The Altecnic Guide to Unvented Hot Water Storage Controls

design and installation guide

altecnic
Caleffi group

Guide to Unvented Hot Water Storage Controls

A GUIDE TO THE WATER CONTROL & TEMPERATURE REQUIREMENTS OF UNVENTED CYLINDERS.

Guidelines to the design and installation requirements of Unvented Hot Water Storage Systems are determined by The Building Regulations 2010 Approved Document G.

This document must be followed along with the installation details stipulated in the installation manual supplied with the unvented hot water cylinder.

Key sections from this document are repeated in this guide for clarity:

The Building regulations 2010

Sanitation, Hot Water Safety and Water Efficiency

Approved Document G

G3: Hot Water Supply & Systems

Definitions:

Hot Water Storage System: means a vessel for storing:

1 Heated wholesome water or softened wholesome hot water for subsequent use.

2 Water that is used to heat other water together with any ancillary devices described in paragraphs 3.10 and 3.11. of Approved Document G and all other applicable operating devices.

3 Hot water storage **system package** means a hot water storage system having safety devices described in 3.10 and 3.17 of the Approved Document factory-fitted by the manufacturer, together with a kit containing other applicable devices supplied by the manufacturer to be fitted by the installer.

4 Hot water storage **system unit** means a hot water storage system having the safety devices described in 3.10 and 3.17 and all other applicable operating devices factory fitted by the manufacturer.

Unvented (closed) hot water storage system means a vessel fed with cold water from a supply pipe or dedicated storage cistern (without a vent pipe) and in which water is heated directly or indirectly.

Expansion of the water when it is heated is accommodated either internally or externally and the system is fitted with safety devices to prevent water temperatures exceeding 100˚C, and other applicable operating devices to control primary flow, prevent backflow, control working pressure and accommodate expansion.

Vented (open) hot water storage system means a vessel fed with cold water from a dedicated storage cistern. Expansion of the water when it is heated is accommodated through the cold feed pipe.

A vent pipe connecting the top of the vessel to a point open to atmosphere above the cold water storage cistern is provided as a safety device.

Definitions:

Tundish means a device, installed in the discharge pipe from a valve, that provides an air break allowing discharge to be conducted safely to a place of termination. The tundish also provides visible indication of a discharge and functions as a backflow prevention device.

The Requirements- Section G3- Building Regulations 2010

2 A hot water system, including any cistern or other vessel that supplies water to or receives expansion water from a hot water system, shall be designed, constructed and installed so as to resist the effects of temperature and pressure that may occur either in normal use or in event of such malfunctions as may reasonably be anticipated, and must be adequately supported.

3 A hot water system that has a hot water storage vessel shall incorporate precautions to:

(a) Prevent the temperature of the water stored in the vessel at any time exceeding 100˚C; and

(b) Ensure that any discharge from safety devices is safely conveyed to where it is visible but will not cause danger to persons in or about the building.

Requirement G3 (3) does not apply to a system which heats or stores water for the purposes only of an industrial process.

In the Secretary of State's view, Requirement G3(3) will be met for a hot water system that has an unvented storage vessel if:

(a) The storage vessel has at least two independent safety devices such as those that release pressure and so prevent the temperature of the stored water at any time exceeding 100˚C in addition to any thermostat; and

(b) The hot water system has pipework that incorporates a provision for the discharge of hot water from safety devices to be visible at some point and safely conveys it to an appropriate place open to the atmosphere where it will cause no danger to persons in or about the building.

3.1 The delivered hot water can be considered as heated wholesome water or heated softened *wholesome* water where:

(a) The cold water supply to the hot water system is wholesome or softened wholesome and;

(b) The installation complies with the requirements of the Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended).

3.7 Pipework should be designed and installed in such a way as to minimise the transfer time between the **hot water storage system** and hot water outlets.

Provision of Hot Water Supply

3.9 The requirement G3 only requires the provision of a hot water supply to:

(a) Any washbasin provided in association with a sanitary convenience in accordance with G4(2).

(b) Any washbasin, bidet, fixed bath or shower in a bathroom in a dwelling or provided for rooms for residential purposes provided in accordance with G5;

(c) Any sink in a food preparation area.

There is no requirement under Building Regulations to provide hot water to other washing facilities.

Design & Installation of Directly or Indirectly heated hot water storage systems.

3.10 Hot water storage systems should be designed and installed in accordance with BS 6700:2006+ A1:2009 or BS EN 12897:2006.

3.11 **Hot water storage vessels should conform to BS853-1:1996, BS1566-1:2002 or BS 3198:1981.**

Unvented hot water storage systems – all systems

3.17 Unvented hot water systems should incorporate a minimum of two independent safety devices.

These shall be in addition to any thermostat provided to control the desired temperature of the stored water.

The selection of safety devices should take account of the location, the design configuration, location of components, and performance characteristics of the system.

3.18 An acceptable approach might consist of:

(a) A non self-resetting energy cut-out to disconnect the supply of heat to the storage vessel in the event of the storage system over-heating; and

(b) A temperature relief valve or a combined temperature and pressure relief valve to safely discharge the water in the event of serious over-heating.

Alternative approaches to this are acceptable provided that they provide an equivalent degree of safety.

3.19 **Water heaters with a capacity of 15 litres or less that have appropriate safety devices for temperature and pressure will generally satisfy the requirement set out in G3(3).**

Unvented hot water storage systems – systems up to 500 litres capacity and 45kW power input.

In addition to the provisions of 3.17, the following also apply:

3.21 If an indirect supply of heat to an unvented hot water storage system incorporates a boiler, the energy cut-out may be on a boiler.

3.22 Any unvented hot water storage system up to 500 litres and less than 45kW should be in the form of a **proprietary hot water system unit or package**.

The package and components should be appropriate to the circumstances in which they are used and should satisfy an appropriate standard that will ensure the requirements of the regulation G3(2) and G3(3) will be met (BS EN 12897:2006 or BS6700:2006+A1:2009).

3.23 Any unvented hot water storage system unit or package should be indelibly marked with the following information:

(a) The manufacturers name and contact details

(b) A model reference

(c) The rated storage capacity of the storage water heater

(d) The operating pressure of the system and the operating pressure of the expansion valve

(e) Relevant operating data on each of the safety devices fitted

(f) The maximum primary circuit pressure and flow temperature of indirect hot water storage system units or packages.

3.24 In addition, the following warning should be indelibly marked on the hot water storage system unit or package so that it is visible after installation:

WARNING TO USER

a. Do not remove or adjust any component part of this unvented water heater: contact the installer.

b. If this unvented water heater develops a fault, such as a flow of hot water from the discharge pipe, switch the heater off and contact the installer.

WARNING TO INSTALLER

a. This installation is subject to the Building Regulations.

b. Use only appropriate components for installation or maintenance.

Installed By:

Name .....

Address .....

Tel. No. .....

Completion date .....

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Unvented hot water storage systems – systems over 500 litres capacity or over 45kW power input.

In addition to the provisions of 3.17, the following also apply:

3.26 Systems over 500 litres capacity will generally be bespoke designs for specific projects and as such are inappropriate for approval by a third party accredited product conformity scheme.

Where this is the case, the unvented hot water storage system should be designed to the safety requirements in 3.17.

3.27 Any unvented hot water storage system having a power output of more than 45kW, but a capacity of **500 litres or less should be in the form of a proprietary hot water storage unit or package**.

The package and components should be appropriate to the circumstances in which they are used and should satisfy an appropriate standard that will ensure the requirements of the regulation G3(2) and G3(3) will be met (BS EN 12897:2006 or BS6700:2006+A1:2009).

Installers

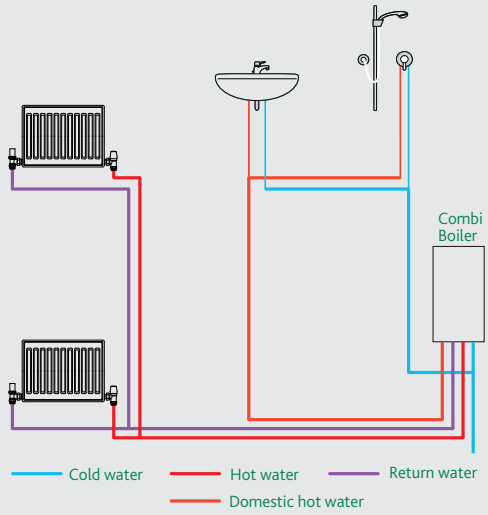
Installers must hold G3 accreditation for unvented cylinders.

A Typical Unvented Installation

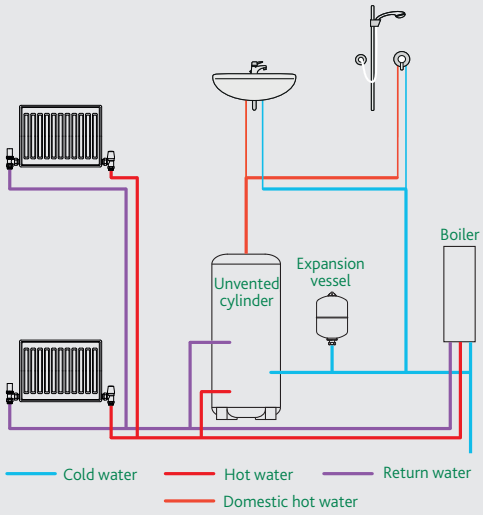
All installations of 'unvented' mains pressure cylinders **MUST** be installed to the current version of the G3 Building Regulations and all work should be undertaken by a qualified installer.

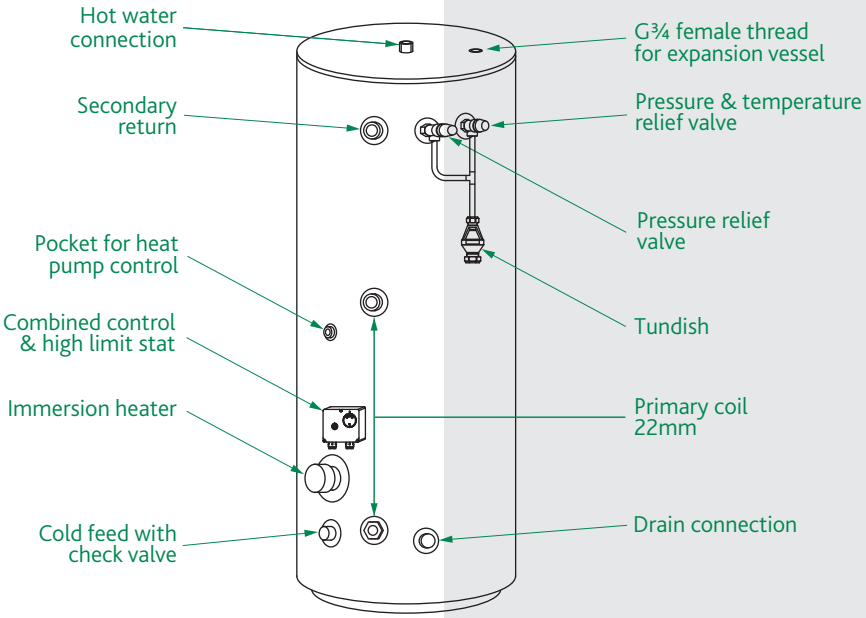
All unvented cylinders must be supplied with all the safety and function devices by the cylinder manufacturer as shown in clauses 3.17, 3.18, 3.21 and 3.26 of Section G3 of Building Regulations 2010.

Typical Direct System

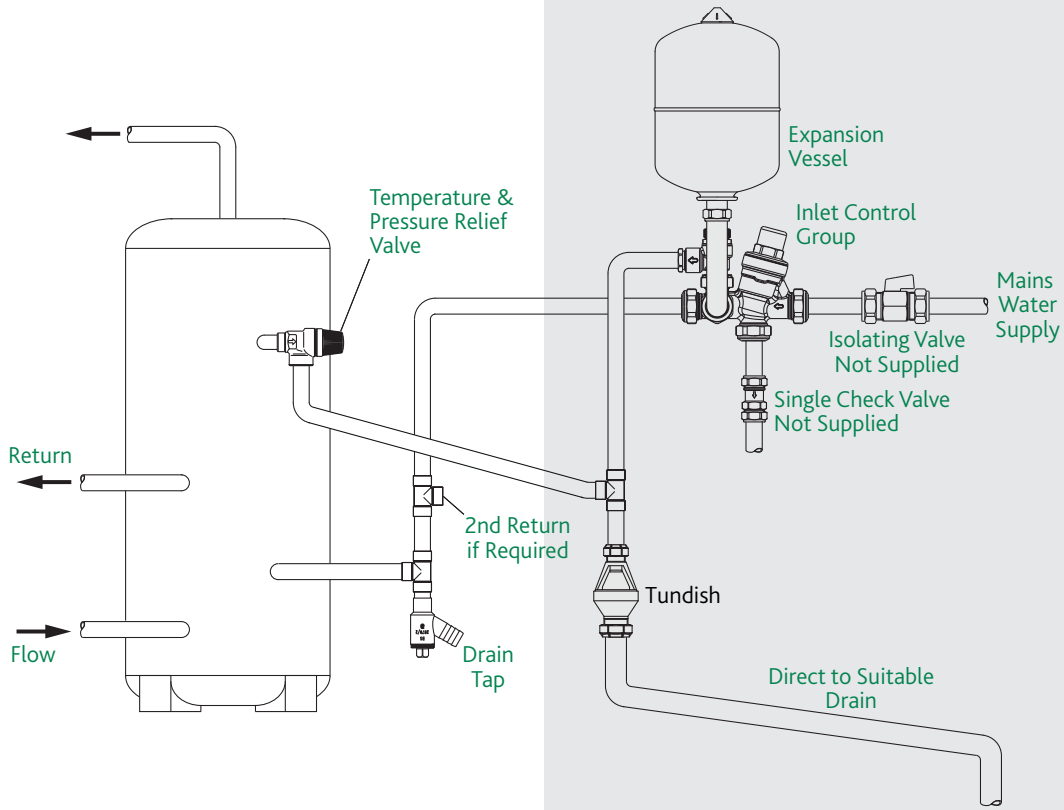


Typical Indirect System

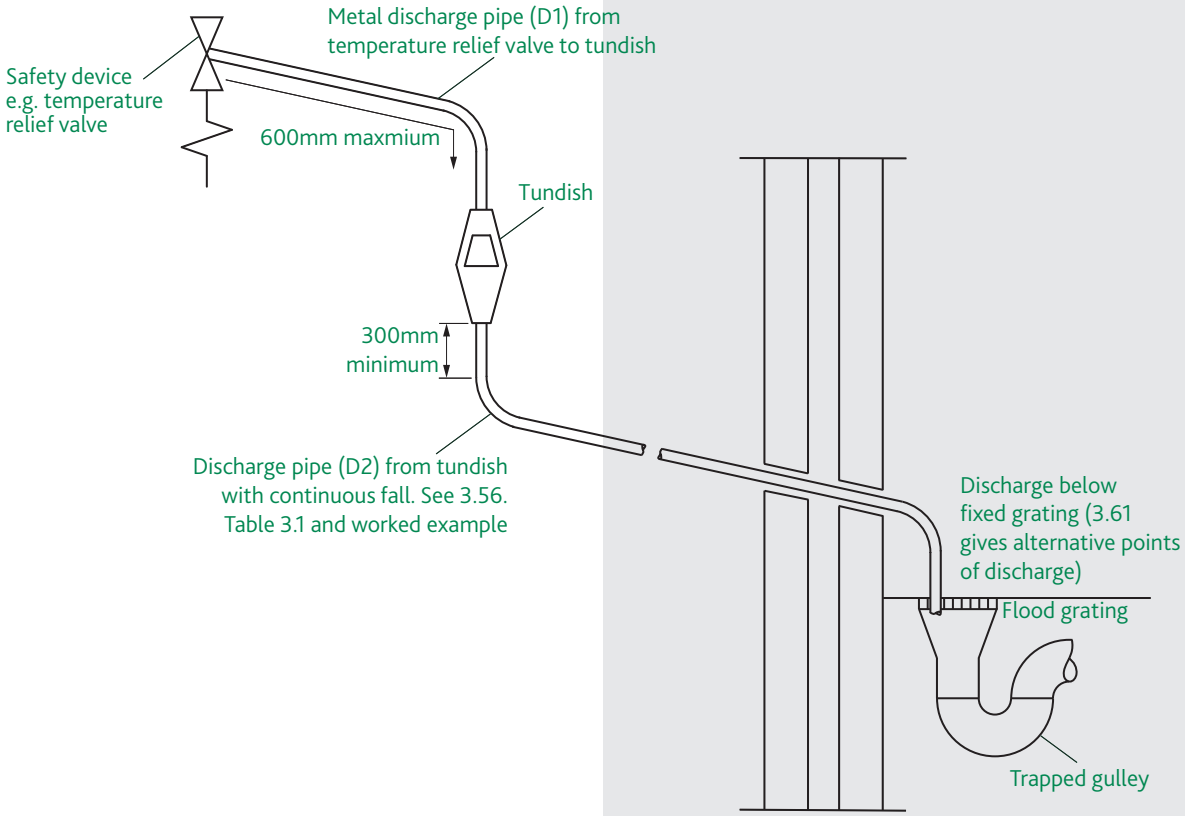




Typical Installation

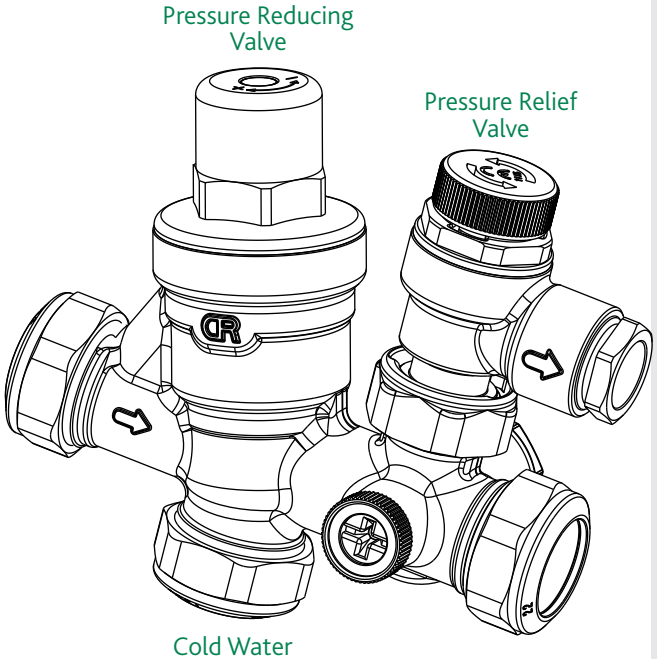


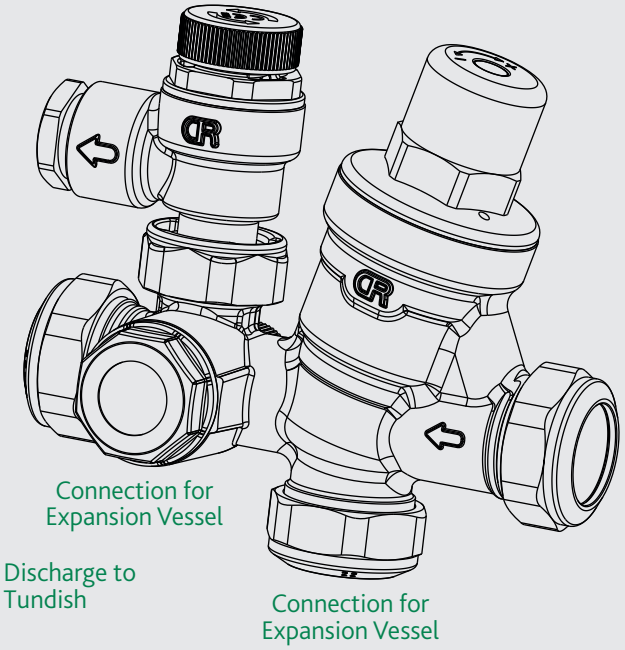
Typical Discharge Pipe Arrangement



Typical Inlet Control Group

The inlet control group contains a pressure reducing valve, pressure relief valve, connection to the expansion vessel, cold water balanced connection and can also include a single check valve all in the one manifold.





Also includes a single check valve - not shown

Safety requirements

There are two basic dangers that unvented systems must address.

- Over pressurisation, caused by a failed pressure reducing valve or back pressure.
- Overheating.

If an unvented cylinder should ever overheat and reach 100°C, then instead of boiling away as it would in a vented system, the water will continue to rise in temperature and pressure until the cylinder can no longer hold the pressure and splits!

At this time, the sudden reduction in pressure resulting from the split may cause water to 'flash' rapidly to steam. The higher the pressure at failure the more steam and cylinders capable of taking higher pressures will fail more dramatically or even explode.

Components

Isolating Valve (optional):

Isolating valves are useful if any products need to be changed.

Line Strainer:

The strainer is normally within the pressure reducing valve enclosure on the incoming cold water main pipe and is there to filter out particles and protect the incoming mains from any undue debris which would otherwise clog/block the pipework

Pressure Reducing Valve:

A PRV is installed on the incoming cold water main pipe to the hot water system to reduce water pressure and keep it at a constant level of pressure.

The pressure reducing valve prevents the system from reaching potentially dangerous levels by limiting the incoming water pressure with typical set pressures being 3.0/3.5bar. Can be part of the Inlet Control Group.

The pressure reducing valve should be WRAS approved and conform to requirements of the British Standard.

Non-Return or Check Valve:

The check valve prevents the warmer downstream water from gravitating back along the pipework and contaminating the drinking water.

Expansion Pressure Relief Valve:

An expansion relief valve is required to allow water to be discharged during heat up if the means of accommodating expansion (normally the expansion vessel) has failed to operate correctly.

Typically, these are 6 or 8 bar pressure relief valves in accordance with BS EN 1567, BS EN 1492, EN13959 and be WRAS approved.

Expansion vessel:

The expansion vessel is used to accommodate the normal day to day working expansion which occurs when the system is heating up.

As water gets warmer the volume can expand by up to 4% and the expansion vessel is designed to store this extra water to prevent the system from bursting.

Temperature and Pressure Relief Valve:

The temperature and pressure relief valve should be located directly on the storage vessel and is normally near to the top of a cylinder and is required to allow water to be discharged when store temperatures or pressures approach unsafe levels. All temperature and pressure relief valves stop the water reaching 100˚C. Any water discharged in this way will typically be replaced by incoming cold mains water that will prevent store temperatures from rising further.

Temperature and Pressure Relief Valve:

Factory fitted combined temperature and pressure relief valves are typically set at 90˚C / 1 mPa (10 bar) and should conform to BS EN 1490:2000 and be WRAS approved.

Can be part of the Inlet Control Group

Temperature relief valves should be sized to give a discharge rating at least equal to the total power input to the hot water storage system when measured in accordance with Appendix F of BS 6283-2:1991 or BS EN 1490:2000.

Temperature Relief valves should be:

- Factory fitted and should not be disconnected
- Not relocated in any other device or fitting installed.

Tundish:

Both relief valves make use of a ‘discharge’ pipe and tundish to allow water to be released from the store under fault conditions.

The tundish should be vertical, located in the same space as the unvented hot water storage system and be fitted as close as possible to and lower than, the safety device.

To comply with Water Supply Regulations, the tundish should incorporate a suitable air gap.

The tundish is installed in the pipe coming from the relief valve and is placed in the pipeline to act as a fault indicator as water flows out of the safety valves under fault conditions.

Discharge pipe (D1 & D2) specifications and sizes are specifically laid down in G3 Building Regulations and must be followed.

Product should be WRAS approved and conform to BE EN 1717.

Thermal Controls / Safety Devices

Non self-resetting energy cut-outs may only be used where they would have the effect of instantly disconnecting the supply of energy in the storage vessel.

Non-self-resetting energy cut-outs should conform to BS EN60335-2-73:2003 and BS EN 60730-2-9:2002 or BS EN257:1992.

Where a non self-resetting energy cut-out operates indirectly on another device to interrupt the supply of heat (e.g. if it is wired to a motorized valve) the energy cut-out should comply with the relevant European Standard.

Where an electrical device is connected to the energy cut-out, such as a motorized valve, the device should operate to interrupt the supply of energy if the electrical power supply is disconnected.

Where there is more than one energy cut-out, each one shall be independent (each should have a separate motorized valve and a separate temperature sensor).

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Components

Immersion Heater (Factory Fitted):

Installed on all Direct hot water storage units in electric systems.

A second immersion heater is sometimes offered on both Direct and Indirect systems.

Electric water heaters should conform to clauses 3.43, 3.44 or 3.45 of Section G3 of Building Regulations 2010.

Additional Thermostat and Thermal Cut-Out (indirect only)

These are typically present on indirect unvented hot water storage units or systems up to 300 litres capacity.

Hot Water Tempering Valves

Where the operating temperature of domestic hot water in the storage vessel in a dwelling is capable of exceeding 80ºC under normal operating conditions, the outlet from the storage vessel should be fitted with a device such as an in-line hot water supply tempering valve in accordance with BS EN 15092:2008, to ensure that the temperature supplied to the domestic hot water distribution system does not exceed 60˚C.

In-Line Blending Valves

The hot water supply temperature to a bath should be limited to a maximum of 48˚C by use of an in-line blending valve or other appropriate temperature control device, with a maximum temperature stop and a suitable arrangement of pipework.

Further guidance can be found under the technical note issued by Altecnic for TMV2 certified products.

2-port Motorized Valve.

The 2-port motorized valve is provided for primary circuit control and must be installed on the primary flow to the cylinder heat exchanger and wired in series with the indirect thermostat and thermal cut-out fitted to the unit.

Drain Valve

A suitable drain tap or valve should be installed in the cold water supply to the storage vessel. It is recommended that the outlet point of the drain pipework is at least 1 metre below the level of the heater.

Drain taps should be WRAS approved and conform to the British Standard.

Electrical safety:

All indirect unvented cylinders have to incorporate a two port zone valve controlling the supply of water to the coil.

Alongside of the temperature and pressure relief valve sits an array of electrical safety which together form what is commonly known as 'three tier' safety control.

1. A cylinder thermostat set at about 60-65˚C
2. A cylinder high temperature energy cut out is set to operate at about 82˚C, both of these thermostats are usually within one casing known as a 'Dualstat'.
3. The high temperature energy cut out thermostat cuts off the heat source by shutting off the boiler and closing the two port valve.

Should the control thermostat fail, the water temperature will rise until it reaches the high limit setting.

If that were to fail, then the water temperature would rise until it reaches the temperature and pressure relief setting.

IMPORTANT

This document is issued only as a guide - please refer to the requirements of BS EN 8558 and the Building Regulations and any further local or national requirements covering the installation of this type of product.

E & O.E

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