Unit 209PH: Understand central heating systems

# Delivery guide

Unit information

The purpose of this unit is for learners to explore central heating 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 central heating systems.

Learners may be introduced to this unit by asking themselves questions such as:

* Why are there different types of central heating systems?
* How do you install a boiler/jig, radiator, radiator valves as part of a heating system?
* How do you test a central heating system?

Learning outcomes

1. Understand the applications, advantages and limitations of central heating 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 in accordance with the plumbing and heating system's design; the working environment; manufacturers' instructions
4. Understand the appropriate testing procedures for confirming the systems' integrity

Suggested resources

British Standards

BS 8558:2015 *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.*

Websites

* [GOV.UK | Structure: Approved document A](https://www.gov.uk/government/publications/structure-approved-document-a)
* [GOV.UK | Conservation of fuel and power: Approved Document L](https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l)
* [GOV.UK | Domestic Building Services Compliance Guide](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/697525/DBSCG_secure.pdf)
* [Planning Portal | Home](https://www.planningportal.co.uk/)

Manufacturers’ websites

* [HHIC | Benchmark Commissioning Servicing section](https://great-home.co.uk/pdf/Benchmark_forms_New_Gas_Boiler_Checklist_v2.pdf)
* [Vaillant | Support | Literature and manuals](https://www.vaillant.co.uk/specifiers/design-and-support/support/literature/)
* [Worcester Bosch | Support | Literature](https://www.worcester-bosch.co.uk/professional/support/literature)

Suppliers’ websites

* [BAXI | Home](https://www.baxi.co.uk/)
* [Danfoss | Home](https://www.danfoss.com/en-gb/)
* [Grundfos | Home](https://uk.grundfos.com/)
* [HETAS | Home](https://www.hetas.co.uk/)
* [Honeywell Home | Home](https://heatingcontrols.honeywellhome.com/)
* [Worcester Bosch | Home](https://www.worcester-bosch.co.uk/)

Suggested resources (continued)

Textbooks

* *HVDH Domestic heating design guide* (2021). London: Domestic Building Services Panel. ISBN 9-7819-1203-488-8
* Young, L. and Mays, G. (2000) *Water Regulations Guide*. 2nd edition. Gwent: WRAS. ISBN 978-0-95397-080-3
* 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

Suggested resources (continued)

* 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** |
| --- | --- | --- |
| 1. Understand the applications, advantages and limitations of central heating systems | * 1. The advantages and disadvantages of central heating systems | * Learners to know the purpose of central heating systems in providing thermal comfort. * Learners to be able to describe the advantages and disadvantages of the following central heating systems and layouts: * pumped heating gravity hot water * fully pumped, 2 x two-port valves (S plan) * fully pumped, 3 x two-port valves (S plan+) * fully pumped, three-port valve (mid-position/diverting) (Y/W plans) * combination boiler * system boiler * one-pipe * two-pipe * manifold (micro and minibore). * Learners to be able to explain the operating principles and the advantages and disadvantages of warm air heating, district heating and storage heaters. * Learners to be shown examples of different central heating systems and to know the features and components of each. |
| * 1. The typical pipe sizes used in central heating systems within dwellings | * Learners to be able to describe the types and typical pipe size used in domestic properties: R250 Copper, Polybutylene, Low Carbon Steel. * Learners to be shown actual examples of different types of pipe and asked to identify the size and materials and give typical uses. |
| 1. Understand the applications, advantages and limitations of appliances, components and accessories in relation to the working environment | * 1. The working principles of central heating systems types, positioning fixing, connection and operation of components | * Learners to be able to identify types and layout features of hot water systems: * pumped heating gravity hot water * fully pumped, 2 x-two port valves (S plan) * fully pumped, 3 x-two port valves (S plan+) * fully pumped, three-port valve (mid-position/diverting) (Y/W plans) * combination boiler * system boiler * one-pipe * two-pipe * manifold (micro and minibore) * underfloor heating. * Learners to be able to describe the working principles of central heating systems, positioning, fixing, connection and operation of the following components: * radiator valves (thermostatic and manual control) * automatic air vents * filling loops * pressure gauges * feed and expansion cisterns * circulating pumps * drain valves * low-loss headers * pressure relief valves * zone valves (two-port, three-port, mid-position, diverter) * programmers * timers * thermostats * frost thermostats * expansion vessels * automatic bypass valve * manifold. * Learners to recap the key operating principles of different types of heating systems. |
| **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 central heating systems | * Learners to know the methods of filling and venting a central heating system. * For open vented systems, learners to know to: * ensure that all radiator valves and radiator air-release points are closed * ensure that all motorised valves are manually set to the open position for initial system filling * turn on the service valve to the Feed and Expansion (F&E) cistern and allow the system to fill * start with the radiator furthest away on the downstairs circuit, open the radiator valves and fill and bleed the air from each radiator * check the water level in the F&E cistern. * Learners to know how to fill and vent a sealed central heating system. * Fill in short bursts via the filling loop. * Turn on the filling loop. * Fill the system up to operating pressure * Turn off the filling loop. * Bleed the air from the radiators until the pressure has depleted and then restart the process until the system is full. * Learners to understand the process of bleeding a radiator. * Learners to know how to install manual and automatic air vents on system pipework. * Learners to know how to fill and vent central heating systems in a variety of settings. * Learners to be shown how to fill and vent central heating systems and then to be asked to complete the process themselves. |
| * 1. The insulation requirements and system frost protection | * Learners to be able to explain the reasons for insulating central heating pipework to save energy, reduce CO2, improve draw-off temperature at the outlet, maintain water temperature and for frost protection. * Learners to be able to describe insulation types (foil-backed lagging, nitrile rubber) and areas of the building where pipework must be insulated, for example in lofts and under suspended floors. * Learners to know why storage cylinders and cisterns need to be insulated and how this can be done to meet building regulations. * Learners to be able to explain the requirements for pipework positioning to prevent undue warming, for example running central heating pipework away from the cold water pipework. * Learners to know the installation requirements of frost thermostats and pipe thermostats on central heating systems and where these controls may be required. * Learners to be given a number of scenarios and asked what type of insulation might be suitable and why. |
| * 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 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 and the maximum depth of pipe chases in walls. * Learners to know the maximum pipework clipping distances for vertical and horizontal central heating system pipework as laid down in current regulations. * Learners to be shown examples of parts of the fabric of a building and to be able to state how pipework would need to be installed, giving reasons why. |
| * 1. How to install central heating systems | * Learners to know how to install the following components in compliance with the manufacturers’ instructions, industry requirements and current regulations and standards: * boiler/jig * radiators (heat emitters) * radiator valves * pipework including LCS, plastic and copper. * Learners to know the bespoke tools used for the installation of domestic central heating systems. * Learners to know how to hang a radiator, including recommended heights and positioning. * Learners to know the expansion and contraction in central heating systems and negative effects and how this is catered for. * Learners to know the installation requirements for feed and expansion cisterns for open vented central heating systems. * Learners to produce a summary guide for how to install components of a central heating system. * Learners to know the standards and regulations that the installation must meet. |
| 1. Understand the appropriate testing procedures for confirming the systems' integrity | * 1. The visual inspection of a central heating system to confirm that it is ready to be soundness tested | * Learners to explain the steps taken during a visual inspection to confirm the central heating 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 regulations. * Check the drain-off valves have been closed off. * Check the radiators have been installed correctly and are level. * Learners to be aware that any problems, such as insufficient clipping of pipes, should be rectified before testing begins. * Learners to be shown the processes that need to be completed during a visual inspection and to demonstrate the process back to the group. |
| * 1. A soundness test to industry requirements on central heating systems pipework and components | * Learners to be able to describe a soundness test to industry requirements on central heating systems pipework (metal and plastic) and components, including: * visual inspection * notifying 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, including test pressure and test durations. * Learners to know flushing requirements, including the use of system additives for new and existing central heating system. * Learners to know how to use hydraulic test equipment. * Learners to be able to describe operational checks required during commissioning, including: * temperature * flow rate * pressures * operation of controls. * Learners to be shown the processes that need to be completed during a soundness check and how to use test equipment. * Learners to demonstrate the process and record key values. |