



Hamworthy Powerstock

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



Heating *at work.*

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, such as solar thermal and biomass.

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.

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 a 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 kits

- 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
- Can fit through a single doorway

BENEFITS

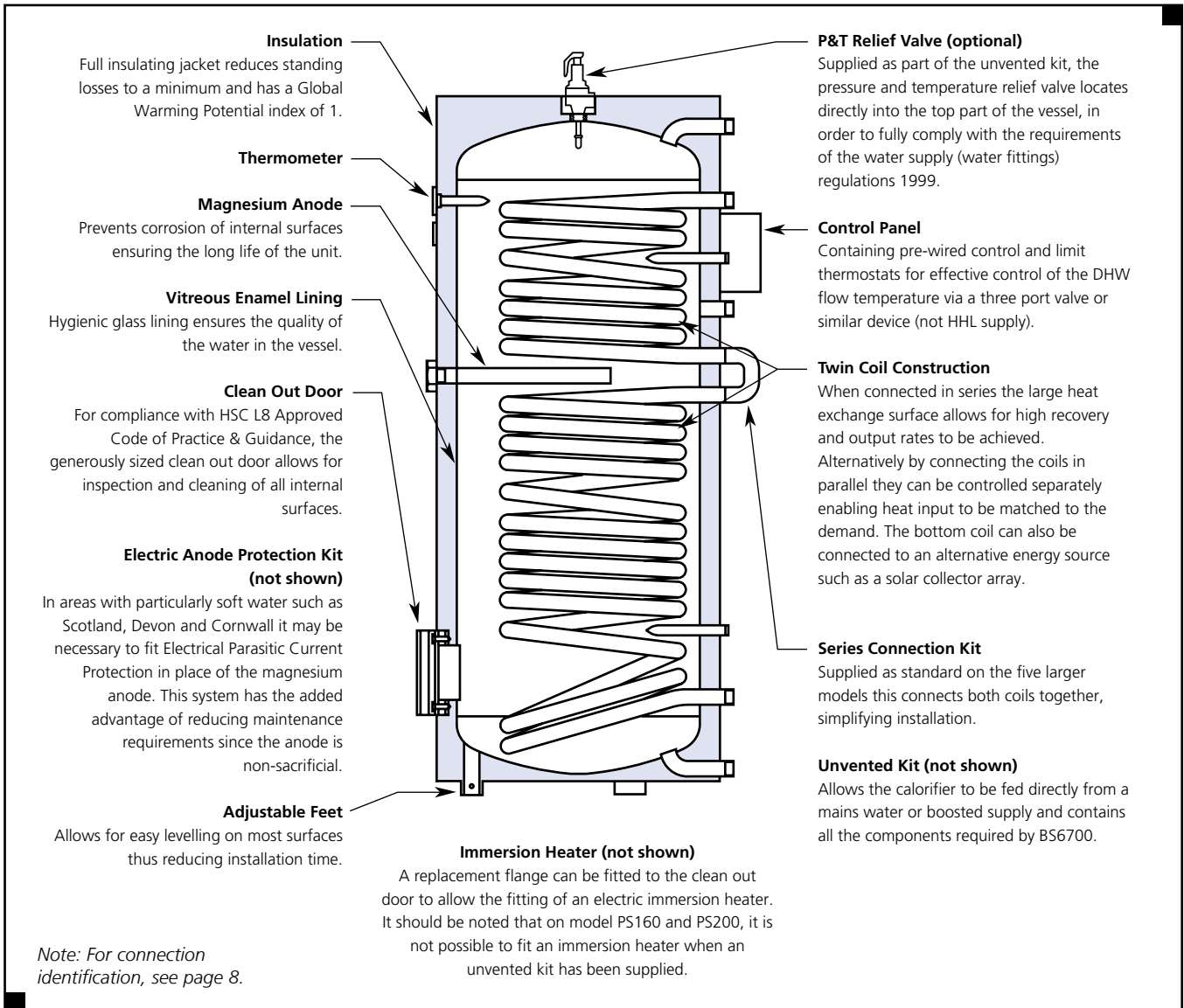
The design of the Powerstock range makes it suitable for use with both conventional and renewable energy sources to generate hot water for commercial buildings.



Modular installation of Powerstock calorifiers

Specification

Powerstock Calorifiers and Storage Tanks Typical Layout of Powerstock Calorifier



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 high grade 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 with a temperature control thermostat and a limit thermostat; and each model is equipped with a magnesium sacrificial anode and clean out door as standard, and finished in a smart insulated PVC factory-fitted 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. 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.

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.

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

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.

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

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.

Immersion Heaters (Optional)

To provide an auxiliary 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 21 and 22, and for immersion heater performance, please refer to page 17.*

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.

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.

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).

Unvented Supply Kit (Optional)

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

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. *For recommended wiring see page 21 and 22.*

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	731	958
	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						
	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
	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
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
		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
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
	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 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

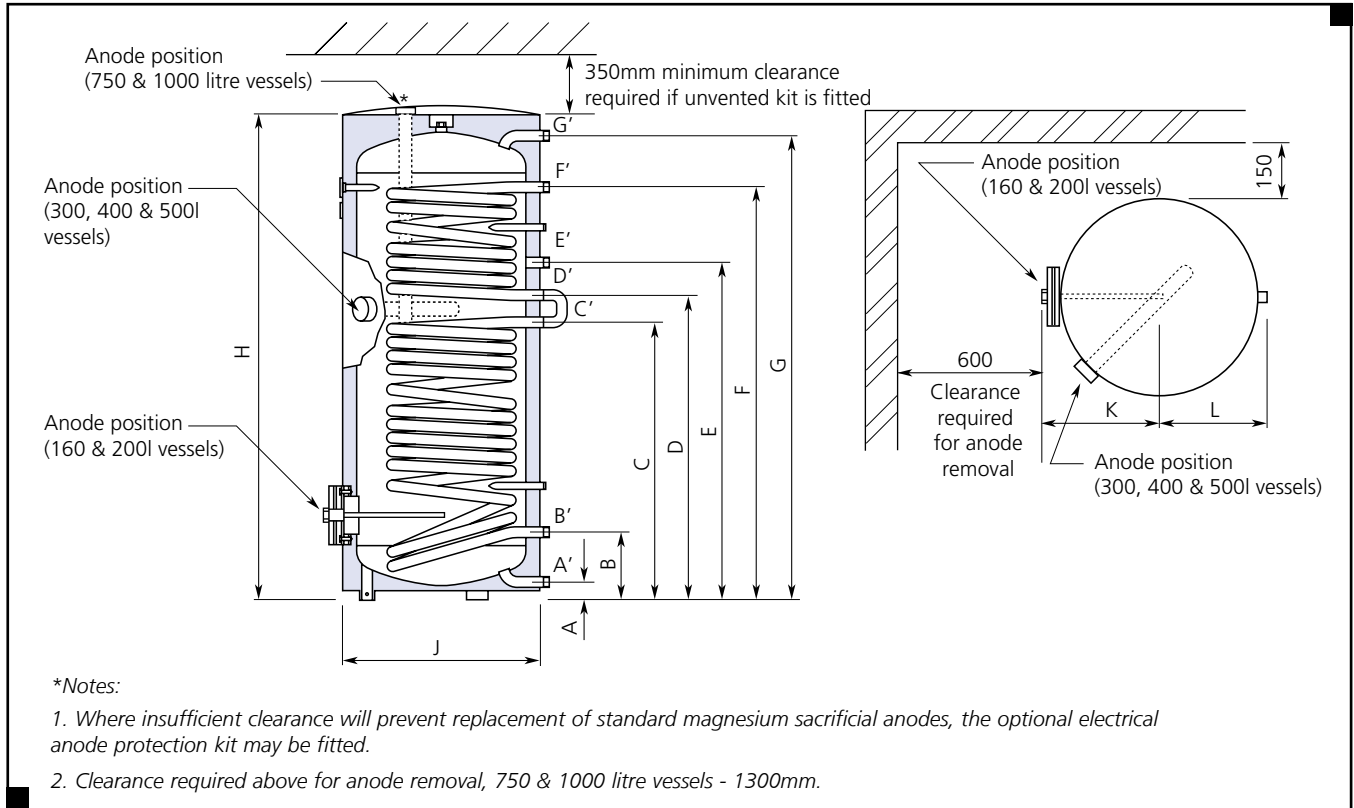
Coil Δt °C	Bottom Coil Only			Top Coil Only			Top & Bottom Coil		
	Heat input kW	Flow rate l/sec	Coil pressure loss mbar	Heat input kW	Flow rate l/sec	Coil pressure loss mbar	Heat input kW	Flow rate l/sec	Coil pressure loss mbar
11	63.0	1.37	301	22.0	0.48	22	85.0	1.85	880
15	63.0	1.00	162	22.0	0.35	12	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

Dimensional Details

Powerstock Calorifiers

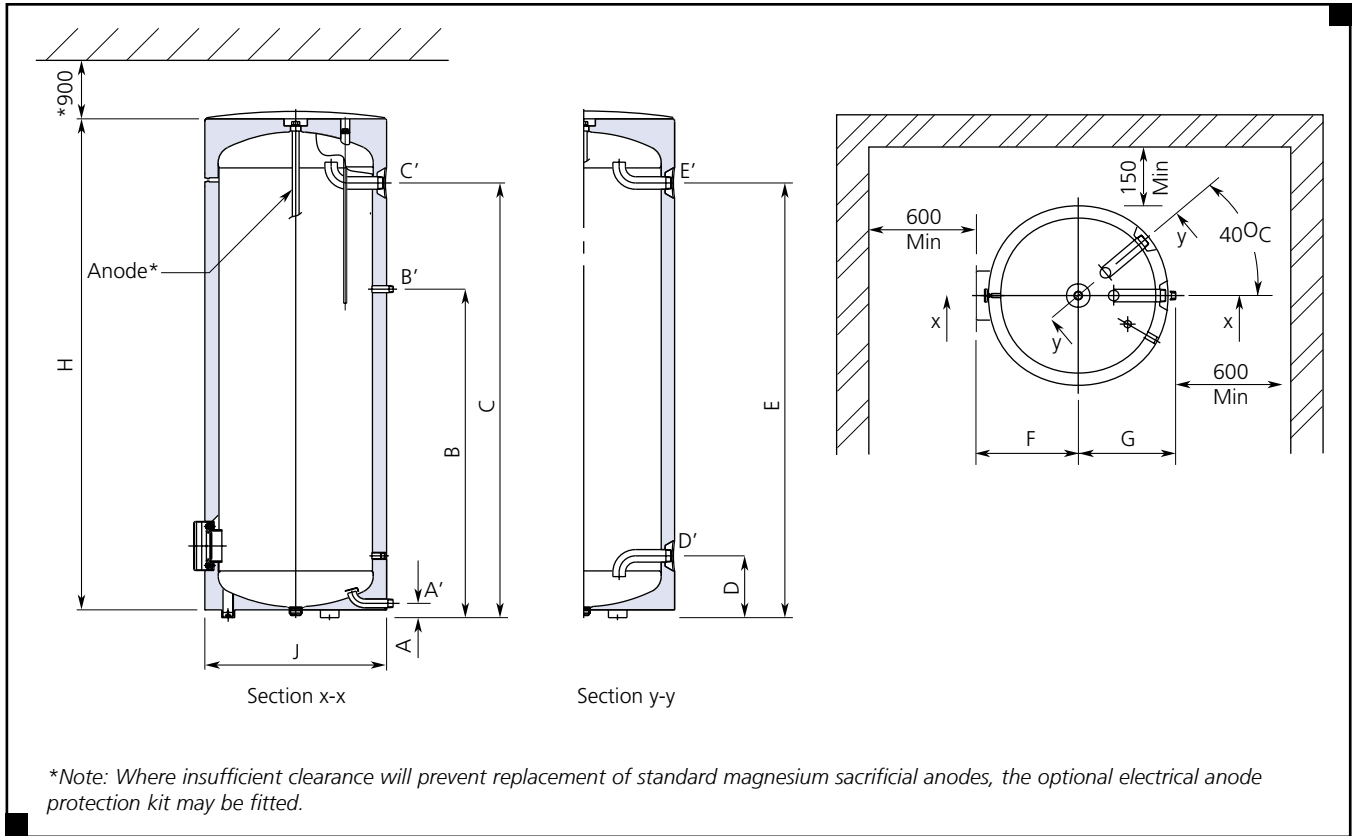


Model	Dimensions (mm)										
	A	B	C	D	E	F	G	H	J	K	L
PS160	55	193	598	N/A	734	N/A	1110	1184	540	312	295
PS200	55	193	688	N/A	901	N/A	1370	1445	540	312	295
PS300	90	254	964	1064	1179	1424	1725	1794	600	352	335
PS400	55	221	909	1007	1112	1355	1526	1591	700	392	375
PS500	55	220	965	1114	1264	1604	1853	1921	700	392	375
PS750	103	280	830	1151	1242	1467	1887	1998	910	487	515
PS1000	103	296	884	1153	1243	1423	1905	2025	1010	537	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"

Dimensional Details

Powerstock Storage Tanks
ST300 and ST500



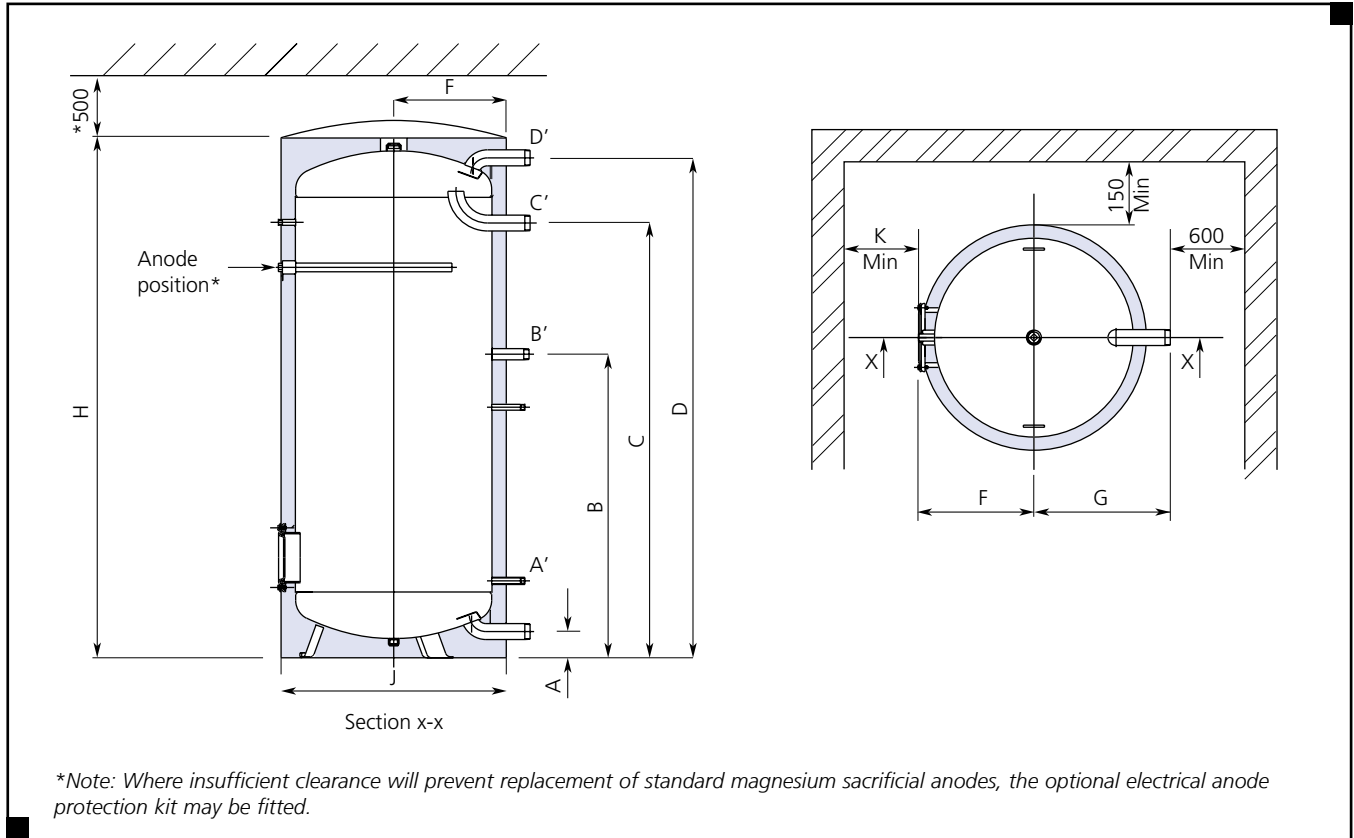
Model	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
ST300	90	1180	1546	272	1546	340	327	1794	600
ST500	55	1265	1674	238	1674	392	375	1921	700

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 1 1/2"	R 1 1/2"	R 1 1/2"
ST500	R 1"	R 3/4"	R 1 1/2"	R 1 1/2"	R 1 1/2"

*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.

Dimensional Details

Powerstock Storage Tanks
ST750 and ST1000



Model	Dimensions (mm)								
	A	B	C	D	F	G	H	J	K
ST750	88	1145	1640	1908	487	515	2023	910	600
ST1000	92	1154	1647	1911	537	565	2040	1010	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.*

System Design

Powerstock Calorifiers and Storage Tanks

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

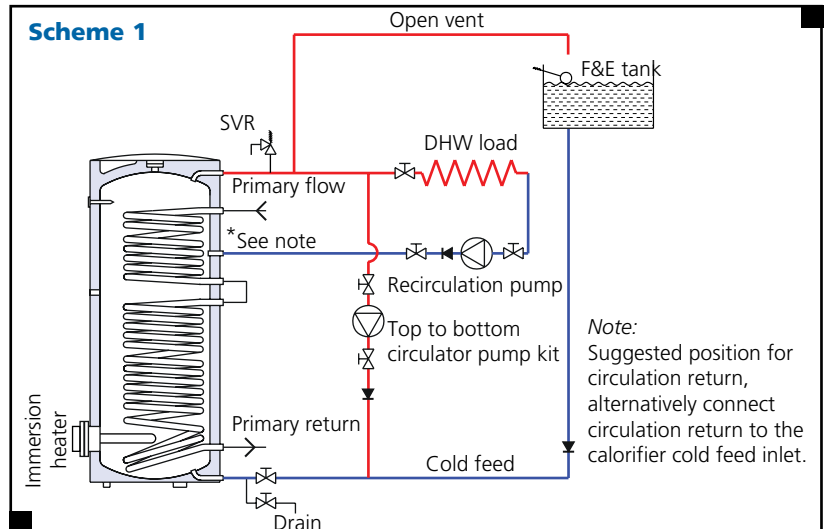
Refer to the specification pages of this brochure for full details of product configurations.

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

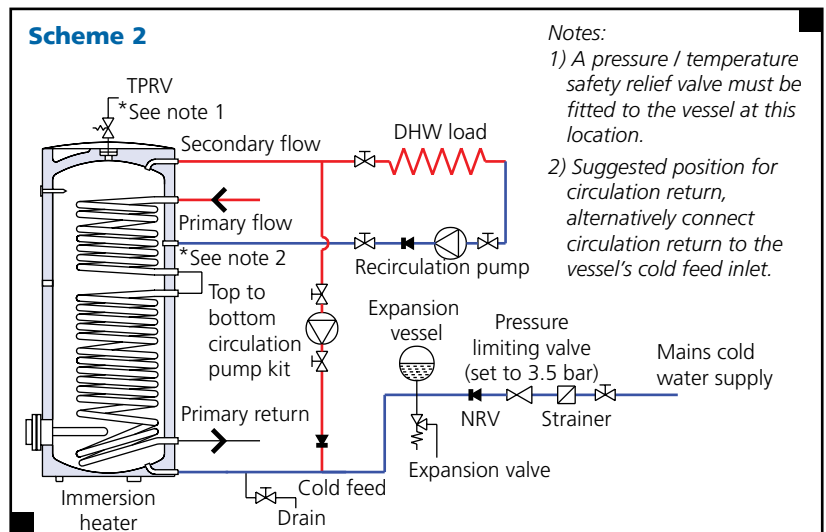


Scheme 2

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

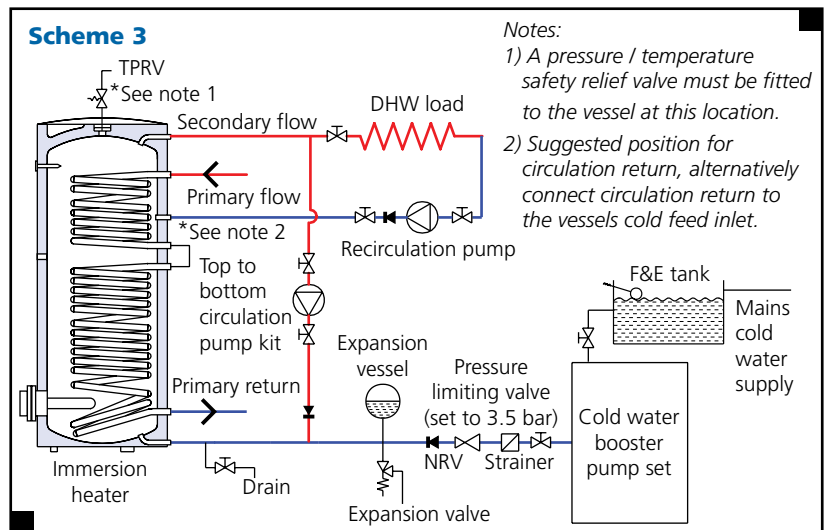


Scheme 3

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

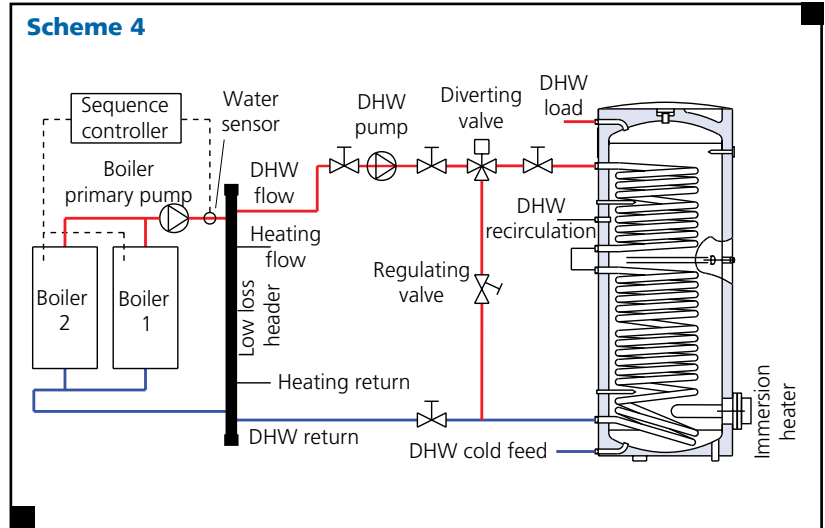
Powerstock Calorifiers and Storage Tanks

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*

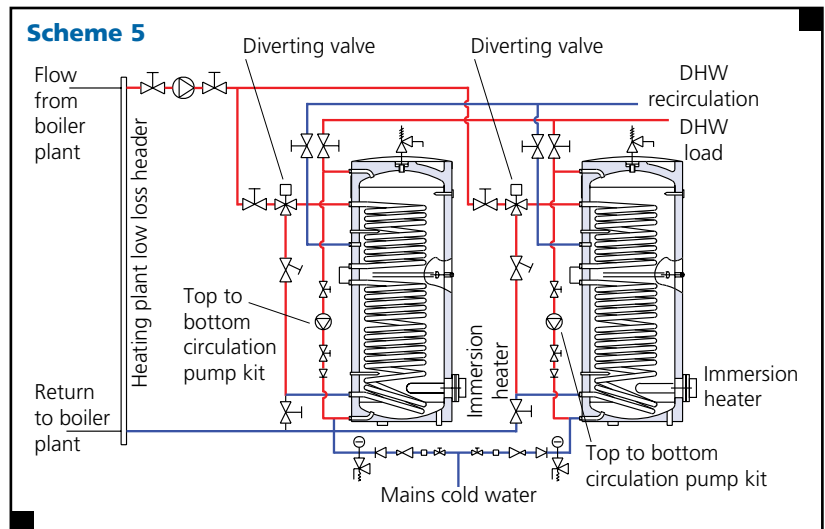


Scheme 5

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.

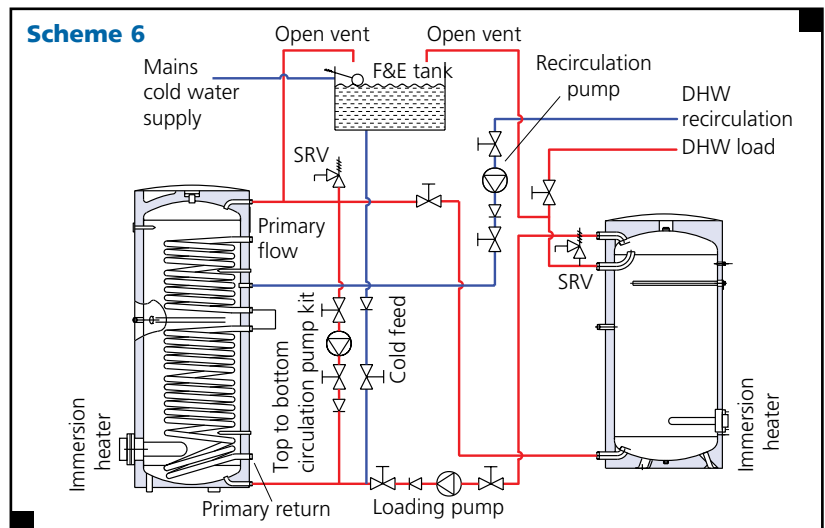


Scheme 6

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*



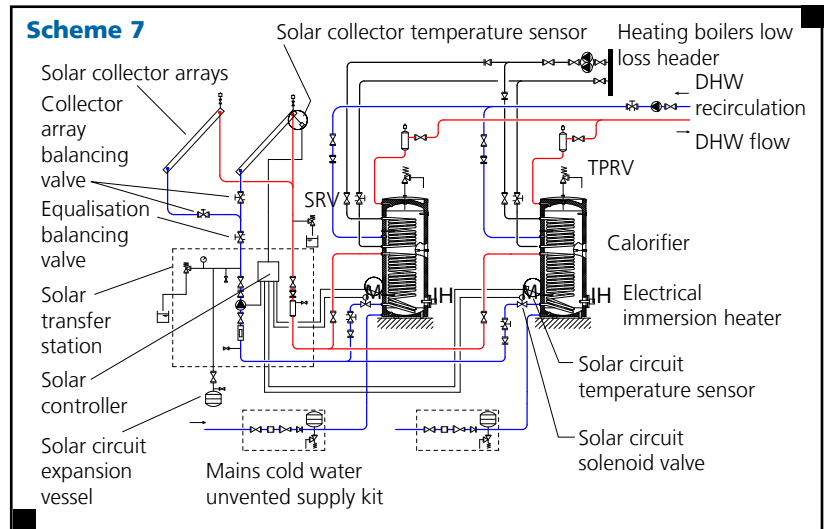
*The immersion heater can only be used with models PS300 to PS1000.

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 overhear 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

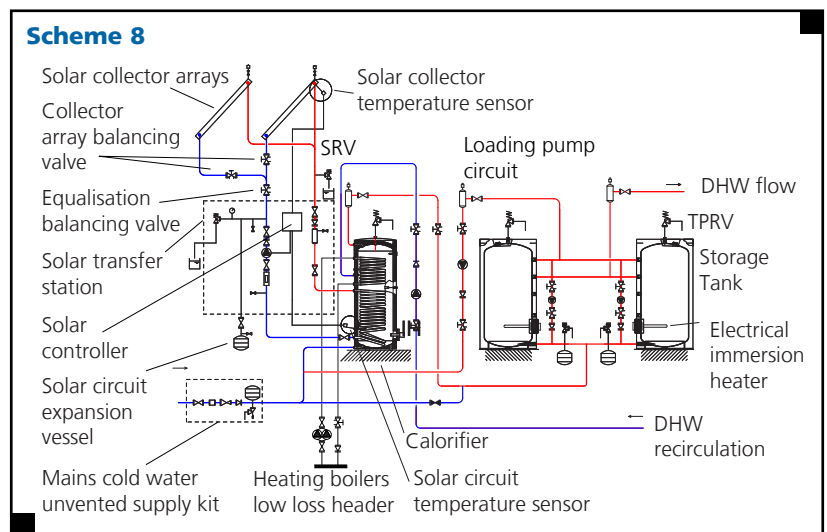


Scheme 8

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



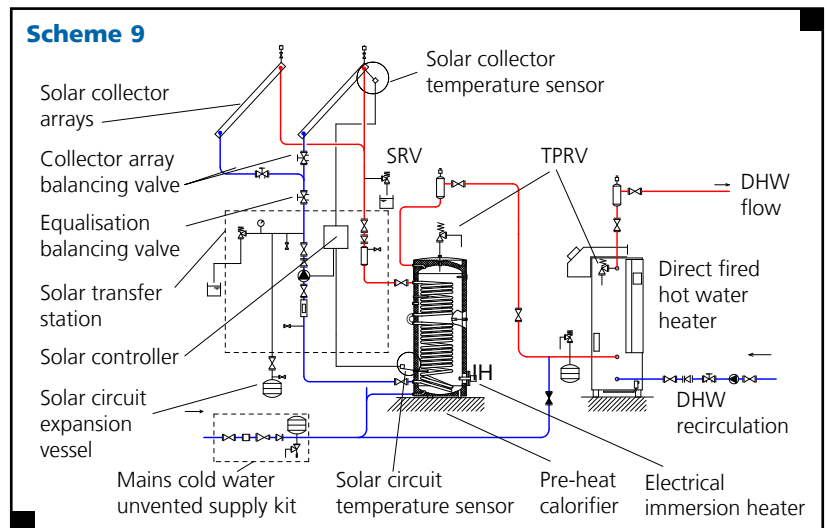
Scheme 9

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.



Application & System Data

Powerstock Calorifiers and Storage Tanks

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 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 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. IET Wiring Regulations. 17th edition.

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

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

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.

CP 342-2 Code of practice for centralized hot water supply. Buildings other than individual dwellings.

CIBSE Publications

CIBSE Guide G Public Health Engineering
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: 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 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.

Standard Kit Expansion Vessel Volumes for Each Vessel Size	
Model	Expansion vessel (litres)
PS 160	24
PS 200	24
PS/ST 300	2 x 24
PS 400	2 x 24
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:

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

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

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

P_w = 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 & System Data

Powerstock Calorifiers and Storage Tanks

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 web site – 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.



Application & System Data

Powerstock Calorifiers and Storage Tanks

HSC Anti-legionella Recommendations

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 electrical immersion heater kit as an option comprising 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 page 21 and 22.*

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 ΔT 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 guideline 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 Guidelines

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 litres. Multiplied by 10 or 20 this can represent a large load which is 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 guidelines which may prove helpful in sizing Hamworthy water heaters.

Restaurants, Kitchens, etc Serving Main Meals

Each meal will use:

9 litres at 60°C

Made up from:

3 litres preparation, 6 litres washing up

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

Bar sinks - allow 114 litres 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 1½ 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 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 per guest per day.

Dormitories

Allow 15 litres per man, 20 litres per woman over a peak 1 hour period.

Flats and Apartment Blocks

Assume average occupancy of 2½ people per flat. Allow 38 litres per person over a peak 3 hour period.

Rest and Convalescent Homes - with Kitchen and Laundry

Allow 38 litres 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 per person per hour for 1 hour peak load.

Commercial Laundry

Allow 6 litres per lb of wash at 71°C.

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 per hour of water at 60°C 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 - 230 litres.

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 give 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 baths per hour, 2 showers each of 10 minutes, sinks filled one per hour, etc.

Approximate Flow Rates From Standard Fittings

Fitting	Flow rate (l/s)
Wash basin tap	0.15
Wash basin spray tap	0.05
Bath tap	0.30
Sink tap 15mm	0.20
Sink tap 20mm	0.30
Shower spray head	0.15
Shower 100mm rose	0.40

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

Cold water 10°C, hot water 60°C, mixed water 40°C

Appliance	Capacity in Normal Use (litres)	Amount of Hot Water (litres)	Amount of Cold Water (litres)	Temperature in Use (°C)
Wash basin	5	3.0	2.0	40
Bath	80	48.0	32.0	40
Small sink	12	7.2	4.8	40
Large sink	18	10.8	7.2	40
1 min shower spray	9	5.4	3.6	40
5 min shower spray	45	27	18.0	40
1 min shower (100mm rose)	24	14.4	9.6	40
5 min shower (100mm rose)	120	72.0	48.0	40

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:

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

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 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

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, 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.

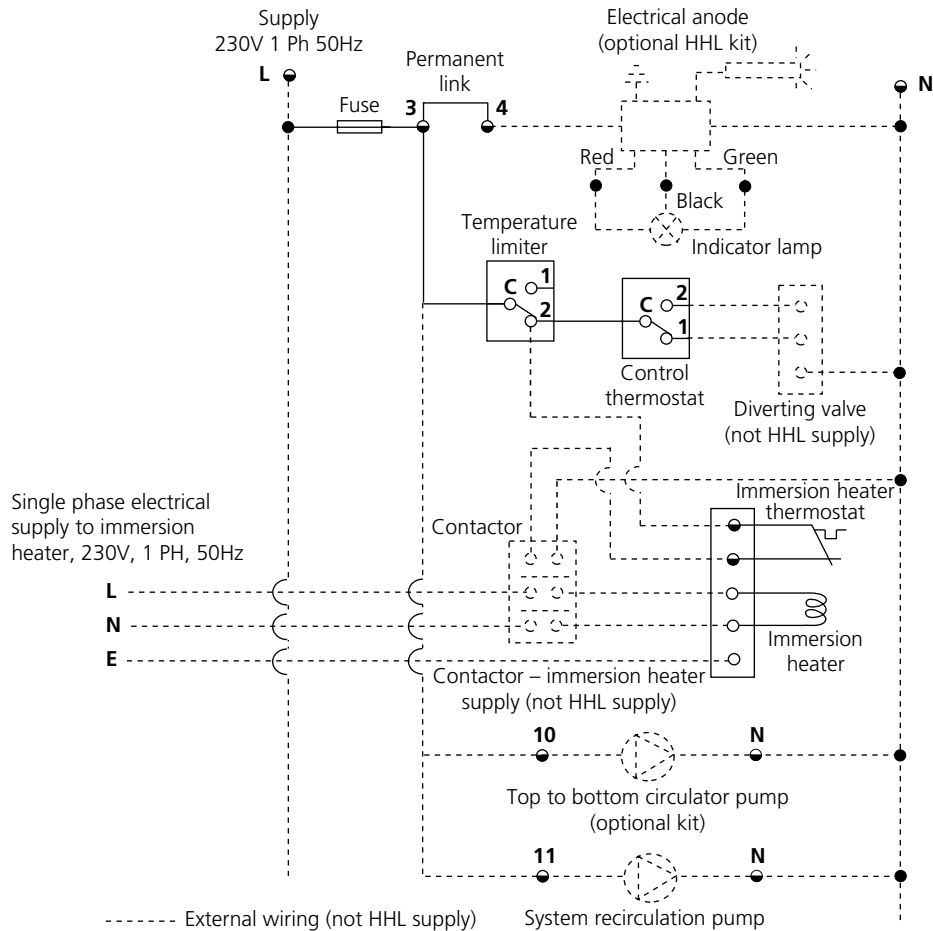
One or more storage tanks may be used in conjunction with Powerstock calorifiers to satisfy hot water demand.

Model			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

Electrical Details

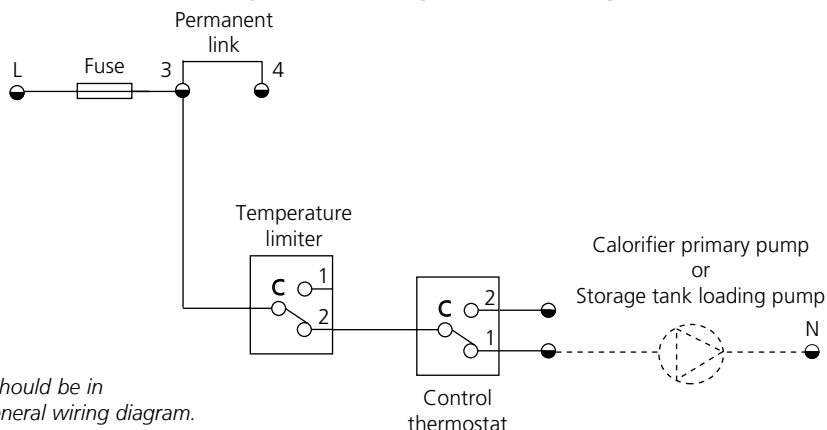
Powerstock Calorifiers and Storage Tanks Wiring Diagrams

Electrical Schematic: Single Phase Electrical Supply to Immersion



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.

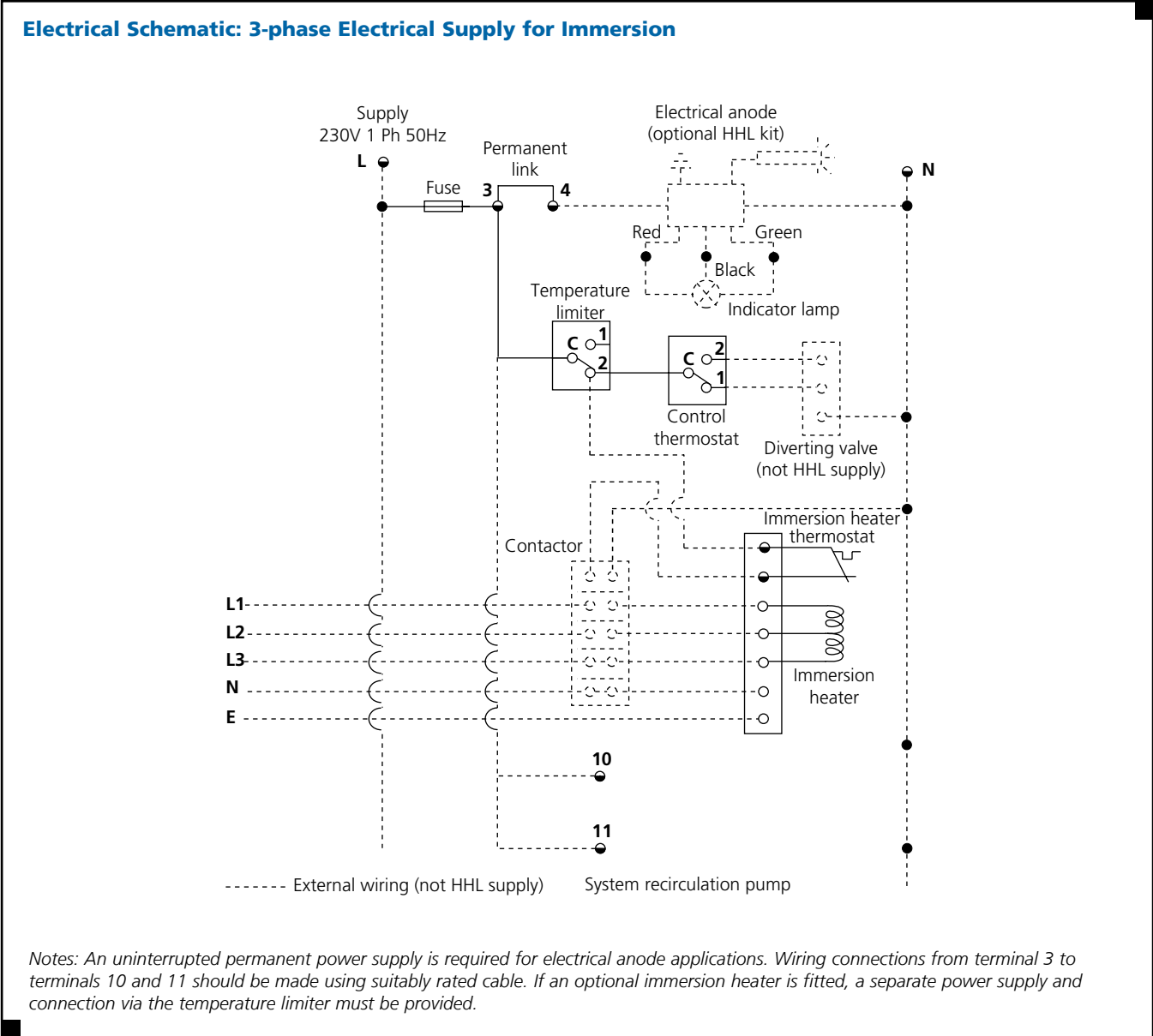
Electrical Schematic: Calorifier Primary Pump/Storage Tank Loading Pump



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

Electrical Details

Powerstock Calorifiers and Storage Tanks Wiring Diagram



Solar Hot Water

Powerstock and Trigon

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

Trigon Solar System

Hamworthy's Trigon solar thermal system provides flexible solutions for both direct and indirect fired storage hot water solutions.

The Trigon solar system key components include:

- High performance flat plate collectors
- On-roof or A-frame modular collector mounting kits
- Solar transfer stations, each with solar pump and safety equipment
- Standard and advanced solar controllers to manage the solar circuit
- Optional monitoring and heat metering equipment

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.

Trigon Solar Duty and Solar Preheat Outputs

Trigon solar equipment can be used with twin-coil Powerstock calorifiers to provide solar duty DHW, with one coil heated by the solar circuit and the other coil heated by water from a gas-fired condensing boiler to provide top-up heat should the available solar energy be insufficient to meet DHW demand.

Alternatively, a two stage approach can be used where, in the first stage a single coil Powerstock calorifier, or twin coil calorifier with both coils linked in series, is heated solely by a Trigon solar circuit and the calorifier output is used as the pre-heated cold water feed to a second stage of heating equipment which then requires less energy to raise the store temperature to match DHW demand. The second stage heating may be carried out by a second Powerstock calorifier and condensing boiler combination or by a direct-fired Dorchester water heater.

Powerstock calorifiers and storage tanks can be combined to increase the overall hot water storage volume to suit the predicted hot water delivery requirements.



Trigon solar equipment designed to integrate with Powerstock calorifiers and Dorchester direct-fired water heaters

Trigon solar systems are an attractive proposition as they profit from "free" solar energy whenever feasible. The more the calorifier is heated by solar energy, the less energy from other means is required to satisfy the heat demand at the DHW output, and so the greater the saving in fossil fuel, and the greater the carbon reduction.

Trigon systems using Powerstock calorifiers become even more attractive when combined with Hamworthy high efficiency gas, oil or biomass boilers for top-up, night time and anti-legionella purge cycle heating; creating highly cost effective solutions while, at the same time, reducing CO₂ emissions.

The Trigon system includes high efficiency collectors with modular array fixing kits, solar transfer stations with industry leading controls, all sized for optimum performance to suit even the most demanding application.

The Hamworthy Trigon system can be sized up to a single collector field of 60m² area (30 collectors), or dual-field east west system up to 40m² (10 collectors /field). Trigon equipment is available as individual items, as equipment kits or as pre-defined schemes that include the Hamworthy Powerstock calorifiers and/ or water tanks, Dorchester water heaters, and auxiliary condensing gas boilers from the extensive Hamworthy range.



Customer Service Centre

Hamworthy Heating Limited
Fleets Corner, Poole,
Dorset BH17 0HH

Telephone: **0845 450 2865**
Email: **sales@hamworthy-heating.com**
Web: **www.hamworthy-heating.com**

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