Unit 14: Low Temperature Hot Water Systems in Building Services

Delivery guidance

Your focus during delivery of this unit will be on developing the knowledge and skills that will enable learners to understand low temperature hot water systems (LTHWS) and to design such systems for a domestic property.

Approaching the unit

Illustrations, images, animations and video clips are all useful resources to explain how LTHWS work in a domestic property. Such resources can be accessed online and can be easily incorporated into your tutor presentations.

In addition to this, site visits would be of great benefit to learners, and could include a low temperature hot water control rig or a solar collector depending on typical local systems. Involving local professionals and experts from the building services engineering sector as guest speakers will be helpful to motivate learners as they gain exposure to the current practices in the industry.

You could either develop a mock project brief or adapt an actual case study/design example to be used as a learning resource ideally throughout the delivery. This would help to develop a holistic understanding of the subject among learners.

Delivering the learning aims

Throughout the delivery, you should relate the content of this unit to a number of units on this qualification, which will help to motivate learners.

Learning aim A is about not only understanding client needs and design requirements for a system – including space heating needs – but also considering factors such as efficiency, functionality and environmental issues.

You could start by introducing how LTHWS work using animations, DVDs, pictures, illustrations or web-based videos. You could then introduce an example of space heating needs of a dwelling.

Engage learners to develop an outline of a client brief and then introduce local applicable regulations and supporting calculations. Learners will need to understand the importance of assessing the practical and functional uses of the system and be able to demonstrate their problem-solving skills when considering potentially conflicting requirements or regulations.

Learners can be supported and challenged during delivery through a variety of methods – such as knowledge quiz, paired/group activities, class discussions and presentations – to provide opportunities for peer learning alongside motivating the learners.

Whether content is taught in parallel or linear sequence, you could adopt a holistic project-based approach in combining the delivery of learning aims B and C, as these have a significant overlap in terms of their content and are assessed through one assignment. You could either develop a new mock project for learners or expand upon the one developed in learning aim A.

Learning aim B is about designing an LTHW installation for a domestic property and learners will need to apply their analytical skills to meet the project requirements with the appropriate selection of components.

In learning aim C, they will be developing the specification for materials, components and equipment, including primary elements of heat generation and considering access and maintenance issues.

You would require access to relevant project information such as drawings – especially those related to component details as you would use these as learning resources – and you could contact local building services companies who may be able to help.

Finally, where possible, invite a guest speaker who could be from boiler manufacturers, green technology solution companies, gas suppliers, LTHWS installation companies or from wholesale organisations. The guest speaker should be able to share with learners the current approaches and design practices ensuring efficiency and environmental sustainability.

Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Understand the design requirements for an LTHW system	**A1** Heating requirements **A2** Design conditions **A3** External considerations **A4** Heat losses	Learners are given a client brief, which they have to analyse in terms of all of the heating and hot water requirements.
B Undertake the design of an LTHW installation for a domestic property	**B1** Pipework circuits **B2** Pumps **B3** Heat emitters **B4** Boilers and heat generators **B5** Expansion vessels **B6** Hot-water storage tanks **B7** Access and maintenance	Learners design a LTHW system for a domestic, two-storey building from given design parameters. As part of the design, learners produce a specification for all the primary elements of the LTHW system.
C Develop a specification for materials, components and ancillary equipment for a domestic LTHW system	**C1** Pipework **C2** Pumps **C3** Heat emitters **C4** Boilers **C5** Expansion vessels **C6** Hot-water storage tanks	

Assessment guidance

There are a maximum number of two summative assignments for this unit. You should set the assignment briefs within the context of a domestic property. For assignment 1, which will cover learning aim A, you should provide adequate details about the client requirements so that learners could carry out suitable evaluation. Learning aims B and C will be addressed in assignment 2, and you should include, in addition to the above, component and materials requirements.

You could ask for assessment evidence in the form of a project report and a portfolio containing drawings and specifications. Ask learners, as part of the instructions, to include sketches, illustrations and a list of information sources used.

Getting started

This provides you with a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

Unit 14: Low Temperature Hot Water Systems in Building Services
Introduction Introduce learners to the unit using animations, DVDs, pictures, illustrations or web- based videos relating LTHWS installation within a domestic property. Engage your learners during delivery through knowledge quiz, paired/group activities, class discussions and presentations as well as through guest speakers and site visits.
Learning aim A – Understand the design requirements for an LTHW system
Learning aim A1 ● You could begin with a tutor presentation to introduce the topic by showing how LTHWS work using animations, DVDs, pictures, illustrations or web-based videos. ● Following this with a tutor-led discussion, you can engage learners to consider an outline of a client brief. You could ask questions such as 'what do you think should be included in a heating system for a house' or 'would you consider minimising carbon emissions or lowering costs'? Summarise key points and add as necessary. ● Working in small groups, learners could then develop a client brief for a given scenario considering the building use, the client needs, and environmental considerations. Groups could present their recommendations to the class. ● In the following session, you can present in more detail, explaining types of systems, performance and environmental requirements, controls, external factors and sustainability. Use DVD/web-based video resources as appropriate. You can further engage learners throughout with informal question and answer (Q and A) sessions to check understanding. **Learning aim A2** ● For a group activity, issue learners a set of example project documents, including client brief, design requirements and the final design. Organise learners into groups and give each a specific topic out of the unit content for this learning aim. For example, group A to identify how performance requirements have been satisfied. All groups to share their findings. You would facilitate and add as necessary, collating group notes for the class in a shared access folder. ● Learners will need knowledge of the local building regulations and standards applicable to a domestic LTHWS design. Tutor presentation could introduce relevant local regulations, legislation as well as Standard Assessment Procedure (SAP) calculations. Use the previous example project data to provide examples of compliance – rather than reviewing extracts from specific regulations – to focus on key requirements and examples. You could provide summary handouts with key features of regulations that learners could apply to the brief. **Learning aim A3** ● You could ask learners to consider the external factors that will impact on the design of a domestic heating system. You could begin by asking learners to think about the reasons why the internal temperature of a building needs to be maintained, and then think about causes of heat losses. You could then divide learners into smaller groups to research ways in which external factors can cause buildings to either become warmer or cooler. For example, one group could consider solar gain, and another could research orientation of buildings. All groups can then share their findings. You would facilitate and add as necessary, collating

group notes for the class in a shared access folder.

Learning aim A4

- Use a knowledge quiz to check learning before starting calculations on thermal transmittance (*U*-values) and heat losses. You could use the same example project data and ask questions to assess their learning so far. Provide model answers, ask learners to do self-assessment and give constructive and developmental feedback.
- Develop task sheets for calculation of *U*-values and heat losses or daytime heat gains within a domestic property. In a tutor-led activity, do some example calculations before handing task sheets to the learners, and support learners while they are working to solve the tasks. This activity could also be conducted in small groups. Conclude this activity with learner feedback and summarise key factors for consideration.
- To review learning across this topic, you could lead a class discussion, evaluating factors to be considered while designing domestic heating systems, summarising learner feedback and expanding on key points as necessary.

Learning aim B – Undertake the design of an LTHW installation for a domestic property

Learning aims B1-B7

- You may wish to revisit the project documents analysed by groups in learning aim A, or develop a new mock project. Learners will need a range of details such as: comfort requirements, external conditions, constraints, building orientation, size of windows and openings, air infiltration rates, performance requirements and environmental considerations.
- Tutor presentations, using design examples, product videos, drawings or other interactive/graphical resources will provide underpinning knowledge about pipe sizing (B1), requirements of pumps (B2), selecting heat emitters and boilers (B3 & B4), expansion (B5) and storage (B6) as well as access arrangements (B7).
- For each of the components that form the heating and hot water system, learners will need to understand the design parameters that are applicable for each. For example, for (B1) pipework learners will need to understand the factors that ensure the circuit is efficient by considering factors such as pipe sizing calculations, flow rates, friction losses and the need to maintain a balanced system.
- Learners could be divided into smaller groups to investigate selection criteria for pumps, heat emitters, boilers and heat generators, expansion vessels and hot water storage tanks. They should consider how each of the factors in the associated unit content (B2 to B6) impact on the design of the system overall and the selection of individual components.
- Knowledge quiz: use the quiz to assess learners' understanding of design factors and components, draw on key points and summarise.
- You could then introduce learners to access and maintenance requirements (B7) and how they need to take into consideration access to valves, radiators, boilers, pipework for maintenance and adaptation when producing designs for their heating system.
- Using an example design project – from learning aim A, or the new mock project – assign small groups a design task to research and develop. For example, you could ask a group to study the pipe network and identify the sizes, flow rates and zoning. Groups will then present to their peers, justifying the design recommendations they have made.
- Develop a number of task sheets covering design exercises related to the mock project for a tutor-led activity. Demonstrate some example calculations before handing these to the learners, and support learners while they are working to solve the tasks. This activity

could also be conducted in small groups.

- Learners can then apply this knowledge analysis to produce their own design for a LTHW installation.
- Learners could prepare and present their project analysis to the class. Learners should justif design choices and update their plans following constructive and developmental feedback.

Learning aim C – Develop a specification for materials, components and ancillary equipment for a domestic LTHW system

Learning aims C1 to C6

- Review with learners the characteristics of the materials used for pipework and the types of jointing method that can be used with each type of pipe (C1). Recap with learners the sizes of pipes that are available. For each of the components that will form the LTHW system, review with learners the options that are available to them and the reasons why each may be selected. Learners could be divided into groups to investigate pumps (C2), heat emitters (C3), boilers (C4), expansion vessels (C5) and hot-water storage tanks (C6).
- Learners can then share their research with other members of the class, with research notes being placed in a shared resource.
- Continue with the same mock project as used for learning aim B. Working in small groups, allocate each group examples of materials, components and ancillary equipment and ask them to research the design specifications and present to their peers. For example, you could ask one group to study the pipe network and identify the materials and jointing methods used.
- Tutor-led practical activity: ask learners to use their design of the mock project and develop specification for materials, components and ancillary equipment.
- Develop a checklist, to support learners, based upon the unit content.
- Support learners while they are working to develop the specifications to make sure that they use the correct terminology and presentation style. This activity could also be conducted in one-to-one tutorials with the groups.
- Ask learners to present their complete design along with their specifications of mock project to the class. Learners should be able to provide evidence of extensive research carried out to finalise their choices. Ask them to justify their design choices and consider the constructive and developmental feedback they have been given.

Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 1: Construction Technology
- Unit 2: Construction Design
- Unit 3: Construction Science
- Unit 6: Construction Mathematics
- Unit 7: Graphical Detailing
- Unit 15: Measurement Techniques in Construction
- Unit 16: Provision of Primary Services in Buildings

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Internationals in Construction and the Built Environment. Check the Pearson website (http://qualifications.pearson.com/endorsed-resources) for more information as titles achieve endorsement.

Textbooks

Burberry P, *Environment and Services* (Mitchell's Building Series, 8th edition), Routledge, 2015, ISBN 9781138167780

CIBSE, *HVDH Domestic Heating Design Guide*, DBSP, 2017 ISBN 9781906846350

Hall F and Greeno R, *Building Services Handbook* (9th edition), Taylor and Francis, 2017 ISBN 9781351997973

Steele G, *Central Heating: A Design and Installation Manual* (Revised), Elsevier, 2013 ISBN 9781483105604

Journals

Building Services Engineering Research & Technology (BSERT) (Sage Publishing)

P & HE Journal, (Chartered Institute of Plumbing and Heating Engineers, CIPHE)

WPC Review Newsletter (World Plumbing Council)

Videos

YouTube: "HVAC Design, Understanding Heating, Ventilation, & Air Conditioning Systems"

Podcast: An interesting podcast titled 'All About Home Heating Systems'

Websites

The website of Chartered Institute of Building Services Engineers (CIBSE)

The website of Chartered Institute of Plumbing and Heating Engineers (CIPHE)

The website of Heating Equipment Testing & Approval Scheme (HETAS)

The website owned by building research establishment (BRE)

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling learners to access them through the school/college intranet.