Unit 318HV: Understand hot water systems for industrial and commercial buildings

# Delivery guide

Unit information

This unit covers the knowledge and understanding for the installation and operating principles of industrial and commercial hot water systems. The unit will cover both traditional open vented, unvented, storage and non-storage, localised and centralised plant hot water systems. This unit will understand the components and controls relevant to the safe and functional operation of hot water systems and the specific methods required for installing hot water system pipework. Methods for the generation of hot water using both traditional generators and energy saving alternatives will be considered. Learners will also have a basic understanding of the purpose of Building Regulation Part G3 and the impact this has on their work.

Learner’s work will be in accordance with the current versions of the appropriate industry standards and regulations; the specification; industry recognised working practices; the working environment and the natural environment.

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

* What are the advantages and limitations of hot water systems?
* What are the different types of hot water system components and how are they applied?
* What are the industry standards and regulations relevant to hot water systems in industrial and commercial buildings?

Learning outcomes

1. Understand the operation, applications, advantages, and limitations of hot water systems
2. Understand the applications, advantages and limitations of hot water system components, controls, and accessories in relation to the working environment
3. Understand the appropriate industry standards and regulations relevant to the installation of hot water systems

Suggested resources

Textbooks

* Brown, R. (2014) *BSRIA Illustrated Guide to Hot and Cold Water Services (BG 33/2014)*. Berkshire: BSRIA.  
  ISBN 978-0-8602-2736-6
* Chadderton, D. (2013) *Building Services Engineering*. Routledge. ISBN 978-0-4156-9932-7
* *HSE Legionnaires Disease. The Control of Legionella Bacteria in Water Systems. Approved Code of Practice and Guidance 2013 (L8)*. IBSN 978-0-7176-6615-7
* Lloyd, S. (1998) *BSRIA Illustrated Guide Cold Water Storage Tanks (TN 13/98)*. Berkshire: BSRIA. ISBN 978-0-8602-2504-1
* Oughton, D., Hodkinson, S. and Brailsford, R. M. (2015) *Faber and Kell’s Heating and Air-Conditioning of Buildings*. London: Routledge. ISBN 987-0-4155-2265-6

Websites

* [APHC | Support for Heating Contractors](https://www.aphc.co.uk/)
* [BEAMA | Recommended Code of Practice for Safe Water Temperatures](https://www.beama.org.uk/resourceLibrary/recommended-code-of-practice-for-safe-water-temperatures---.html)
* [Engineering Toolbox | Homepage](http://www.engineeringtoolbox.com/)
* [GOV.UK | The Water Supply (Water Fittings) Regulations 1999](https://www.legislation.gov.uk/uksi/1999/1148/contents/made)
* [Health Guidance Note | “Safe” hot water and surface temperatures 1998](http://www.wales.nhs.uk/sites3/documents/254/HGN%20Safehotw.pdf)
* [Water Regulations | Water Regulations Guide](https://www.waterregsuk.co.uk/guidance/publications/water-regulations-guide/)

British Standards

* BS EN 806:2012. *Specification for installations inside buildings conveying water for human consumption (Parts 1–5).*
* BS EN 12897:2002. *Water supply. Specification for indirectly heated unvented (closed) storage water heaters*.
* BS 1710:2014. *Specification for identification of pipelines and services, including colour bandings.*

Legislation

* *Building Regulations 2010 Approved Document G: Sanitation, hot water safety and water efficiency*. Newcastle upon Tyne: NBS. ISBN 978-1-8594-6600-1
* *Building Regulations 2010 Approved Document L2A: Conservation of fuel and power in new buildings other than dwellings. 2013 edition with 2016 amendments.* Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6745-9

* *Building Regulations 2010 Approved Document L2B: Conservation of fuel and power in existing buildings other than dwellings. 2010 edition (incorporating 2010, 2011, 2013 and 2016 amendments).* Newcastle upon Tyne: NBS.

ISBN 978-1-8594-6746-6

| **Learning outcomes** | **Criteria** | **Delivery guidance** |
| --- | --- | --- |
| 1. Understand the operation, applications, advantages and limitations of hot water systems | * 1. The working principles of hot water systems | * Learners to know the system layouts of common commercial and industrial hot water systems within the building. * Learners to be able to identify why different systems are used and their advantages including: * expansion * temperature * pressure and its effect on the boiling point of water. * Learners to understand and describe the risks associated with water under pressure, which is heated. |
| * 1. The application of hot water systems relevant to building layout and use | * Learners to know the various system layouts, and why various system types are best suited to a range of building uses and types. * Learners to know how these systems vary dependant on the building type such as: * commercial * industrial * agricultural * horticultural * leisure and entertainment * residential medical and care facilities * public services establishments and * pre-1919 traditional/historic buildings. * Learners to know the difference between storage and non-storage hot water, localised and centralised systems and how these are suited to different buildings and use. |
| * 1. The advantages and limitations of various hot water system types | * Learners to know how these systems offer advantages relevant to different applications and building types. * Learners to know the individual advantages and limitations of: * localised and centralised systems * direct * indirect * unvented * multipoint * single point * storage * non-storage. |
| * 1. The methods to protect, insulate and identify hot water pipework | * Learners to know the methods available to protect hot water pipework. * Learners to know how insulation is used to protect against heat loss and the purpose of vapour barriers and phenolic blocks. * Learners to be shown examples of sacrificial anodes used to protect against corrosion. * Learners to know the types of pipe identification methods, including the letters used to identify the system and contents to be identified. Learners to be given a test to check their understanding. * Learners to be familiar with BS 1710: 2014 – Specification for identification of pipelines and services, including colour bandings. |
| * 1. The installation requirements specific to hot water pipework within the building | * Learners to know good installation practices for the installation of hot water systems. * Learners to be shown physical examples of system installations, pipework and materials suitable for hot water and the clipping and bracket requirements for: * pipework types * clipping and bracketry * routes and positions and typical sizes. * Learners to understand how loading units and design will dictate pipe size for industrial commercial systems. |
| * 1. Types of hot water generators installed on industrial and commercial hot water systems | * Learners to know the types of storage and non-storage heat generators and the methods of heat transfer from a range of heat sources. * Learners to be shown examples of different types of heat generators and know which type of heat generator is most suited to different types of building and system. * Learners to be shown plate heat exchangers and to know how primary and secondary water is separated. * Learners to know about calorifiers and the types of heat exchanger within them along with the use of Low Temperature Hot Water (LTHW), High Temperature Hot Water (HTHW) and steam as a heat source. * Learners to know the types of fuel used to generate heat within direct hot water heaters: * storage and non-storage calorifiers * heat exchangers * multi-point/single-point * direct fire storage heaters. |
| * 1. The application and operating principles of renewable energy sources for hot water generation | * Learners to know the principles involved in energy saving hot water generation including: * solar thermal hot water systems * ground source heat pumps * air source heat pumps. * Learners to be able to explain and demonstrate system operation. * Learners to know how solar hot water collectors and associated calorifiers/cylinders are connected and controlled. * Learners to know the basic refrigeration cycle and to understand how heat is created through heat pump systems. * Learners to be shown working systems or to look at videos of working examples. |
| * 1. The advantages and limitations of renewable energy sources for hot water generation | * Learners to know the advantages and limitations of the systems discussed. * Learners to know the space requirements for systems such as Ground Source Heat Pumps (GSHP), the need for extra equipment to link these systems as part of a retrofit and the financial impacts in comparison with suggested savings. * Learners to know the term ‘coefficient of performance’ relevant to these systems and to be able to give typical examples of energy savings. |
| 1. Understand the applications, advantages and limitations of hot water system components, controls and accessories in relation to the working environment | * 1. The basic operating principles and positions of functional control components used within industrial and commercial hot water systems | * Learners to know the operation of functional controls used to control, maintain and monitor hot water systems. * Learners to know where these components are located within the system and to be shown physical examples of these. * Learners to know why these components are used and how they control pressure, temperature and water quality etc., including: * strainers * pressure reducing valves * secondary pumps * cisterns * expansion vessels * automatic valves * service valves * blending/mixing valves * sacrificial anodes * heat exchangers * buffer vessels. |
| * 1. The basic operating principles and positions of safety control components used within industrial and commercial hot water systems | * Learners to understand the difference between functional and safety controls, when relevant, to hot water systems. * Learners to know how safety controls are used to protect against dangerous situations and system damage including prevention of water exceeding 100°C. * Learners to know how these safety controls are used in both vented and unvented systems and the temperatures at which these devices operate including: * thermostats * energy cut-outs * pressure and temperature relief valves * expansion relief valves * vacuum relief valves * open vent pipes * time control devices. |
| * 1. The specialist terminal fittings installed on commercial hot water systems | * Learners to be shown examples of specialist terminal fittings and to know their advantages and limitations including: * infrared taps * concussive/percussion taps * vented taps * mixer taps. * Learners to know how they are connected including any valve and backflow requirements. * Learners to know water saving elements of these where relevant and how vented taps may lead to dripping after heating up. * Learners to be able to explain the requirements in health care premises and the types of mixer taps available. |
| * 1. The storage and delivery temperatures of industrial and commercial hot water systems | * Learners to know why temperature control is important in hot water systems and the link to bacterial growth and preventing scalding, particularly with young children and the elderly. * Learners to know the relevant temperatures of stored water, distribution (secondary circuits) and outlet temperatures at a range of outlets including those in healthcare facilities. |
| * 1. The methods used to prevent scalding | * Learners to be shown a range of mixer valves used to control hot water and discuss the differences between TMV2 and TMV3 valves. * Learners to know the relevant temperatures at both the inlet and outlet of the valve. * Learners to know other methods of protection and ways to protect users including: * thermostatic mixing valves * maximum delivery temperatures * energy cut-out devices * signage. |
| * 1. The methods used to prevent contamination | * Learners to know contamination risks and causes within hot water and the methods used to prevent this from occurring. * Learners to be shown working systems and to discuss the components and pipework arrangements within it, which have a role to play in contamination prevention including: * storage temperatures * dead legs * insulation * secondary circulation * trace heating * sacrificial anode. * Learners to understand secondary circulation and the arrangements for this including how it is controlled. * Learners to know what a dead leg is and how they should be removed and how components should be insulated to prevent cooling. * Learners to be shown examples of system corrosion, limescale and examples of sacrificial anodes used to protect against corrosion. * Learners to be able to identify where backflow prevention is required within the system to prevent contamination of other services from category 2 water. |
| * 1. The reasons for and effects of limescale within hot water systems | * Learners to be familiar with examples of scaled components within hot water systems including pipework and heat exchangers. * Learners to know the effect of this and how limescale reduces flow and heat exchange leading to wasted energy. * Learners to know how water quality and hardness leads to limescale build up and the temperatures at which limescale deposits start to increase on hot surfaces in temporary hard water areas. * Learners to be familiar with water softeners and how they can help reduce this impact. |
| 1. Understand the appropriate industry standards and regulations relevant to the installation of hot water systems | * 1. The current regulations and standards relevant to industrial and commercial hot water systems | * Learners to be able to find information regarding the installation of hot water systems. * Learners to know the specifics within these current regulations and standards and the purpose of each document including: * The Building Regulations 2010 Approved Document G3 Hot water supply and systems * The Building Regulations 2010 Approved Document L2A Conservation of fuel and power in new buildings other than dwellings * The Building Regulations 2010 Approved Document L2B Conservation of fuel and power in existing buildings other than dwellings) * BS EN 806:2012. Specification for installations inside buildings conveying water for human consumption (Parts 1–5) * BS EN 12897:2002. Water supply. Specification for indirectly heated unvented (closed) storage water heaters * Health Guidance Note: “Safe” hot water and surface temperatures 1998. * Learners to know how each document may be referred to on site and when they may be used. * Learners to examine these documents and to be given set tasks to find information within them. * Learners to be encouraged to use and refer to these documents. |
| * 1. The limitations to authority for work on hot water systems | * Learners to know the specific requirements that allows operatives to carry out work on hot water systems including unvented hot water systems. * Learners to be able to explain what a competency-based assessment – such as UHW Regulations, Building Regulation Part G3 Hot Water Certificate, and the Part L Efficiency Qualification - comprises of and how these qualifications are gained to allow operatives to work on these systems. * Learners to be shown examples of competency scheme cards etc. |