Unit 308PH: 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 understand how 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

Textbooks

* 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) (City & Guilds Textbooks)).* London: Hodder Education. ISBN 978-1-5104-1648-2
* Tanner, P. and Stephen, L. (2019) *The City & Guilds Textbook: Plumbing Book 2 for the Level 3 Apprenticeship (9189), Level 3 Advanced Technical Certificate (8202) & Level 3 Diploma (6035) (City & Guilds Textbooks).* London: Hodder Education.

ISBN 978-1-5104-1646-8

* Young, L. and Graham, M., (2000) *Water Regulations Guide*. *Water Regulations Advisory Scheme*. Stockport: WRAS.

ISBN 978-0-9539-7080-3

Websites

* [Ariston | Ariston Water Heaters](https://www.ariston.com/en-uk/products/electric-gas-water-heaters/)
* [BSI | Specifications for installations inside buildings conveying water for human consumption - Operation and maintenance](https://d.docs.live.net/0654c38050dc99c9/Desktop/Just%20Content/C%5e0G%20Apprenticeship%20Delivery%20Guides/Apprenticeship%20-%20BSE/Plumbing%20and%20heating/2%20Edited%20units%20for%20review/BSI%20|%20Specifications%20for%20installations%20inside%20buildings%20conveying%20water%20for%20human%20consumption%20-%20Operation%20and%20maintenance)
* [Grohe | Taps and valves](https://www.grohe.co.uk/en_gb/)
* [Kingspan | Hot water cylinders](https://www.kingspan.com/gb/en-gb/products/hot-water-cylinders)
* [Megaflo Unvented | Megaflo Cylinders](http://www.megaflo-unvented.co.uk/megaflo-cylinders.php)
* [Mira Showers | Homepage](https://www.mirashowers.co.uk/)
* [Pegler Yorkshire | Homepage](https://www.pegleryorkshire.co.uk/)
* [Plasson | Homepage](http://www.plasson.co.uk/)
* [Toolstation | Brassware, valves and taps](https://www.toolstation.com/plumbing/brassware-valves-taps/c183)
* [WRAS | Homepage](https://www.wras.co.uk/)

British Standards

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

Legislation

* *Building Regulations 2010 Approved Document A: Structure*.

Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6508-0

* *Building Regulations Approved Document G: Sanitation, hot water safety*

*and water efficiency*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6600-1

* [GOV.UK | Private Water Supply Regulations (Wales)](https://www.legislation.gov.uk/wsi/2017/1041/contents/made)

| **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 understand the different types of hot water systems, including direct and indirect systems and vented and unvented hot water systems. * Learners to be able to state the advantages and disadvantages of each type of hot water system and give typical applications for each. * Learners to be able to describe the advantages and disadvantages of each hot water system in relation to: * flow rates * installation cost * installation requirements * lifespan * supply pressures * suitability for the property * design requirements * energy efficiency. |
| * 1. The types and typical pipe sizes used in hot water systems within dwellings | * Learners to understand system types and typical pipe layouts and pipe sizes used in open vented and unvented systems including: * hot water systems (vented and unvented systems) direct and indirect * boilers * thermal store * instantaneous hot water heaters * single point (point of use) heaters. * Learners to be able to describe the types and typical pipe sizes used in hot water systems within dwellings including: * R250 Copper, Polybutylene * minimum pipe size for a distribution pipe from a cold-water storage cistern (22mm) * minimum pipe diameter supplying water to a combination boiler (15mm) * minimum pipe size for water supplying a bath from a vented hot water system (22mm). * Learners to be aware of the pipe sizes and materials used for unvented systems discharge pipework. |
| 1. Understand 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 aware of the working principles, including the positioning, fixing, connection and operation of the following components: * cylinders (vented and unvented) * appliances * taps, outlets and valves. * Learners to be able to identify appliances and layout features of components and accessories connected to hot water systems including: * hot water systems (vented and unvented systems) direct and indirect * boilers * thermal store * instantaneous hot water heaters * single point (point of use) heaters. * 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 including baths, basins, sinks, over the rim bidets. * taps, outlets and valves including mixer taps, bib taps, pillar taps * gate valves, float-operated valves, drain valves, servicing valves and ceramic disc taps. * Learners 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 refer to 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. |
| 1. Understand 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 be able to list the stages of filling the system with water and the additional fitting that will have to be added prior to the soundness test. * Learners to know the methods of filling and venting a hot water system including: * opening the service valve to the hot water cylinder/heater or boiler * turning on the kitchen hot tap * allowing the water to flow into the kitchen sink to clear any debris that may have collected in the pipework * closing the hot tap on the kitchen sink and allowing the system to fill to full standing pressure * opening any taps and terminal fittings fed from the system and clearing any air in the system * allowing the water to run to clear any debris. * Learners to be able to provide examples of filling and venting hot water systems in a variety of settings. * Learners to use a demonstration/test rig to complete a filling/venting task. |
| * 1. The insulation requirements and system frost protection | * Learners to be able to explain the reasons for insulating hot water systems pipework, storage systems, cisterns and components in compliance with Building Regulations: * to provide frost protection and prevent undue warming in addition to energy conservation * to prevent the wastage of water and 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 be familiar with methods of optimising the length of hot water draw-offs, including trace heating and insulated secondary circulation. |
| * 1. The positioning and fixing of pipework within the building fabric | * Learners to know the industry standard methods of connecting system pipework to the outlets and components and how to interpret typical installation drawings showing outlets identified. * Learners to know how to produce a fitting schedule. * Learners to be able to identify different types of building fabric and to know the precautions to be taken when installing pipework and components within them. * 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 including: * suspended timber floors * 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 to be covered for vertical and horizontal hot water system pipework as laid down in the Water Regulations. |
| * 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 (open vented and unvented) * baths * wash hand basin (WHB) * plastic and copper pipework. * Learners to be aware of how to connect hot water pipework to components. * Learners to be able to explain 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. |
| 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 know the process of and reasons for a visual inspection prior to filling with water and to be familiar with some of the types of problem that the inspection might uncover. * Learners to know the steps taken during a visual inspection to confirm the hot water system is ready to be soundness tested including checking: * that all joints have been made correctly * that all pipework is secure * the installation conforms to the Building Regulations * any open ends of pipes have been fitted with cap ends * any cisterns/cylinders are supported * service valves have been fitted correctly * drain off valves have been closed off * tap and cylinder connections are fully tightened. * Learners to complete a visual inspection on a test rig that has faults introduced into it. * Learners to be aware that any problems, such as insufficient clipping of pipes and missing or incorrectly installed service valves, are to be rectified before testing begins. |
| * 1. A soundness test to industry requirements on hot water systems pipework and components | * Learners to know the equipment used for pressure testing and the British Standard soundness test including stabilisation time for rigid and plastic pipe. * Learners to be able to describe a soundness test to industry requirements on hot water systems pipework and components including: * visual inspection * notifying occupants * initial fill * stabilisation * testing to required pressure * checking for leaks * checking pressures after the test period * completing documentation and notifying as required. * Learners to be made aware of the equipment used and the types of tests for both rigid 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. * Learners to be given the chance to use hydraulic test equipment in a simulated environment. |