Unit 208PH: Understand hot water systems

# Delivery guide

Unit information

The purpose of this unit is for learners to explore hot water systems within a domestic property and industrial and commercial building and the knowledge that underpin work on the different systems. Learners will have the opportunity to install and test hot water systems. Learners may be introduced to this unit by asking themselves questions  
 such as:

* Why are there different types of hot water systems?
* How do you install a cylinder, bath or wash hand basin to the hot water supply?
* How do you test a hot water system?

Learning outcomes

1. Understand the applications, advantages and limitations of hot water systems
2. Understand the applications, advantages and limitations of appliances, components and accessories in relation to the working environment
3. Understand the methods and techniques for fitting, fixing and connecting the selected appliances, components and accessories
4. Understand the appropriate testing procedures for confirming the systems' integrity

Suggested resources

British Standards

* BS EN 806 *Specification for installations inside buildings conveying water for human consumption (Parts 1*–*5).*
* Manufacturers’ Instructions.

Websites

* [GOV.UK | Building regulations 2010 | A](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/429060/BR_PDF_AD_A_2013.pdf)

Websites (continued)

* [GOV.UK | Building regulations 2010 | G](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf)
* [GOV.UK | Building regulations 2010 | L1A](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/540326/BR_PDF_AD__L1A__2013_with_2016_amendments.pdf)

* [Water Regs UK | Home](https://www.waterregsuk.co.uk/)
* [Planning Portal | Home](https://www.planningportal.co.uk/)
* [HSE | Home](https://www.hse.gov.uk/)
* [Safety Sign UK | Home](https://www.safetysignuk.co.uk/)

Suppliers’ websites

* [Grohe | Home](https://www.grohe.co.uk/en_gb/)
* [Pegler | Home](https://www.pegleryorkshire.co.uk/)
* [Kingspan | Hot water cylinders](https://www.kingspan.com/gb/en-gb/products/hot-water-cylinders)
* [Megaflo unvented | Cylinders](http://www.megaflo-unvented.co.uk/megaflo-cylinders.php)
* [Ariston | Water heaters](https://www.ariston.com/en-uk/products/electric-gas-water-heaters/)
* [Mira showers | Home](https://www.mirashowers.co.uk/)
* [Wavin | Product overview | Plumbing and waste water drainage solutions](https://orbia.blob.core.windows.net/assets/F-29838-0.pdf)
* [Worcester Bosch | Gas-fired boiler range | Product guide 2021](https://www.worcester-bosch.co.uk/support/literature/download/8716116713)
* [Myson | Product Brochures](https://www.myson.co.uk/downloads/brochures.htm)

Textbooks

* Young, L. & Mays, G. (2000) *Water Regulations Guide*. 2nd edition. Gwent: Water Regulations Advisory Scheme (WRAS).
* Maskrey, M. (2019) *The City & Guilds Textbook: Plumbing Book 1 for the Level 3 Apprenticeship (9189), Level 2 Technical Certificate (8202) & Level 2 Diploma (6035)*. London: Hodder Education. ISBN 978-1-51041-648-2
* Tanner, P. and Lane, S. (2019) *The City & Guilds Textbook: Plumbing Book 2 for the Level 3 Apprenticeship (9189), Level 3 Advanced Technical Certificate (8202) & Level 3 Diploma (6035)*. London: Hodder Education.ISBN 978-1-51041-646-8

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
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| 1. Understand the applications, advantages and limitations of hot water systems | * 1. The advantages and disadvantages of hot water systems | * Learners to be able to describe the advantages and disadvantages of the following hot water systems: * hot water systems (vented and unvented systems) direct and indirect * boilers * thermal store * instantaneous hot water heaters * single point (point of use) heaters. * in relation to: * flow rates * installation cost * installation requirements * lifespan * supply pressures * suitability for the property * design requirements * energy efficiency. * Learners to recap the key points of hot water systems and to be able to state the purpose of different components. |
| * 1. The types and typical pipe sizes used in hot water systems within dwellings | * Learners to be able to describe the types and typical pipe sizes used in domestic properties: * R250 Copper, polybutylene * minimum pipe size for a distribution pipe from a cold water storage cistern, diameter 22mm * minimum pipe size for supplying water to a combination boiler, diameter 15mm * minimum pipe size for water supplying a bath from a vented hot water system, diameter 22mm. * Learners to be able to give examples of where each type of pipe could be used and why. |
| 1. The applications, advantages and limitations of appliances, components and accessories in relation to the working environment | * 1. The working principles of hot water systems, positioning, fixing, connection and operation of components | * Learners to be able to identify types and layout features of hot water systems: * hot water systems (vented and unvented systems) direct and indirect * boilers * thermal store. * Learners to be able to describe the working principles of hot water systems, positioning, fixing, connection and operation of the following components: * cylinders, including grades and sizes of direct and indirect cylinders, primatic cylinders, quick recovery cylinders, combination cylinders and thermal stores * sanitary appliances such as baths, basins, sinks, over the rim bidets * taps, outlets and valves such as mixer taps, bib taps, pillar taps, gate valves, float-operated valves, drain valves, servicing valves, full-way gate valves and ceramic disc taps. * Learners to be able to give examples of different types of hot water systems and to be able to identify key features and state how they operate. * Learners to be able to refer to storage, non-storage, centralised and localised hot water systems. * Learners to be made aware of the fuel types used with direct and indirect hot water storage systems. * Learners to understand the importance of temperature control on hot water systems and the methods of controlling temperature. * Learners to know the operating principles and installation requirements of blending valves. * Learners to be shown examples of hot water systems with different fuel types and to know which is appropriate for different situations. |
| **Install** | | |
| 1. The methods and techniques for fitting, fixing and connecting the selected appliances, components and accessories in accordance with:  * the plumbing and heating system's design * the working environment * manufacturers' instructions | * 1. How to fill and vent hot water systems | * Learners to know the methods of filling and venting a hot water system. * Open the service valve to the hot water cylinder/heater or boiler. * Turn on the kitchen hot tap. * Allow the water to flow into the kitchen sink to clear any debris that may have collected in the pipework. * Close the hot tap on the kitchen sink and allow the system to fill to full standing pressure. * Open any taps and terminal fittings fed from the system and clear any air in the system. * Allow the water to run to clear any debris. * Learners to be given examples of filling and venting hot water systems in a variety of settings. * Learners to be shown how to carry out the process and to use simulations or test rigs to complete the process themselves. |
| * 1. The insulation requirements and system frost protection | * Learners to be able to explain the reasons for insulating hot water systems’ pipework and components (to provide frost protection, to prevent undue warming in addition to energy conservation, to prevent the wastage of water and to reduce the risk of Legionella). * Learners to be able to describe insulation types (foil-backed lagging, nitrile rubber) and areas of the building where pipework must be insulated. * Learners to be able to explain the requirements for pipework positioning to prevent undue warming, for example running hot water pipework above the cold water pipework. * Learners to know the methods of optimising the length of hot water draw-offs, including trace heating and insulated secondary circulation. * Learners to be shown examples of insulation materials and how these are used for hot water installations. |
| * 1. The positioning and fixing of pipework within the building fabric | * Learners to be able to describe the positioning and fixing of pipework within the building fabric in line with current industry requirements and applicable regulations for pipework: * under suspended timber floors * under solid floors * embedded in walls * in areas of the building subject to frost. * Learners to be able to describe how to cater for the weight distribution of cisterns and heavy components within a building. * Learners to know the requirements for notching and drilling holes in timber joists, including the maximum depth and permitted zones. * Learners to know the maximum depth of pipe chases in walls. * Learners to know the maximum pipework clipping distances for vertical and horizontal hot water system pipework as laid down in the Water Regulations. * Learners to carry out exercises to identify and describe how pipework would be installed in different parts of a building by identifying the type of building fabric and then giving reasons for their choice of installation. |
| * 1. How to install hot water systems | * Learners to know how to install the following components in compliance with the manufacturers’ instructions, industry requirements and current regulations and standards: * cylinders * water heaters * baths * plastic and copper pipework. * Learners to know how to connect hot water pipework to components. * Learners to know the requirements for pipework from a cold water storage cistern (CWSC) to a domestic hot water storage cylinder. * Learners to know the key installation features of hot water storage cylinders, including compliance with current building regulations, avoidance of parasitic circulation, stratification in hot water storage cylinders, temperature control methods – solid fuel (uncontrolled), other fuel types, thermostatic control, application of horizontal cylinders and combination cylinders. * Learners to be provided with drawings of a hot water installation and be asked to identify connections with system components and produce a fitting schedule for the installation. |
| 1. Understand the appropriate testing procedures for confirming the systems' integrity | * 1. The visual inspection of a hot water system to confirm that it is ready to be soundness tested | * Learners to be able to explain the steps taken during a visual inspection to confirm the hot water system is ready to be soundness tested. * Check that all joints have been made correctly. * Check that all pipework is secure. * Check the installation conforms to the Water Regulations. * Check any open ends of pipes have been fitted with cap ends. * Check any cisterns/cylinders are supported. * Check service valves have been fitted correctly. * Check drain-off valves have been closed off. * Check tap and cylinder connections are fully tightened. * Learners to know that any problems, such as insufficient clipping of pipes and missing or incorrectly installed service valves, should be rectified before testing begins. * Learners to review the key aspects of testing procedure and to be able to state what they think typical problems could be. |
| * 1. A soundness test to industry requirements on hot water systems pipework and components | * Learners to be able to describe a soundness test to industry requirements on hot water systems pipework and components: * visual inspection * notify occupants * initial fill * stabilisation * testing to required pressure * checking for leaks * checking pressures after test period * completing documentation and notifying as required. * Learners to be made aware of the equipment used and the types of test for both rigid metal and plastic pipework, including test pressure and test durations as laid down in the Water Regulations. * Learners to be informed of the requirements for flushing a hot water system. * Learners to be shown how to use hydraulic test equipment and given the opportunity to use the equipment themselves. * Learners to be able to state which pieces of equipment would be used and why. |