Unit 309PH: 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 understand how 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
4. Understand the appropriate testing procedures for confirming the systems’ integrity

Suggested resources

Textbooks

* *Domestic Building Services Compliance Guide* (2018). Crown Copyright.

ISBN 978-1-8594-6880-7

* *HVDH Domestic Heating Design Guide* (2021). London: Domestic Building Services Panel (DBSP).

ISBN 978-1-9120-3488-8

* 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

* [Baxi | Homepage](https://www.baxi.co.uk/)
* [Danfoss | Controls](https://www.danfoss.com/en-gb/)
* [Gas Safe Register | Homepage](https://www.gassaferegister.co.uk/)
* [Grundfos | Homepage](https://uk.grundfos.com/)
* [HETAS | Homepage](https://www.hetas.co.uk/)
* [Honeywell Home | Honeywell Controls](https://heatingcontrols.honeywellhome.com/)
* [OTFEC | Homepage](https://www.oftec.org/)
* [Planning Portal | Homepage](https://www.planningportal.co.uk/)
* [Worcester Bosch | Homepage](https://www.worcester-bosch.co.uk/)

Legislation

* *Building Regulations 2010 Approved Document A: Structure*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6508-0

* *Building Regulations 2010 Approved Document L1A: Conservation of fuel and power in new dwellings*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6743-5

* *Building Regulations 2010 Approved Document L1B: Conservation of fuel and power in existing dwellings*. Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6744-2

* [GOV.UK | Domestic Building Services Compliance Guide](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/697525/DBSCG_secure.pdf)

| **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 understand and to know 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, 3 port valve (mid position/diverting) (Y/W plans) * combination boiler * system boiler * one pipe * two pipe * manifold (micro and minibore) * district heating from the domestic perspective. * Learners to know the advantages and disadvantages of the above central heating systems in relation to: * flow rates * installation cost * installation requirements * lifespan * supply pressures * suitability for the property * design requirements * energy efficiency. * Learners to be able to explain the advantages and disadvantages of warm air heating, district heating and storage heaters. |
| * 1. The types and 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 for: * R250 Copper (10mm, 15mm, 22mm, 28mm) * Polybutylene (10mm, 15mm, 22mm) * Low Carbon Steel (LCS) (15mm, 18mm, 22mm, 28mm). |
| 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 aware of the working principles of mechanical controls and electrical controls used on central heating systems, including the positioning, fixing, connection and operation of the controls. * Learners to be able to describe the working principles of central heating systems, positioning fixing, connection and operation of the following components: * radiator valves * automatic air vents * filling loops * pressure gauges * feed and expansion cisterns * circulating pumps * drain valves * low loss headers * pressure relief valves * zone valves (2 port, 3 port, mid-position and diverter) * programmers * timers * thermostats * frost thermostats * expansion vessels * automatic bypass valves * manifolds * underfloor heating components * air separators. * Learners to be made briefly aware of the fuel types used for central heating systems and the regulatory requirements such as Gas Safe registration, Heating Equipment Testing and Approvals Scheme (HETAS) and Oil Firing Technical Association (OFTEC). * Learners to be able to explain the requirements to install magnetic filters on central heating systems. * Learners to be able to explain the principles of heat transfer and the different heat emitters available on central heating systems including: * panel radiators * LST radiators * fan convectors * plinth heaters * towel warmers. |
| 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 central heating systems | * Learners to be able to list the stages of filling and venting a system with water and the additional fitting that will have to be added prior to the soundness test. * Learners to be able to list the stages of filling and venting a central heating system. * Learners to be able to list the following stages for open vented systems: * 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 & Expansion (F&E) cistern and allow the system to fill * starting with the furthest away radiator 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 be able to explain how to fill and vent a sealed central heating system filled 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 * restart the process until the system is full. * Learners to be able to describe the process of bleeding a radiator. * Learners to know how to install manual and automatic air vents on system pipework. * Learners to be able to provide an example of filling and venting central heating systems in a variety of settings. |
| * 1. The insulation requirements and system frost protection | * Learners to be able to explain the reasons for insulating central heating pipework, storage cylinders and cisterns to comply with Building Regulations: * to save energy * reduce CO2 * improve draw off temperature at the outlet * maintain water temperature and 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 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. |
| * 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 drawing 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 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 should also be covered. * Learners to know the maximum pipework clipping distances should be covered for vertical and horizontal central heating system pipework as laid down in current regulations. |
| * 1. How to install central heating systems | * Learners to know how to install the following components in compliance with the manufacturer 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 be able to explain the importance of pump positioning on central heating systems. * Learners to understand the expansion and contraction in central heating systems, the negative effects associated with these and how this is catered for. * Learners to be able to explain the installation requirements for feed and expansion cisterns for open vented central heating systems. * Learners to be able to interpret typical installation drawings with outlets identified. * Learners to be able to explain how to produce a fitting schedule. |
| 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 know the process of and reasons for a visual inspection of a central heating system and to know the types of problem that the inspection might uncover. * Learners to be able to explain the steps taken during a visual inspection to confirm the central heating system is ready to be soundness tested including: * checking that all joints have been made correctly * checking that all pipework is secure * checking the installation conforms to the Regulations * checking drain-off valves have been closed off * checking 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. |
| * 1. A soundness test to industry requirements on central heating systems pipework and components | * Learners to know the equipment used for pressure testing and the British Standard soundness test including stabilisation time for a rigid (metal) and plastic pipe. * Learners to be able to describe a soundness test to industry requirements on central heating systems pipework and components including: * visual inspection * notify occupants * initial fill * stabilisation * test to required pressure * check for leaks * check pressures after the test period * complete documentation and notify as required. * Learners to be made of aware the equipment used, including test pressure and test durations. * Learners to know how to use hydraulic test equipment. |