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Module 1

Vented and unvented hot water systems and their operating principles

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Aim of the module

On completion of this module (and following attendance on the BPEC Course) you should be able to:

- Identify the key method of operation of hot water systems
- State the differences between vented and unvented systems in terms of the key components and working principles of the system
- List the relative advantages and disadvantages of vented and unvented hot water systems
- Identify the legislation covering the installation and maintenance of hot water systems in the UK and its key requirements
- State the function of key components that are installed in hot water systems

Image 1 **Unvented cylinder**

This course is designed to enable you to demonstrate competence in the installation and maintenance of hot water systems in accordance with building and water regulations.

The supply of hot water in domestic dwellings was first introduced into the majority of households around 1920 to 1930. From these early, relatively simple applications, emerging technology has vastly improved the design principles and use of components and appliances in today's modern domestic hot water systems.

Early vented systems were referred to as 'direct systems'. This means that water heated in the boiler is fed directly into hot water storage vessel and ultimately is the water that is distributed to the hot taps.

Direct systems could also be heated solely by an immersion heater rather than by a boiler.

The introduction of central heating brought about the use of indirect systems. Here the water from the heat source, which also supplies the radiators, is kept separate from the domestic supply to the taps by the use of a copper coil (known as the heat exchanger) inside the cylinder.

The stored water is heated 'indirectly' via the heat exchanger. Single feed self priming cylinders were an alternative to the use of a coil type heat exchanger, but are no longer used in new installations.

During the earlier decades of the Twentieth Century mains fed hot water supply systems (unvented systems) were utilised throughout the industrialised world with the exception of the United Kingdom.

With the introduction of the Building Regulations 1985, a relaxation of the Water Byelaws current at the time and the Water Byelaws which came into force on the 1 January 1989, such systems were allowed to be installed in the UK.

Since then a number of amendments have been made to the Approved Document G to the Building Regulations and all unvented hot water storage systems must now comply with section G3 in England and Wales and the Water Regulations 1999. In Northern Ireland it is Regulation P5 and the Water Regulations 2009 and Technical Standard P3 and the Water Supply Byelaws 2014 for Scotland.

The installation of unvented hot water systems in the UK is now relatively commonplace with the unvented system providing a number of key benefits to the system user.

Although reference is made here to Approved Document G of the Building Regulations in England and Wales, the requirements are the same for the devolved administrations and the table below shows which parts of the relevant legislation in Scotland and Northern Ireland affect hot water storage systems.

England and Wales	Scotland	Northern Ireland
Part A	Section 1 (Structure)	Technical Booklet D
Part B	Section 2 (Fire)	Technical Booklet E
Part C	Section 3 (Environment)	Technical Booklet C
Part E	Section 5 (Noise)	Technical Booklet G
Part G	Section 4 (Safety)	Technical Booklet P
Part L	Section 6 (Energy)	Technical Booklet F1
Part P	Section 4 (Safety)	Part P

Unvented systems are a perfectly safe method of storing and supplying domestic hot water provided that the installation and maintenance of these systems is undertaken by properly trained and qualified individuals. To that end legislation is in place which identifies who may carry out work on these types of system.

Let's read on and look at hot water systems in a little more detail!

Vented and unvented hot water systems

Firstly, let's take a look at an illustration of an early vented system and its key components:

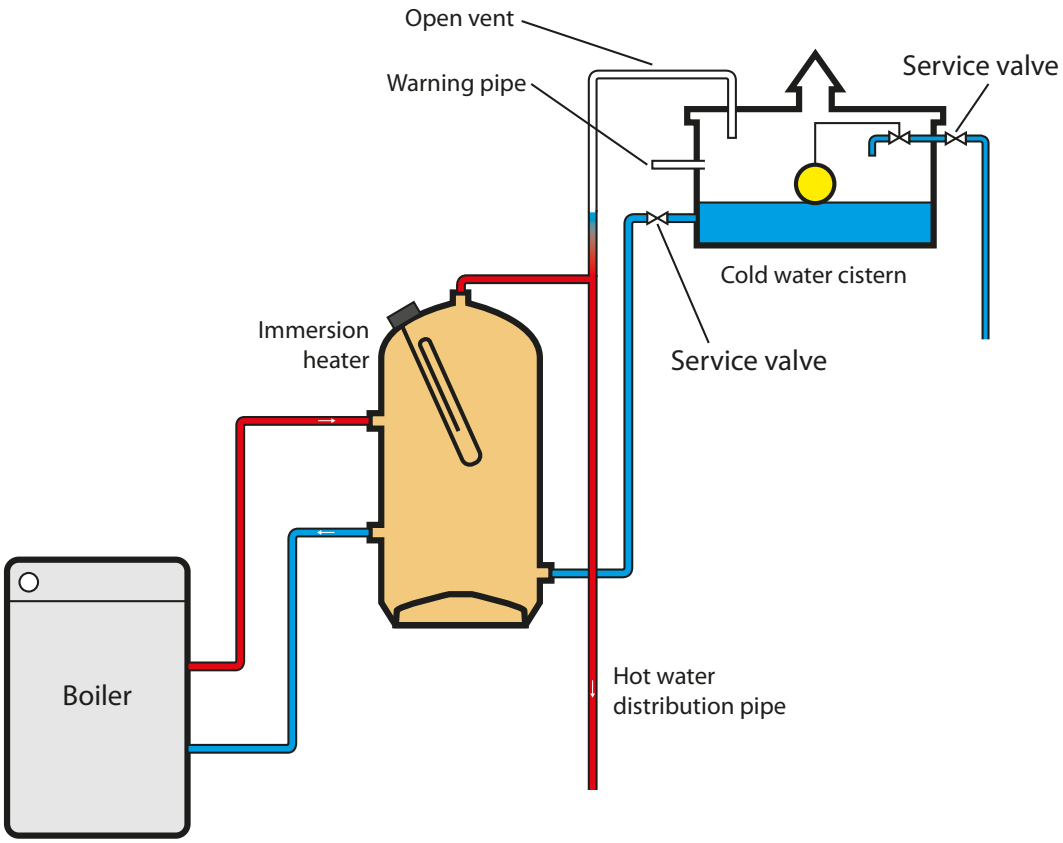

Image 2 **The direct vented hot water storage system**

The supply of hot water to houses within the UK has traditionally been provided from a cold water storage cistern usually located in the roof space, which then feeds a hot water store cylinder.

The rate of discharge and water pressure at the tap is dependent on the height or head of water between the level in the cold water cistern and the draw off tap.

Because water expands as it is heated, the volume of water in the system has to be accommodated. In a traditional vented system, with a cold water storage cistern, the expansion takes place primarily back up through the cold feed pipe and into the cold water storage cistern; thus the volume of water increases in the cistern and the water level rises. There is no pressure increase in the system because the cistern is open to atmosphere.

Finally, the traditional vented system is provided with a key safety measure; the open vent pipe (or often incorrectly called expansion pipe).

These systems were unhygienic as many had no lid on the cold water cistern so contaminants such as birds and mice could get into the water. The water in the cylinder circulated through the boiler and was then drawn off at the taps.

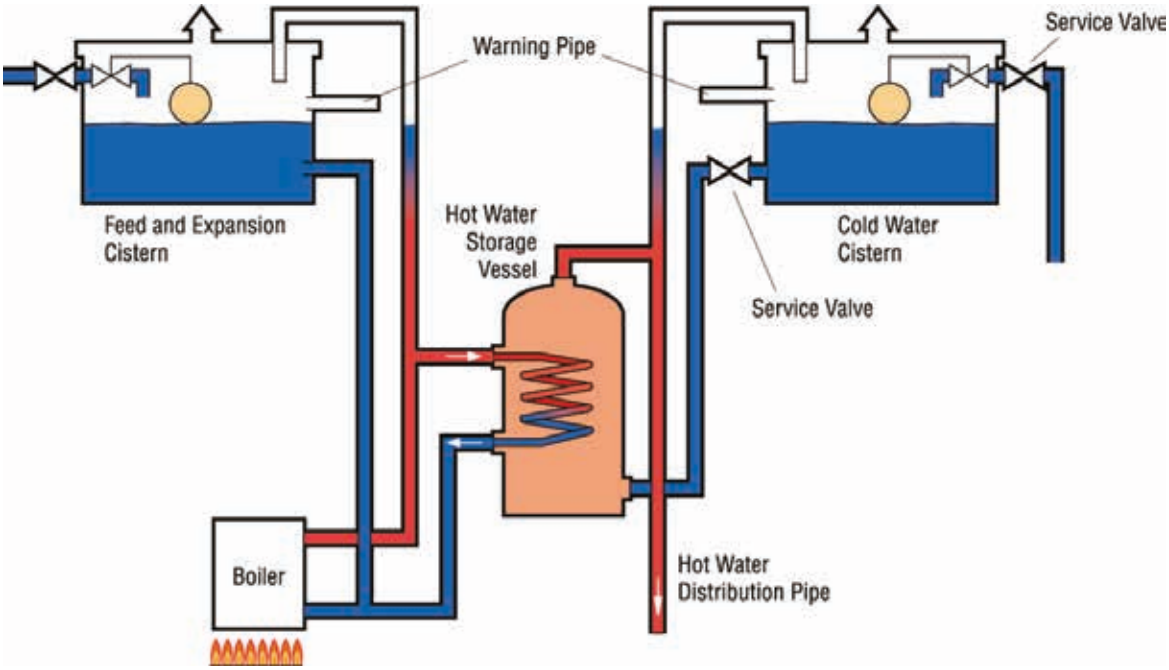

Image 3 **The indirect vented hot water storage system**

Here are a few important factors about double feed indirect hot water systems:

- The system requires an open vent and cold feed pipe connecting into the primary pipe circuit, or it can be separately fed into the boiler.
- The system requires a separate feed and expansion cistern.
- The heating appliance (boiler) may have a cast iron heat exchanger.
- No type of shut off valve should be fitted to the open vent pipe.
- If the open vent pipe is not connected to the highest point in the primary circuit, then an air release valve must be fitted, preferably an automatic one.

Note: This is an illustration and not a technical installation diagram

Use of immersion heaters in direct and indirect hot water storage systems

Some existing systems are heated solely by the use of immersion heaters. Due to a number of high profile scalding incidents which have resulted in fatalities, any new immersion heater must now be compliant with the requirements of BS EN 60335-2-74.

This standard requires the heater to contain:

- An operating thermostat which can be adjusted to user requirements (normally 60-65°C).
- An overheat thermostat which is set by manufacturer to operate at a temperature of typically 80°C. The overheat thermostat is of the non self-resetting type meaning that when it activates it must be re-set by the plumber after the fault has been investigated.

The purpose of the overheat thermostat is to activate and prevent further heating of the cylinder if the normal operating thermostat fails.

Module 4

Other Applicable Building Regulations

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