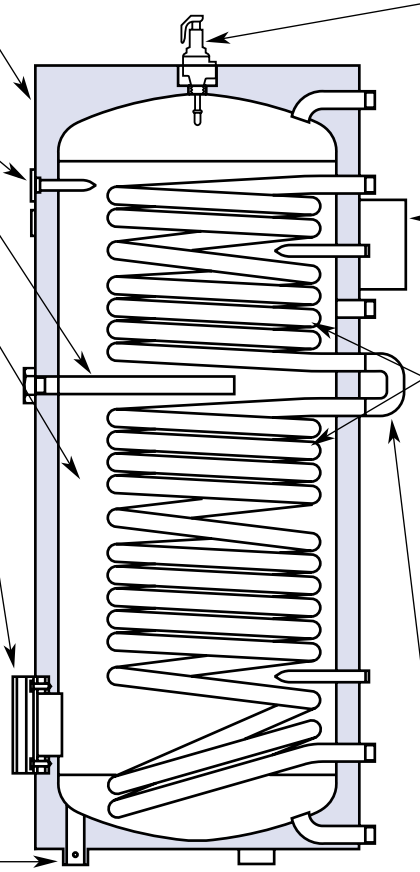
Magnesium Anode
Prevents corrosion of internal surfaces ensuring the long life of the unit.

Vitreous Enamel Lining
Hygienic glass lining ensures the quality of the water in the vessel.

Clean Out Door
For compliance with HSC L8 Approved Code of Practice & Guidance, the generously sized clean out door allows for inspection and cleaning of all internal surfaces.

Electric Anode Protection Kit (not shown)
In areas with particularly soft water such as Scotland, Devon and Cornwall it may be necessary to fit Electrical Parasitic Current Protection in place of the magnesium anode. This system has the added advantage of reducing maintenance requirements since the anode is non-sacrificial.

Adjustable Feet
Allows for easy levelling on most surfaces thus reducing installation time.



P&T Relief Valve (optional)
Supplied as part of the unvented kit, the pressure and temperature relief valve locates directly into the top part of the vessel, in order to fully comply with the requirements of the water supply (water fittings) regulations 1999.

Control Panel
Containing pre-wired control and limit thermostats for effective control of the DHW flow temperature via a three port valve or similar device (not HHL supply).

Twin Coil Construction
When connected in series the large heat exchange surface allows for high recovery and output rates to be achieved. Alternatively by connecting the coils in parallel they can be controlled separately enabling heat input to be matched to the demand. The bottom coil can also be connected to an alternative energy source such as a solar collector array.

Series Connection Kit
Supplied as standard on the five larger models this connects both coils together, simplifying installation.

Unvented Kit (not shown)
Allows the calorifier to be fed directly from a mains water or boosted supply and contains all the components required by BS6700.

Immersion Heater (not shown)
A replacement flange can be fitted to the clean out door to allow the fitting of an electric immersion heater. It should be noted that on model P160 and P200, it is not possible to fit an immersion heater when an unvented kit has been supplied.

The Hamworthy Powerstock range of calorifiers and storage tanks provide plenty of choice in meeting hot water demands for a wide variety of commercial applications.

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, and all models are Water Regulations Advisory Scheme (WRAS) approved.

Cylinders are constructed from mild steel with a high quality vitreous enamel lining, and the five largest units in the calorifier range incorporate a twin coil arrangement, for using two separate heat sources or providing higher continuous outputs.

The twin coil construction allows the designer to choose the configuration in which to connect the coils, to best suit the application, either in series or in parallel. This allows greater control of the heat input and gives the ability to utilise alternative energy sources such as a solar collector array.

All Powerstock models are supplied as standard with a pre-wired control panel containing a temperature control thermostat and a limit thermostat; a sacrificial anode, a clean out door and a factory fitted insulating jacket.

Optional kits are available to fit unvented supply, top to bottom pump recirculation, electrical anode protection and an electric immersion heater.

Specification

Powerstock Calorifiers and Storage Tanks

Construction

Powerstock cylinders are constructed from high grade steel and coated 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. The insulation jacket has a Global Warming Potential (GWP) index of 1.

Calorifier Heat Exchanger

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.

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

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.

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

Twin coils in Powerstock calorifiers enable two energy sources to be used, such as solar with gas boilers

Unvented Supply Kit (optional)

All Powerstock calorifier 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. The WRAS approved 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 individual unvented supply kit is required for each calorifier and storage tank.

Top to Bottom Pump Recirculation (optional)

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).

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.

Anode Protection

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.

Electrical Anode Protection (optional)

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 any 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.

Immersion Heaters (optional)

To provide an auxiliary heat source, a single electrical immersion heater can be specified, with ratings of either 4 kW or 9 kW output. Replacing the standard clean out door with a specially machined stainless steel flange allows fitting of the immersion heater to the cylinder. The 4 kW heater requires a single phase 230 volts power supply whilst the 9 kW version requires a three phase 415 volts supply.
For details of immersion heater performance, please refer to page 16.

It should be noted that on calorifier models PS160 and PS200, it is not possible to fit an electrical immersion heater when an unvented system kit is installed.

External Controls

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

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.

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.

All Hamworthy deliveries are made to site using a vehicle with a tail-lift, and are closely co-ordinated with the customer to suit the site construction programme. Standard delivery is to ground level from the tail-lift vehicle. *To enquire about special delivery services please contact our customer services team. Tel: 0845 450 2865.*

Commissioning

Hamworthy Heating strongly recommends that all units are commissioned by their service department. *For more information on commissioning contact Hamworthy Heating Service team: Tel: 0845 450 2866*

Warranty

Products from Hamworthy carry a standard two-year warranty on parts, and where the product is commissioned by Hamworthy service engineers, then the warranty covers parts and labour. In offering flexible solutions for after-sales support, Hamworthy can tailor packages to suit individual customer requirements, many of which include extended warranty benefits.

Technical Data

Powerstock Calorifiers and Storage Tanks
Performance and General Data

	Calorifier Model		PS160	PS200	PS300	PS400	PS500	PS750	PS1000
General Data	Storage capacity	l	160	200	292	380	470	750	995
		gal	35	44	64	83	103	165	219
	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
		gal	N/A	N/A	1.4	1.5	2.0	1.8	1.7
	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
		gal	1.1	1.4	2.3	2.7	2.9	3.0	3.8
	Maximum operating pressure (primary - coil)	bar	10						
	Maximum operating pressure (secondary - storage)	bar	10						
	Maximum operating temperature (primary - coil)	°C	110						
	Maximum operating temperature (secondary - storage)	°C	70						
	Weight empty	kg	70	80	130	185	215	217	275
	Standby losses	kW/h	0.06	0.08	0.10	0.12	0.13	0.15	0.20
Bottom Coil Only in Operation	Continuous output*	l/h	501	600	816	976	1109	1062	1281
		UK gal /h	110	132	179	215	244	233	282
	Heat input	kW	29.2	35.6	48.4	57.9	65.7	63.0	76.0
		Btu x 1000	99.6	121.5	165.1	197.6	224.2	214.9	259.3
	10 min peak output*	l	250	362	448	615	771	1100	1197
		UK gal	55	80	99	135	170	242	263
	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
		UK gal/h	N/A	N/A	227	283	341	315	360
	Heat input	kW	N/A	N/A	61.2	76.2	91.8	85	97
		Btu x 1000	N/A	N/A	208.8	260.0	313.2	290.0	331.0
	10 min peak output*	l	N/A	N/A	567	889	1077	1319	1483
		UK gal	N/A	N/A	125	196	237	290	326
	Recovery time	min	N/A	N/A	17	18	18	31	36

*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.

	Storage Tank Model		ST300	ST500	ST750	ST1000
General Data	Storage capacity	l	300	502	750	990
		gal	66	110	165	218
	Maximum operating pressure	bar	10	10	10	10
	Maximum operating temperature	°C	95	95	95	95
	Weight empty	kg	87	111	195	248
	Standby losses	kW/h	0.10	0.13	0.15	0.2

Technical Data

Powerstock Calorifiers
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 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	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

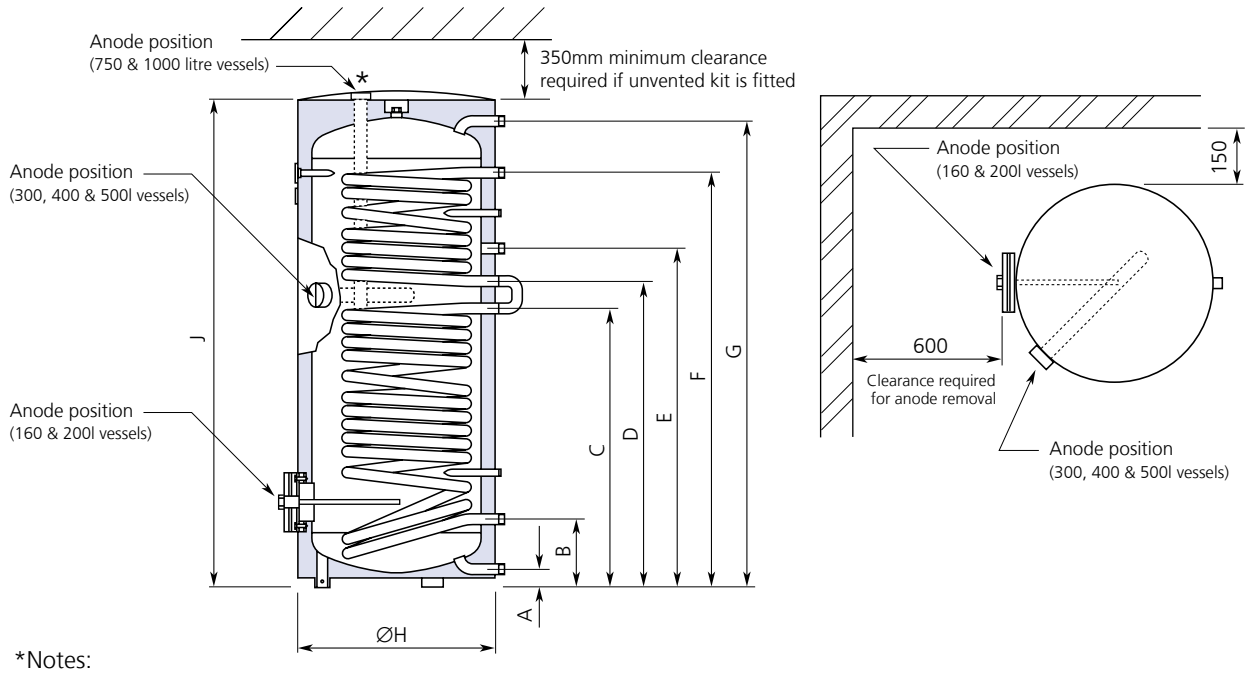
Coil Δt °C	Bottom Coil Only			Top Coil Only			Top & Bottom Coil		
	Heat Input kW	Flow Rate l/sec	Coil Pressure Loss mbar	Heat Input kW	Flow Rate l/sec	Coil Pressure Loss mbar	Heat Input kW	Flow Rate l/sec	Coil Pressure Loss mbar
11	63.0	1.37	301	22.0	0.48	22	85.0	1.85	880
15	63.0	1.00	162	22.0	0.35	12	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

Dimensional Details

Powerstock Calorifiers



*Notes:

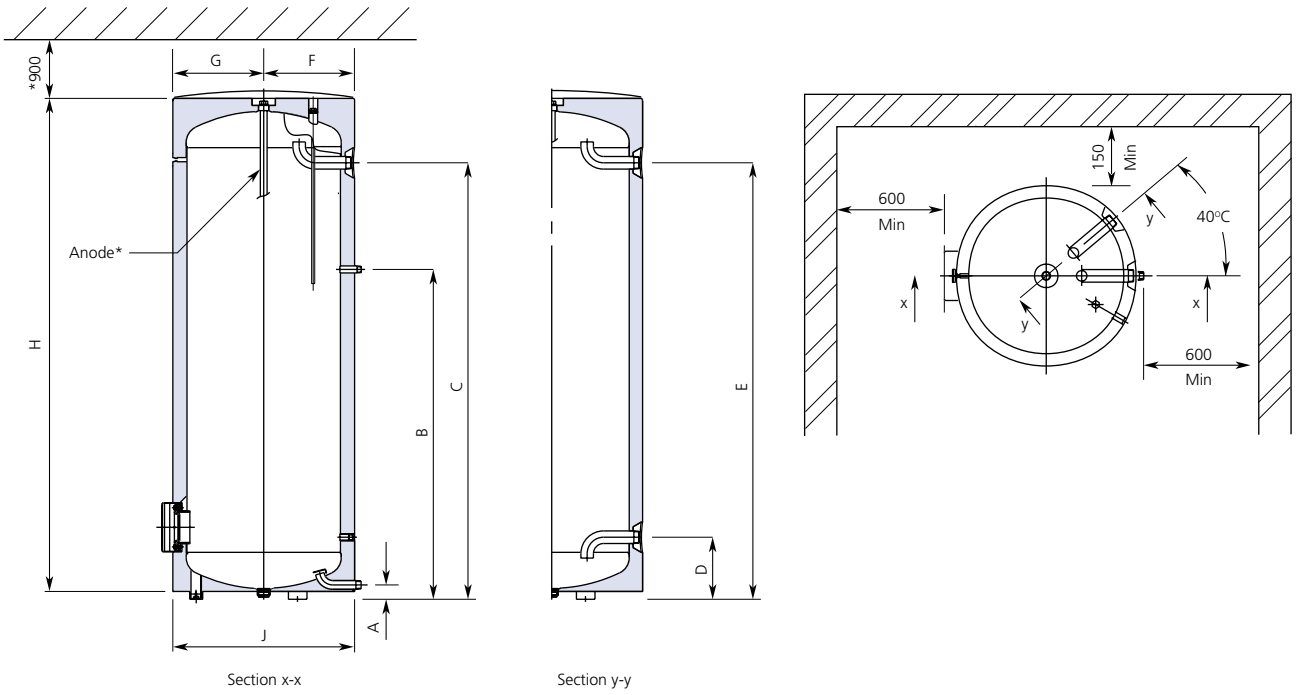
1. Where insufficient clearance will prevent replacement of standard magnesium sacrificial anodes, the optional electrical anode protection kit may be fitted.
2. Clearance required above for anode removal, 750 & 1000 litre vessels - 1300mm.

Model	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
PS160	55	191	596	N/A	732	N/A	1106	540	1172
PS200	55	191	686	N/A	899	N/A	1366	540	1432
PS300	90	254	694	1064	1179	1424	1725	625	1775
PS400	55	220	909	1006	1111	1354	1523	700	1591
PS500	55	220	965	1114	1264	1604	1853	700	1921
PS750	103	288	830	1151	1242	1467	1887	910	1998
PS1000	103	296	884	1153	1243	1423	1905	1010	2025

Model	Connections						
	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 1 ¼"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1 ¼"
PS1000	R 1 ¼"	R 1"	R 1"	R 1"	R ¾"	R 1"	R 1 ¼"

Dimensional Details

Powerstock Storage Tanks
ST300 and ST500



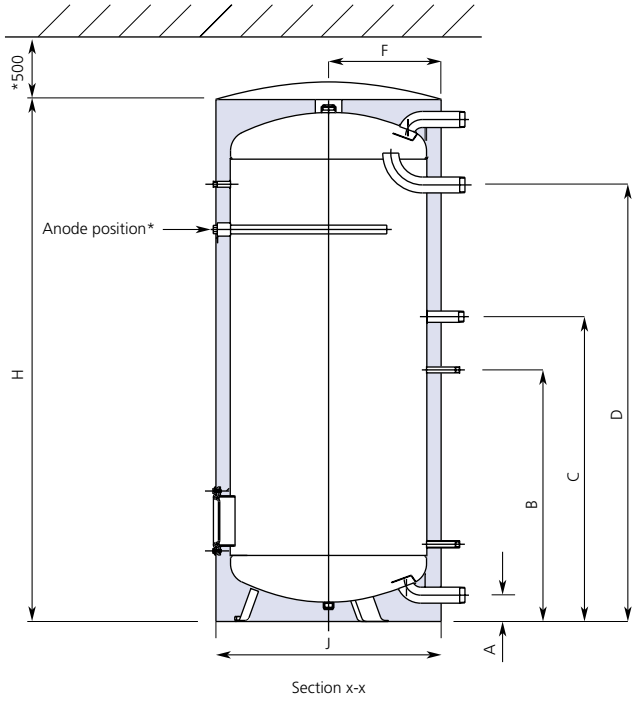
* Where insufficient clearance will prevent replacement of standard magnesium sacrificial anodes, the optional electrical anode protection kit may be fitted.

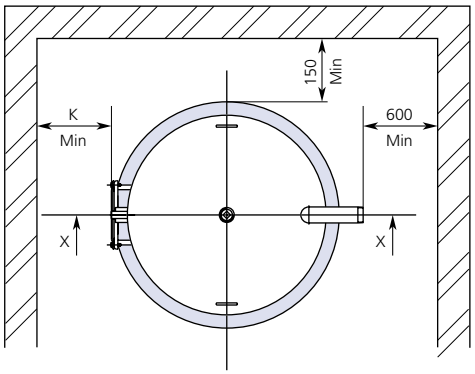
Model	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
ST300	90	1180	1546	272	1546	327	340	1836	600
ST500	55	1265	1673	238	1673	375	392	1967	700

Model	Connection				
	A	B	C	D	E
	Cold Water Inlet	Circulation Return	Hot Water Outlet	Charging Outlet	Charging Inlet
ST300	R1″	R^{3}/4″	R1 ½″	R1 ½″	R1 ½″
ST500	R1″	R^{3}/4″	R1 ½″	R1 ½″	R1 ½″

Dimensional Details

Powerstock Storage Tanks
ST750 and ST1000





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

Model	Dimensions (mm)							
	A	B	C	D	F	H	J	K
ST750	88	1145	1640	1908	515	2040	915	600
ST1000	92	1154	1647	1911	565	2040	1010	700

Model	Connection			
	A	B	C	D
	Charging Outlet	Circulation Return	Hot Water Outlet	Charging Inlet
ST750	R2″	R1 ¼″	R2″	R2″
ST1000	R2″	R1 ¼″	R2″	R2″

System Design

Powerstock Calorifiers and Storage Tanks

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

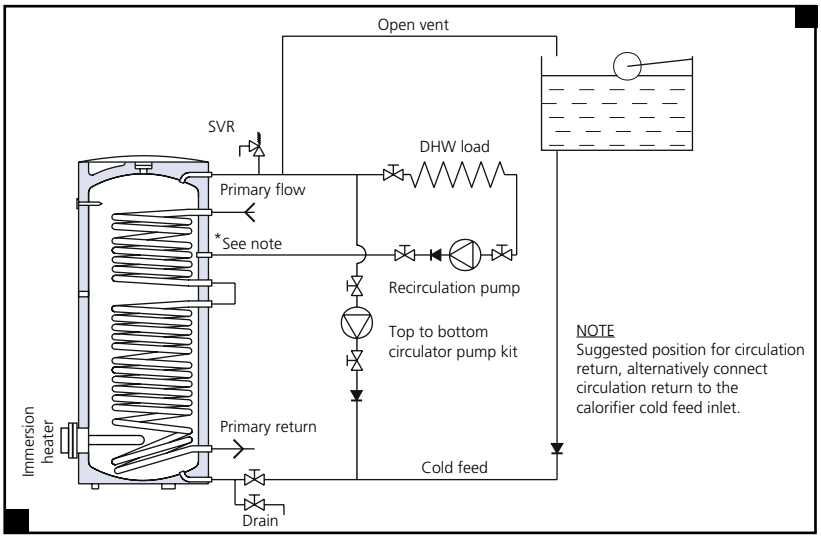
Refer to the specification pages of this brochure for full details of product configurations.

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

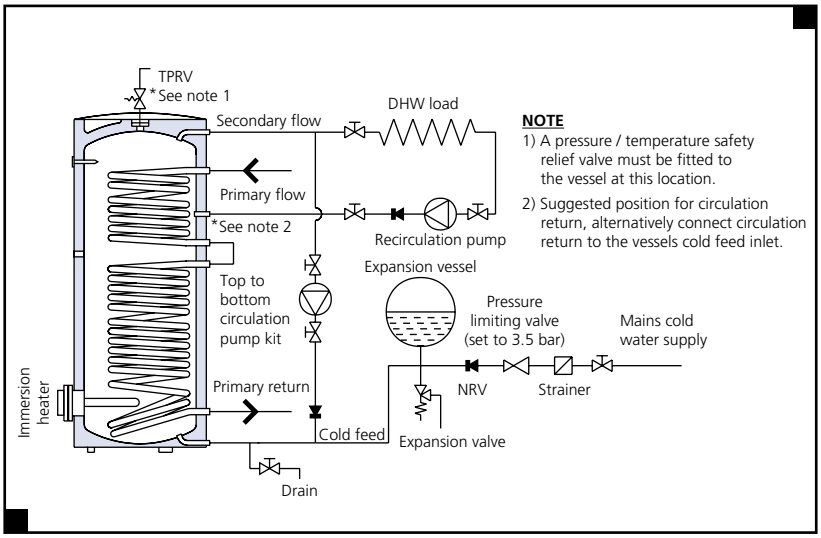


Scheme 2

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



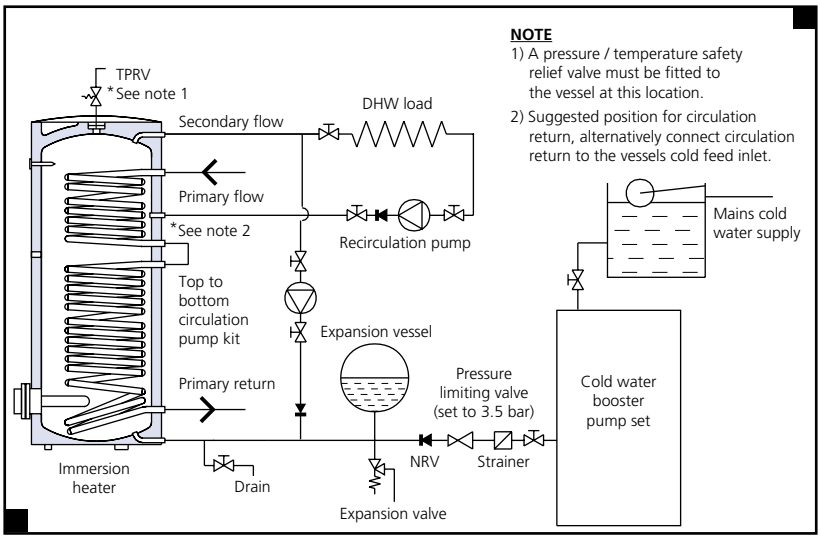
Scheme 3

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.



System Design

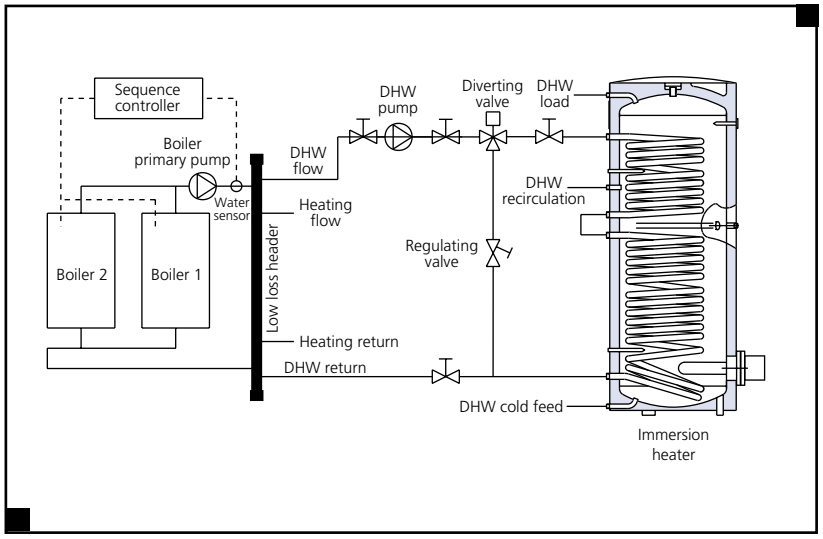
Powerstock Calorifiers and Storage Tanks

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*

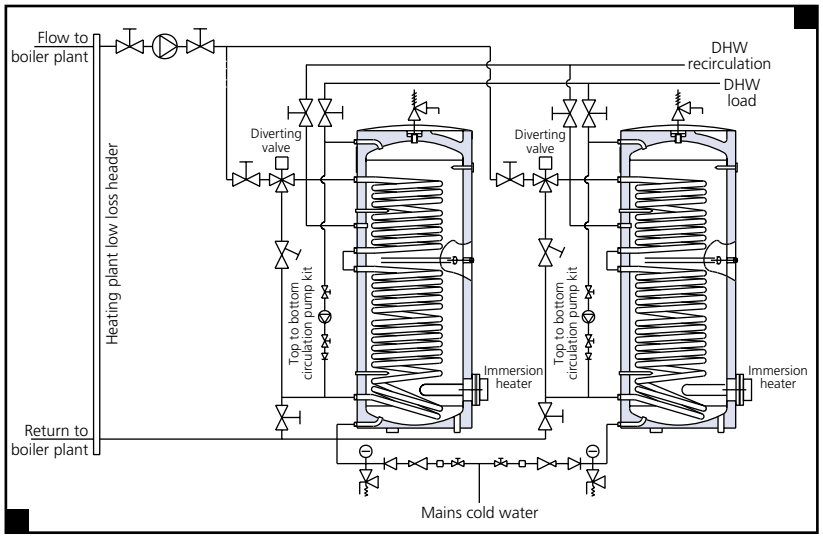


Scheme 5

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.



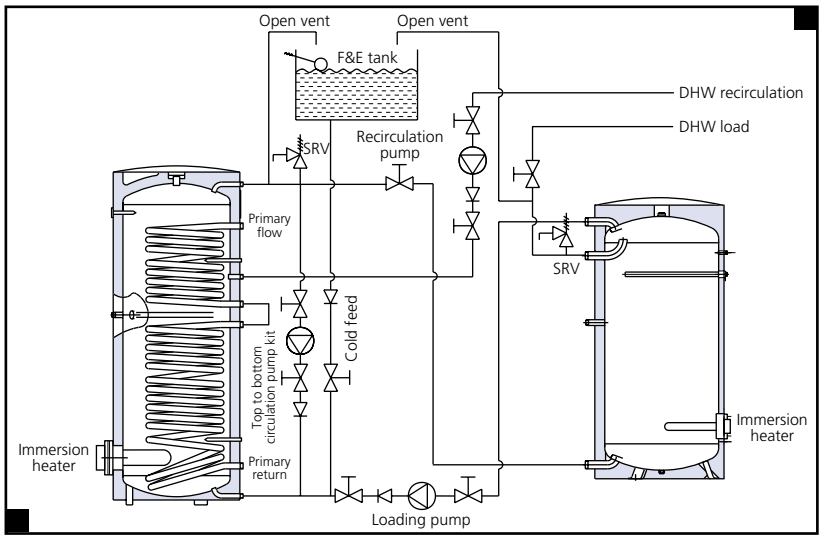
Scheme 6

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 in this configuration.

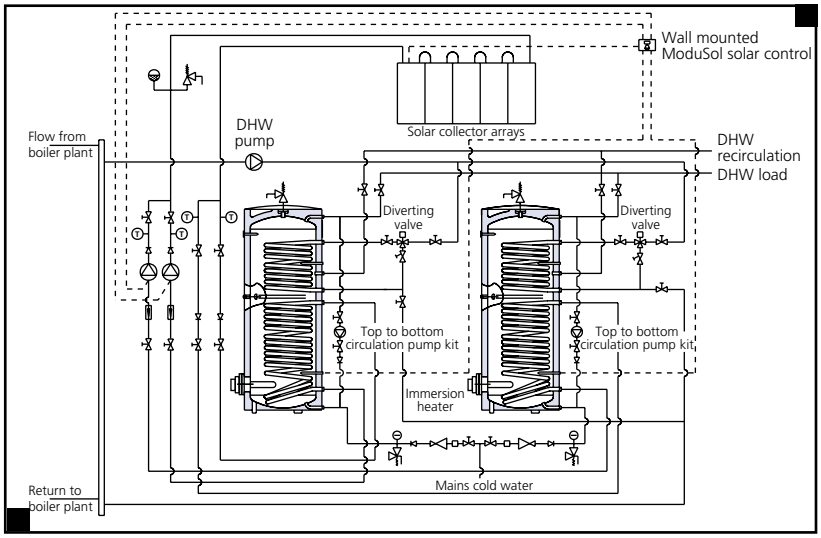


Scheme 7

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

Features:

- Solar collector array
- Low loss header in boiler primary circuit
- Upper and lower coil connected independently in reverse return arrangement
- Unvented supply kits
- Optional diverter valve and regulating valve in by-pass pipe work, depending on control philosophy
- Top to bottom pump recirculation for anti-legionella cycle
- Electric immersion heater

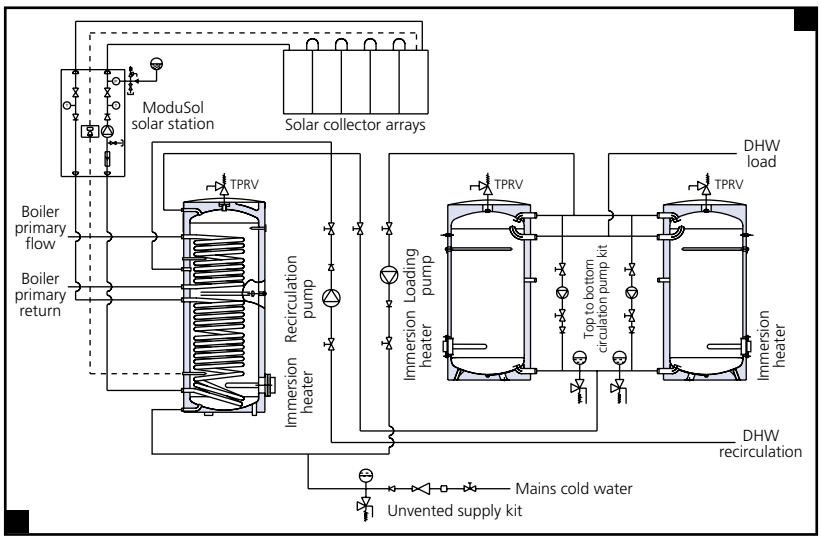


Scheme 8

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

Features:

- Two heat sources
- Each coil connected independently in reverse return arrangement
- Unvented supply kits
- Storage tank loading pump
- DHW secondary circuit pump
- Temperature and pressure relief valve in each cylinder
  Electric immersion heater



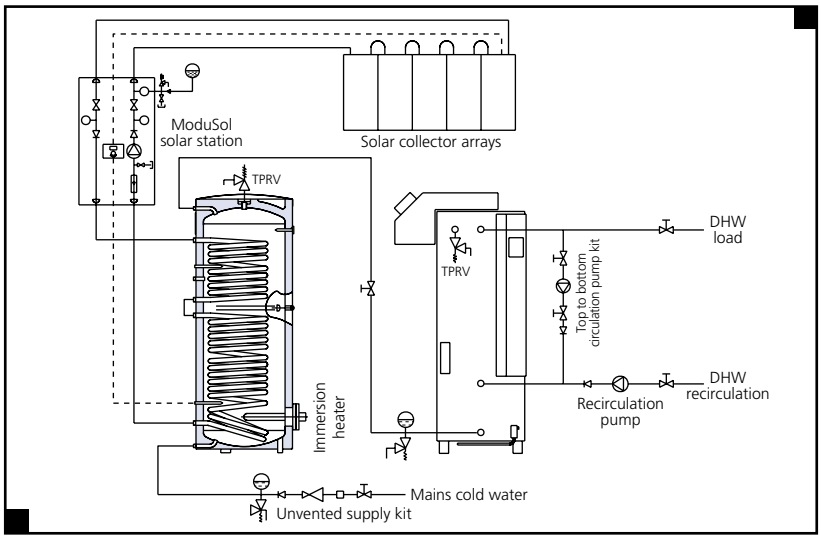
Scheme 9

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 in this configuration.



Application & System Data

Powerstock Calorifiers and Storage Tanks

Installation must be in accordance with the relevant requirements of the Building regulations, IEE 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 of the following documents:

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

British Standards

BS 6700 Design, installation, testing and maintenance of services supplying water for domestic use.

BS EN 806-2 Specification for installations inside buildings conveying water for human consumption - Part 2: Design.

BS 6880 Part 1, 2 & 3 Code of Practice for low temperature hot water heating systems of output greater than 45kW.

BS 7074 Part 1: Application, selection and installation of expansion vessels and ancillary equipment for sealed water systems.

Part 2: Code of Practice for low and medium temperature hot water heating systems.

BS 7671 Requirements for electrical installations. IEE Wiring Regulations. 17th edition.

BS EN ISO 4126-1 Safety devices for protection against excessive pressure. Safety valves.

BS EN 12828: 2003 - Heating systems in buildings. Design for water-based heating systems.

BS EN 14336: 2004 - Heating systems in buildings. Installation and commissioning of water based heating systems.

Health & Safety Commission (HSC)

L8. Approved Code Of Practice & Guidance - The control of Legionella bacteria in water systems.

Department of Health

Health Technical Memorandum 04-01: The control of Legionella, hygiene, 'safe' hot water, cold water and drinking water systems.

Part A Design, installation and testing.

Part B Operational Management Department of Health (DH).

Statutory Instrument

The Water Supply (Water Fittings) Regulations 1999

Water industry England and Wales.

CIBSE Publications

CIBSE TM13:2002 - Minimising the risk of Legionnaires' disease.

CIBSE Guide H Building Control Systems.

CIBSE Guide Energy Efficiency in Buildings.

CIBSE Commissioning Code B: 2002.

General Requirements

All connections to the local water main must comply with Water Supply (Water Fittings) Regulations 1999. Additionally the water supply connection must also comply with all local WRAS regulations.

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 7.

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.

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 is WRAS approved and 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 a single expansion vessel 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.

Standard Kit Expansion Vessel Volumes for Each Vessel Size	
Model	Expansion Vessel - litres
PS 160	24
PS 200	24
PS/ST 300	40
PS 400	40
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 portable hot water systems, to suit most system requirements.

Expansion Vessel Calculations

Expansion volume can be calculated using the following formulae:

$$V2 = \frac{\Sigma \times V1}{1 - PC/PW}$$

Where:

V2 = Required expansion vessel

V1 = Total system volume (cylinder plus pipe work)

Σ = Water expansion factor

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

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

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

Application & System Data

Powerstock Calorifiers and Storage Tanks

Dead Legs

Dead legs to water draw off points should be as short as possible and in no case should they exceed the lengths laid down in the Water Supply (Water Fittings) Regulations 1999.

These regulations state that the maximum length of 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 are as listed below:

Pipe Internal Dia. (mm)	Max Dead Leg (m)
≤ 19	12
19-24	7.6
≥ 25	3

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 web site – www.tmva.org.uk*

HSC L8 Approved Code Of Practice & Guidance for the control of Legionella bacteria in water systems, recommends as follows:

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.

Immersion Heater Kit

Hamworthy can supply an electric immersion heater as an option with either 4 kW or 9 kW heat output. The immersion heater is supplied loose for fitting on-site in place of the clean out door flange. 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 4 kW heater requires a single phase 230 volts power supply whilst the 9 kW version requires a three phase 415 volts supply.

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

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.

Sizing Guidance Notes

Powerstock Calorifiers and Storage Tanks

The following notes are given for guide-line purposes and the assumptions made are general. The diversification of hot water requirements are great and each particular application must be examined in detail.

General Guide-lines

There are applications where sizing a water heater is a straightforward exercise. An obvious example is an industrial hot water load for a process requiring a specific amount of hot water, in a specified time at a specified temperature. All that is required is the lowest cold water supply temperature and the heater/s output can be directly related to the amount of hot water required. If the load is continuous the heater or heaters must be sized to cope with the full amount. If the load is intermittent consideration can be given to a smaller heater installed in conjunction with a suitably sized storage tank. Other types of installations which can be easily sized are sports pavilions and leisure centres, especially those catering for team games, when a known number of players will use showers, baths etc at a known time.

This is in effect the peak load when a large quantity of hot water may be dumped quickly since all showers may be running continuously. For sizing it is necessary to determine the duration of continuous use, which will depend on the maximum number of players using the showers. Showers can save water, but one shower running continuously for 1 hour can dump 328 l (72 gal). Multiplied by 10 or 20 this can represent a large load which is obviously best catered for by storage with a long recovery time. However, due consideration should be given to additional heaters and lower storage on the grounds of standby and cost.

The third category comprises almost all other commercial and industrial applications where hot water demand is random. To size the hot water requirement it is necessary to determine when the demand is greatest. Obviously if the water heater can cope with the peak demand, the remainder will be adequately catered for. However, heater cannot be sized on the assumption that all outlet appliances will run continuously for 1 hour since this will result in gross over -sizing of heaters. Since there are no common usage of diversity factors in general use, simple guide-lines and common sense must be used to estimate "how many times a bath will be used per hour or how long is an average shower, or how many people will bath rather than shower?" Listed below are a series of guide-lines which may prove helpful in sizing Hamworthy water heaters.

Restaurants, Kitchens, etc Serving Main Meals

Each meal will use:

9 litres (2.0 gal) at 60°C (140°F)

Made up from:

3 litres (0.75 gal) preparation, 6 litres (1.25 gal) washing up

The peak period would be spread over 1, 2 or 3 hours etc, depending on the establishment.

Bar sinks - allow 114 litres (25 gal) per hour.

School kitchens in general use 30% less than restaurants but allowance should be made for the number of sittings.

Hotels and Motels

Assume average occupancy as 1 1/2 people per room unless specified as single rooms.

Generally the peak will occur over a two hour period in the morning (7.0am-9am). In specialised hotels catering for specific functions (i.e. conferences) the peak could be reduced to one hour. For medium sized hotels 100-200 people allow 25-35 litres (6-8 gal) hot water per person over two hour peak period. For smaller hotels allow more per person-for larger hotels allow slightly less.

These figures assume that mainly showers are used, one per room. For older hotels without showers and public bathrooms assume that baths are filled 3 or 4 times per hour.

Always check restaurant load to ensure that peak morning capacity will cover it. Overall, allow 115-135 litres (25-30 gal) per guest per day.

Dormitories

Allow 15 litres (3.2 gal) per man, 20 litres (4.2 gal) per woman over a peak 1 hour period.

Flats and Apartment Blocks

Assume average occupancy of 2 1/2 people per flat. Allow 38 litres (8.4 gal) per person over a peak 3 hour period.

Rest and Convalescent Homes - with Kitchen and Laundry

Allow 38 litres (8.4 gal) per person over a peak 3 hour period.

Industrial Shower Rooms

Assume shower period to be 20 minutes at the end of each shift and that all showers and wash taps are running continuously for this period at full flow i.e. dump load ideal for heater plus storage application.

School Changing Rooms

Assume all showers and wash basins are used at full flow for 10 minutes after each gym period.

Offices

Allow 1.5 litres (0.33 gal) per person per hour for 1 hour peak load.

Commercial Laundry

Allow 6 litres (1.25 gal) per lb of wash at 71°C (160°F).

Launderettes

Determine the cycle time of the machines (add 10 minutes for unloading and reloading). Calculate the number of cycles that occur in one hour and multiply the number of machines and then multiply by the amount of hot water used by one machine in one cycle to arrive at the maximum demand.

Hairdressers and Beauty Salons

Allow 280 litres (63 gal) per hour of water at 60°C (140°F) per wash basin per peak demand.

Hospitals etc.

Demand will depend on the type of hospital, nursing home, etc. Overall consumption per person per day of hot water can range between 70 litres (15.4 gal) - 230 litres (52 gal).

Sizing Guidance Notes

Powerstock Calorifiers and Storage Tanks

In all applications it is desirable to cross check general assumptions with actual flow rates and capacities and in applications where no general guidelines exist it may be necessary to calculate hot water demand by listing the number and type of appliance in use.

The following tables gives the approximate flow rates for standard hot or mixed water fittings and the approximate capacity in normal use. By appraising what function appliances perform it is possible to determine peak usage i.e. 3 bath per hour, 2 showers each of 10 minutes, sinks filled one per hour, etc.

Approximate Flow Rates From Standard Fittings

Fiting	Flow rate	
	l/s	UK gal/min
Wash basin tap	0.15	2.0
Wash basin spray tap	0.05	0.7
Bath tap	0.30	4.0
Sink tap 15mm	0.20	2.6
Sink tap 20mm	0.30	4.0
Shower spray head	0.15	2.0
Shower 100mm rose	0.40	5.3

Approximate Mixed, Hot and Cold Capacities of Appliances in Normal Use

Cold water 10°C (50°F), hot water 60°C (140°F), mixed water 40°C (104°F)

Appliance	Capacity In Normal Use		Amount of Hot Water		Amount of Cold Water		Temperature in Use	
	l	UK gal	l	UK gal	l	UK gal	°C	°F
Wash basin	5	1.1	3.0	0.66	2.0	0.44	40	104
Bath	80	17.6	48.0	10.60	32.0	7.00	40	104
Small sink	12	2.6	7.2	1.60	4.8	1.00	40	104
Large sink	18	4.0	10.8	2.40	7.2	1.60	40	104
1 min shower spray	9	2.0	5.4	1.20	3.6	0.80	40	104
5 min shower spray	45	9.9	27	5.90	18.0	4.0	40	104
1 min shower (100mm rose)	24	5.3	14.4	3.20	9.6	2.10	40	104
5 min shower (100mm rose)	120	26.4	72.0	15.80	48.0	10.60	40	104

The quantities of hot water shown above are only correct to those particular temperatures. For other combinations use the following formula to determine the proportion of hot water:

$$\text{Quantity of hot water} = \text{capacity of appliance} \times \frac{\text{Mixed water temperature - Cold water temperature}}{\text{Hot water temperature - Cold water temperature}}$$

As a further example the table opposite gives the factors by which the capacity of an appliance is multiplied to obtain the quantity of hot water required when stored at 60°C (140°F) for various cold water supply temperatures and various mixed water temperatures.

Factors at Various Cold Water and Mixed Water Temperature for Determining Hot Water Quantity at 60°C (140°F)

Cold Water Supply Temperature	Mixed Water Temperature						
	60°C	55°C	50°C	45°C	40°C	35°C	30°C
5°C	1.0	0.91	0.82	0.73	0.64	0.55	0.45
10°C	1.0	0.90	0.80	0.70	0.60	0.50	0.40
15°C	1.0	0.89	0.78	0.67	0.55	0.44	0.33
20°C	1.0	0.88	0.75	0.63	0.50	0.38	0.25

Sizing Guide

Powerstock Calorifiers and Storage Tanks

Having 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 when, if the cold water supply temperature remains at 5°C the calorifier outputs will be further reduced.

The question of additional storage if required and how much should be looked at in light of general consumption throughout the day, recovery times, whether the peak period is spread over 1 hour or 3 hours and whether a larger storage buffer than the calorifiers own storage is required to guard against the possibility of high flow rates at peak time.

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 calorifer 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.

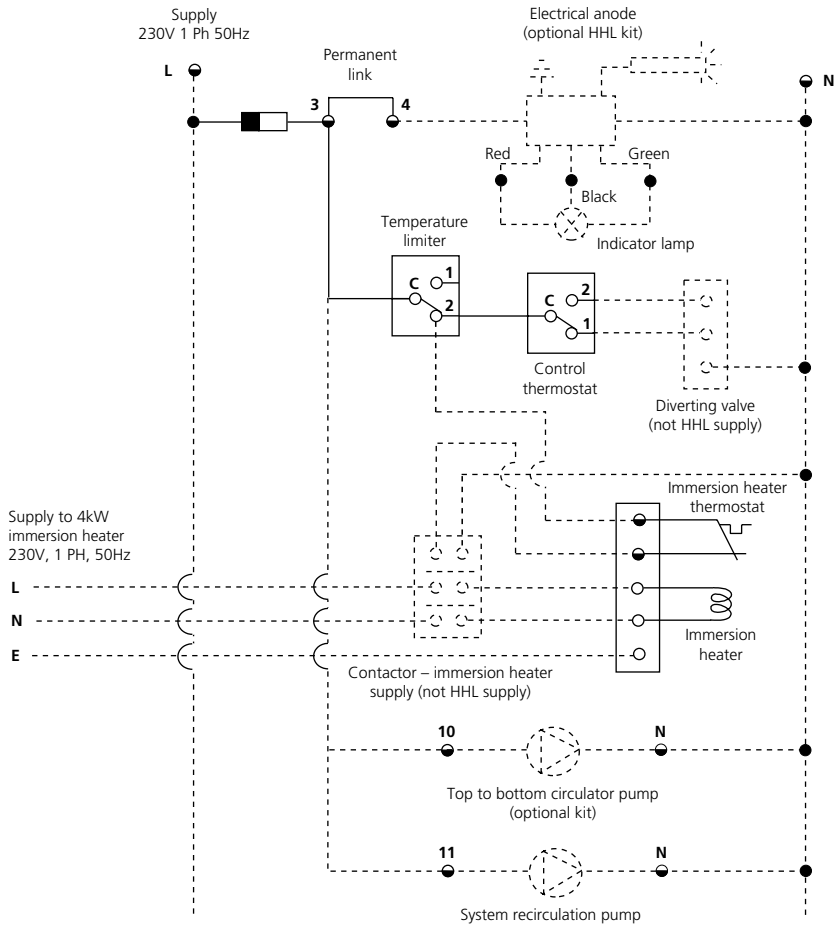
It is important that cold water supply capacities and pressures as well as pipe work layouts are suitable for high volume draw off at peak times to ensure satisfactory hot water delivery to draw off points.

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

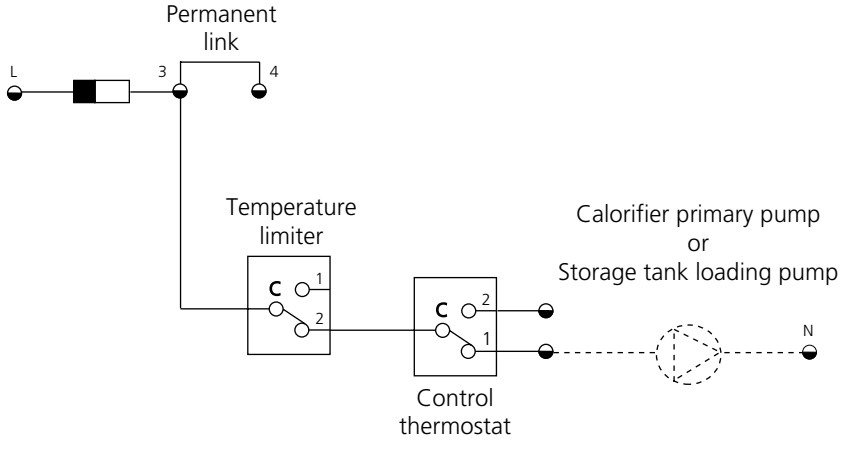
Model			Temperature Rise Across Calorifier (Hot Water Temperature – Cold Water Supply Temperature			
			40°C (72°F)	44°C (80°F)	50°C (90°F)	55°C (100°F)
PS160	Single coil only	l/h	551	501	441	401
		UK gal/h	121	110	97	88
PS200	Single coil only	l/h	660	600	528	480
		UK gal/h	145	132	116	106
PS300	Bottom coil only	l/h	898	816	718	653
		UK gal/h	197	179	158	143
	Top and bottom coil	l/h	1135	1032	908	826
		UK gal/h	250	227	200	182
PS400	Bottom coil only	l/h	1074	976	859	781
		UK gal/h	236	215	189	172
	Top and bottom coil	l/h	1413	1285	1131	1028
		UK gal/h	311	283	249	226
PS500	Bottom coil only	l/h	1220	1109	976	887
		UK gal/h	269	244	215	195
	Top and bottom coil	l/h	1704	1549	1363	1239
		UK gal/h	375	341	300	273
PS750	Bottom coil only	l/h	1168	1062	936	850
		UK gal/h	256	233	205	186
	Top and bottom coil	l/h	1575	1432	1260	1146
		UK gal/h	346	315	277	252
PS1000	Bottom coil only	l/h	1409	1281	1127	1025
		UK gal/h	310	282	248	226
	Top and bottom coil	l/h	1798	1635	1439	1308
		UK gal/h	396	360	317	288

Wiring Diagram

Powerstock Calorifiers and Storage Tanks
Controller Schematics



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.



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

Solar Hot Water Systems

Hamworthy Heating have a full range of products to provide solar thermal solutions for hot water in commercial buildings.

Hamworthy's ModuSol solar hot water systems provide flexible solutions for direct and in-direct fired storage hot water, complete with integrated controls.

The ModuSol system components include:

- High performance flat plate collectors
- In-roof, on-roof or 'A' frame installation
- Solar energy controllers
- Insulated solar transfer station
- Twin coil solar calorifiers
- Hot water storage tanks
- Twin coil direct fired water heaters
- High efficiency condensing boilers
- Solar system pressurisation unit

Biral Solar Controller

The solar controller can be supplied for wall mounting or as part of a pump mounted solar transfer station. Featuring 9 pre-programmed hydraulic circuits, the controller can handle multiple storage vessel settings, integrated boiler control and a choice of solar charging strategies.

A Legionella protection function ensures that the hot water system is purged regularly to minimise the risk of infection.

Controller features:

- Matched pump and controller
- Pump or remote mounting
- LCD backlit display
- Pre-programmed solutions
- Choice of operating modes
- Filling and drainage facilities
- Variable speed pump control
- Comprehensive operating data

Solar Collectors

Hamworthy have partnered with an experienced European manufacturer of high quality well engineered solar collectors to provide reliable and proven solar technology for the ModuSol package. The solar collector features:

ModuSol solar package for commercial hot water systems

- Polycarbonate moulded casing
- Tolerance to extreme temperatures
- High selectively coated full area absorber
- Quick and easy installation features
- Compact space saving design
- In-roof or on-roof mounting
- Pitched or flat roof mounting
- Tested and certified to EN 12975

Calorifiers & Storage Tanks

In-direct hot water storage is provided by a range of Hamworthy Powerstock high performance quality calorifiers and storage tanks up to 1000 litre capacity. Manufactured from steel with a superior glass lined internal finish, all products have full WRAS Approval.

- Twin & single coil construction
- 10 bar pressure rated
- Pre-wired control panel
- Unvented kit for mains water supply
- Electric immersion elements
- Electric anode protection for soft water
- Quality finish

Solar Water Heaters

The latest extension to the Hamworthy Dorchester range of direct gas fired water heaters includes a condensing unit with an additional coil for solar energy input.

With fully integrated control, this innovative solution is ideal for installations where boilers are not required.

To find out how Hamworthy can tailor commercial solar solutions for your project, call 0845 450 2865 or email sales@hamworthy-heating.com

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