Unit 331: Cold water system planning and design

Sample scheme of learning

Please revise the following text to suit your requirements.

This sample scheme of learning covers both classroom and workshop based learning for Unit 331. It is based on 90 hours over 25 sessions, plus additional hours for independent learning. Some suggestions of independent learning are made in the session plans. **This requires tutors to produce their own support material to enable the learners to achieve.**

This is only an example of a possible scheme of learning. You can use it as it is, adjust it or extract content to suit your delivery needs, or the needs of individual learners. We have endeavoured to make the schemes of learning as flexible as possible: where sessions may be taught out of order, this has been signposted. You may find it useful to use our lesson plan template to translate and adapt the sessions.

The schemes of learning are intended to be learner-focused, and they embrace current pedagogical methodology such as flipped and blended learning. They include the following types of learning tasks:

- **Pre-learning** – tasks for the learner to complete in advance of the session to allow for flipped learning
- **Active learning** – active, experiential and discovery learning approaches
- **Challenge focus** – stretching tasks to challenge more able learners
- **Independent learning** – tasks that learners can complete individually or collaboratively without tutor supervision. These tasks may be given as homework.

Reference is made within the scheme of learning to suggested learning materials and other resources required for each session. **Materials will have to be produced by the tutor prior to delivering each session**. Ideas for support material can be found on the internet, by using sites such as:

- www.tripticoplus.com
- www.asdan.org.uk
- www.quizlet.com
- www.worksheetsworks.com
- www.classtools.net

and adapting their base material to suit.

Resources consist of physical equipment required, as well as any technologies needed. Where possible we have included blended learning activities that make good use of technology so as to help centres to fulfil the minimum amount of digital teaching recommended by the government.

The scheme of learning also signposts opportunities within the unit content to introduce the following wider skills and government initiatives:

- English, mathematics and ICT
- employability skills and behaviours
- British values (including the Prevent strategy).

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Centres should also incorporate the following themes, where appropriate. Although they are not specifically referred to in the scheme of learning, City & Guilds regards these as essential in the teaching of the qualification:

- spiritual, moral, social and cultural issues
- health and safety considerations, in particular the need to impress upon learners the fact that they must preserve the health and safety of others as well as themselves
- environmental education and related European issues.

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Unit 331: Cold water system planning and design

Sample scheme of learning

Course/qualification: _____ **Tutor's name**: _____

Number of sessions: 25 **Delivery hours**: 90 **Venue**: _____ **Group**: _____

Learning outcomes:	**To enable learners to**:
• know the legislation relating to the installation and maintenance of cold water systems • understand cold water system layouts • understand requirements for backflow protection in plumbing systems • apply design techniques for cold water systems • diagnose and rectify faults in cold water systems and components • commission cold water systems and components	• understand how Water Regulations apply to everyone and how they aim to preserve the high quality of the nation's drinking water supplies • interpret plans and how cold water systems are identified within a building and their curtilages • actively apply design techniques to cold water systems and components to enable performance and operation to the standards and regulations • solve problems through diagnosis of faults in cold water systems • commission cold water systems to the required industry standard and apply processes of handover and technical communication to clients

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Sessions 1 and 2: Legislation relating to the installation and maintenance of cold water systems **Suggested Teaching Time**: 4.5 hour

Learning Outcome: 1. Know the legislation relating to the installation and maintenance of cold water systems.

- Identify legislation controlling the installation and use of water systems supplied from a water undertaker and a private source.
- Differentiate between installer and user responsibilities.
- Describe notification requirements for work on wholesome and recycled water systems to the water undertaker, building control or self-certification.

Topics: 1.1 – Cold water system legislation; 1.2 – Notification requirements

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to read section '*WRAS Publication: The Water Regulations Guide'* and look at an installation at home or work, and identify isolation valves in relation to the WRAS guide: www.wras.co.uk. Learners to **write notes** about components in their properties to bring into the lesson and discuss their location, purpose and functionality. **Active learning:** • Tutor to ask learners about the components, eg isolation valves they've found at home, at work or in their properties. Tutor will create a group **mind map**, incorporating all of the learners' observations, and then extend the **discussion** on typical domestic installation expectations and common errors, ie hot and cold wrong way round. • Tutor to show **Presentation 1** on the legislation for cold water supply, as per the handbook. • Learners to complete **Worksheet 1** individually, about a series of questions based on the regulations and standards for cold water supply. Learners to switch completed notes with the person next to them; compare findings and mark	**Materials** For the tutor to devise in advance: • **Presentation 1** • **Worksheet 1** • **Worksheet 2** • **Worksheet 3** • **Handout 1** **Resources** • Computers/phones and tablets • Private Water Supplies Regulations 2009 • Water Regulation 1999	• Tutor to create a mind map and start a discussion to check if learners have correctly identified valves. • Verify understanding of onsite communication with BCO and client. • Assess whether learners can confirm that an installation complies with the Regulations by asking questions. • Confirm learners' knowledge of the appropriate paperwork and documentation to support practical applications, by asking questions. • Review learners' response to scenario exercises and peer-assess each other's solutions using **Worksheet 2** to measure quality of observations and level of understanding. • Tutor-led and learner-led discussions on

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Key learning activity/approach	Suggested materials and resources	Skills check
answers through peer review. • Learners to get into pairs to carry out a **role play** based on the discussion from **Worksheet 2.** Tutor to create a scenario based on an old chemical works site being changed into a housing estate that is supplied by a private water supply. What procedure wold have to be followed? Scenes to include scenarios with BCO and clients, displaying effective communication and problem solving. • Tutor to facilitate a **discussion** with learners about the regulations relating to cold water supplied for domestic purposes. • Learners to explore and examine the legislation controlling the installation and use of water systems supplied from a water undertaker and from a private source by **researching some case studies online** (https://youtu.be/Ykfn_1WdGJ0 – Severn Water case studies) and making notes to present back to the class. Look at the following links to gather information: www.opsi.gov.uk/si/si2009/uksi_20093101_en_1 www.opsi.gov.uk/si/si1999/19991148.htm. • Learners to **present** findings back to the class. • Learners to complete **Worksheet 3**, which involves using a series of photographs of cold water installations. Get the learners to identify any errors and reference them with regulations. • Tutor to **state** the notification requirements for work on wholesome and recycled water systems to the water undertaker and building control or process of self-certification and answer any learners' questions.		the benefits to public health of the application of Water Regulations and how they add value to people's lives in the nation. • Tutor can ask learners key questions and ask them to write down their thoughts. Then pair them up to discuss their thoughts with one another, before asking a few groups to share their thoughts with the larger group. • After presenting the Severn Trent case studies, the tutor can introduce real case studies, as shown in **Worksheet 3**, where there are installation problems that need addressing; learners need to identify the most appropriate way of providing a satisfactory solution.

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • Learners to **write a mock letter** to the local council and ask how to notify work. Ask if they prefer a face-to-face meeting, written notification or electronic communication and photos. • More able learners to examine a **case study** exploring a specific real-life scenario by writing a **short report** on how to carry out a basic survey for a new water supply. **Independent learning:** • Learners to download Part G of the building regulations and examine 'The Water Efficiency Calculator' for new dwellings: www.planningportal.gov.uk/**buildingregulations**/approved. Learners to then **calculate** the minimum flow and pressure in peak and off-peak demand. • Learners to **research** and **compare** private water supplies legislation link for England: www.opsi.gov.uk/si/si2009/uksi_20093101_en_1. They must make comparisons on the testing regulators and individual requirements for domestic households, regarding the quality of water supply, by writing a **short summary**. • Download a free copy of the **Water Supply (Water Fittings) Regulations 1999:** www.opsi.gov.uk/si/si1999/19991148.htm. Use the document in conjunction with **Handout 1** about the WRAS guide to identify the legal requirements of the plumber, ie the reasons for the regulations and five categories of water. • Contact CIPHE: www.ciphe.org.uk and CIBSE, and explore the benefits of student membership.		

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Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about installations schedules with clients, eg when water will be turned off, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when completing the active learning exercise in **Worksheet 1**. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. • Learners demonstrate **reading** skills in the pre-learning task, as they **identify** the **correct information** to answer the comprehension questions about components found at home or in the workplace. **Maths:** • Learners will need to **calculate minimum flow and pressure** in a peak/off-peak demand, as part of the water efficiency calculator for new buildings task.	**British values:** • Remind learners about the **importance** of the **laws of England**, and their **purpose** to **protect citizens**, when applying the law regarding water quality to citizens through the application of Water Regulations, by the design of compliant pipework systems within dwellings. **Employability:** • Learners should demonstrate **self-analysis** by **identifying** the **skills** needed when communicating with public and professional bodies, eg mock letter task or contacting CIPHE, and using this to evaluate and prioritise their **own strengths** and **skill gaps** for development.

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Session 3: Layout features for multi-storey dwellings

Suggested Teaching Time: 6 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to:

- state the layout features for large scale storage cisterns
- identify water supplied directly from the main
- describe break cisterns arrangements
- define systems for drinking water provision.

Topic: 2.1 – Layout features for multi-storey dwellings

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Observe multi-storey dwellings in your local area or online and write down your thoughts about how high the cold water main would reach from the undertaker's main and how potable water could be conveyed to the top of the building. **Active learning:** • Tutor to ask learners about their thoughts regarding the process of supplying water to a multi-storey dwelling directly from the main. • Tutor to take learners on an **on-site visit or college/council building plant room** and learners to observe the boosted cold water systems operating. Take photographs and videos, and discuss with the tutor in class (could be uploaded onto centre's Moodle/VLE). • Tutor to show **Presentation 2** on the layout features for multi-storey dwellings, as per the handbook • Learners to split into groups; tutor to circulate **Handout 2**, involving a labelled diagram of a protected cistern installation,	**Materials** For the tutor to devise in advance: • **Presentation 2** • **Handout 2** • **Handout 3** **Resources:** • Computers and hand-held devices	• **Handout 2** can be used to confirm that learners are aware of the location of the fitting and isolation valves. This can be used as a model to help with solution in the case study. • Tutor can ask learners questions about the problem in the **Handout 3** scenario and ask them to write down their thoughts. • Tutor to check that more able learners provide innovative responses to research that could improve the water quality and security for the nation, by asking questions when feeding back to larger group.

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Key learning activity/approach	Suggested materials and resources	Skills check
and **discuss** the layout of large scale protected cisterns. • Learner to refer to **pre-learning exercise** in Topic 1.1 to compare components such as float valves used in their homes and in multi-storey buildings. • Tutor to **lead a discussion** on verifying the quality of wholesome water from the undertaker and at point of use from a break cistern. • Learners to split into groups and **discuss** how to communicate with the public in a **scenario** situation using **Handout 3.** This will contain a scenario of a potentially contaminated drinking water supply in a multi-storey dwelling. List out questions based on consequences and course of action. **Challenge focus:** • More able learners to get into pairs to examine a **case study** about research methods of water contamination, identification and management for residential supplies. They will need to offer answers to the problems, and then the tutor can ask them to share their thoughts with the larger group. **Independent learning:** • Learners to conduct **online research** to find out how long cold water can be stored in a break tank system.		

Opportunities to develop maths, English, ICT and wider skills:

ICT:	British values:
• Learners have the opportunity to engage in **blended learning** in	• Talk about **appropriate learner behaviour**, both at college and at

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the on-site/college visit when uploading photographs or videos, making use of the centre's Moodle or VLE. This is an example of **cloud-based** technology.	work, when conducting the on-site/college visit. • Talk about how learners might be able to **contribute positively** to **wider society** as part of the discussions about verifying the quality of wholesome water from the undertaker and at point of use from a break cistern, as it is essential that everyone in the nation can access clean potable water which promotes good health and wellbeing. **Employability:** • Learners should gain an understanding of **customer expectations** and be able to explain them as a result of case study task. They should have an idea of how to **listen to** and **meet customer demands**, as well as deal with those who are **dissatisfied**, and learn about how companies communicate with tenants to reassure them that a problem has been resolved.

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Session 4: Components of systems in multi-storey dwellings

Suggested Teaching Time: 4.5 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to:

- explain the function of components
- state operation of booster pumps
- describe self-assembly sets
- identify pressure switches, transducers, float switches and accumulators.

Topics: 2.2 – Components of systems in multi-storey dwellings

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Look at www.grundfos.com and research boosting pumps and sets for multi-storey dwellings whilst **making notes** to discuss in the session. **Active learning:** • Tutor to show **Presentation 3** about components of systems in multi-storey dwellings, as per the handbook, and then lead a **discussion** on the function of components, such as booster pumps in high-rise buildings. • Learners to complete the think-pair-share activity on **Handout 4**. This should involve learners thinking about the principles of boosted cold water systems – direct and indirect – and then getting into pairs to share their thoughts. • Learners to split into groups and tutor to circulate **Handout 5**, which has a labelled diagram of a direct boosted cold water system. Learners to **discuss** the advantages of the addition of a pressure vessel to give more options to the location of	**Materials** For the tutor to devise in advance: • **Presentation 3** • **Handout 4** • **Handout 5** • **Handout 6** • **Handout 7** • **Worksheet 4** • **Activity 1**	• Tutor to check **Handout 4** by ensuring that learners have calculated effective working head in relation to booster pump specification required. • Tutor to check for accuracy of **Handout 5** by reviewing comments and reasons for the location of certain components. Comprehension of how the system works can be presented by any of the group to the class. • Tutor to ask basic questions about **Handout 6**. These should relate to high-rise flats and how this type of system is utilised. • Tutor to ask questions on break tanks in relation to booster pumps at low level in a building. Verify the integrity and security of such a system, ie access and monitoring and what would happen if the system pump

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Key learning activity/approach	Suggested materials and resources	Skills check
certain components. **Discuss** the maintenance requirement and how to check for equal pressure throughout the system, whilst tutor goes round and monitors progress. • Tutor to lead a **discussion** based on **Handout 6**, which shows a labelled diagram of an indirect boosted cold water system. Learners to think about the functionality of this method and how to sustain equal performance. Learners to look for how to sustain equal pressure throughout the building. • Learners to split into groups with **Handout 7,** which outlines the function, capacities, design and location of accumulators in multi-storey buildings. The sizing is important, as well as the working pressure. **Discuss** the calculation and the rule of thumb method, as well as the popular inclusion of accumulators in dwellings. • Learners to stay in groups to complete **Worksheet 4,** which shows an unlabelled diagram of direct and indirect boosted cold water for learners to label. • Learners to complete **Activity 1**. This involves an unlabelled photo of boosted cold water installation for learners to identify individually, and then provide feedback to the class with results. **Challenge focus:** • More able learners to attempt the stretcher questions produced by the tutor. They should write down their answers and hand to the tutor to mark. **Independent learning:** • Learners to conduct **online research** about the application of		failed. • Tutor to check learners' comprehension of Boyle's law in relation to absolute pressure and volume regarding **Handout 7**. Check learners' feedback on types of calculations or rule of thumb. • Tutor to check that learners can define the function of components and identify key operation features/purpose within a multi-storey system in **Activity 1.** • Tutor to check that learners can identify key components on a boosted system, using a break cistern at low level, by using **Worksheet 4**. • Tutor can check more able learners' understanding by marking their answers to the stretcher questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
accumulators in multi-story dwellings and **draw up a list** of their advantages and limitations to give to the tutor to mark.		

Opportunities to develop maths, English, ICT and wider skills:

Maths: • Learners will need to **measure** the **height** of a building using kPa in relation to metres in a context of the calculation of working pressure in high-rise buildings for booster pumps in **Handout 4**. • Learners will need to **identify** and **specify** the **volume** of an accumulator in a multi-storey building context, as part of the sizing exercise in **Handout 7**. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about the application of accumulators in multi-storey dwellings.	**Employability:** • Learners can experience **working in a team** as part of the group discussions, eg when completing **Worksheet 4**. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately.

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Session 5: Water for single occupancy dwellings (Part 1) **Suggested Teaching Time**: 4.5 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to describe methods of providing private water supplies.

Topics: 2.3 – Water for single occupancy dwellings

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to **identify** locations either in their vicinity at home/work or by **research online** where boreholes or other sources of water supply residential properties. **Make notes** to bring into class. **Active learning:** • Tutor to lead a **discussion** on methods of providing water supplies, such as water pumped from boreholes, and their application rurally from learners' research. Include other sources such as surface water streams and springs. Tutor should refer to Topic 1.1 to explore legal processes involved in accessing and supplying water from these sources. • Tutor to show **Presentation 4** on water for a single occupancy dwelling, as per the handbook, covering legislation, boreholes, wells, aquifers, rivers, lowlands and springs. Learners to split into small groups and **brainstorm** details about the survey leading to the drilling of a borehole and the type of aquifer. • Learners to share their thoughts with the class, and tutor to extend **discussion** about testing the water supply and what the Regulations require. • Tutor to give learners **Handout 8**, which shows a photograph of a basic booster pump set and associated components, and	**Materials** For the tutor to devise in advance: • **Presentation 4** • **Handout 8** **Resources** • Interactive whiteboard	• Tutor to check learners' research and knowledge of borehole applications by discussing findings in class. • Tutor to ask learners to explain who to involve in the initial inspection and risk assessment, and how to categorise the water supply. • Tutor can assess whether learners can differentiate between the legal requirements of the Water Regulations and the Private Water Regulations. • Tutor to evaluate whether learners have understood the correct process in surveying the aquifer area through their feedback and ideas after the brainstorm. • Tutor's discussion can affirm whether learners know the purpose of break tanks and operation of pumping sets. • Tutor to check learners' feedback by asking questions about water quality variations, appropriate application of settlement and

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Key learning activity/approach	Suggested materials and resources	Skills check
lead a **discussion** on the use of integral break tanks and pumping sets within a private water supply. • Learners to get into pairs to complete a **think-pair-share** activity based on **Presentation 4.** They must compare and contrast the differences between a surface and submersible pumps, and **discuss** the quality variations of water from river and lowlands and the purpose of spring water settlement and collection tanks. They should then **present** their findings back to the class. • Tutor should **effectively question** learners using oral questioning. Learners can write down answers discuss and share ideas when feeding back to the class. **Challenge focus:** • More able learners to complete the '**Stretcher**' **test**. How effective is a domestic ozone generator if cryptosporidium is present in the water? Learners to give an example of an alternative component that is effective in this process. **Independent learning:** • Learners to explore the Groundwater Forum website (www.groundwateruk.org) and **research** findings from 'Groundwater Basics' on the threats to and from Groundwater. **Present** findings in the next session. • Learners to **watch** the video clip and write a **short summary** about the importance of sustainable development: www.groundwateruk.org/How-Rivers-Work-Role-of-Groundwater.aspx.		collection tanks in the think-pair-share activity. • Tutor can check answers and effectively question learners to assess learning across the topic. • Tutor can check that learners can identify the different pumping sets used in private supplies by discussing **Handout 8**.

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Opportunities to develop maths, English, ICT and wider skills:

English: • Learners can demonstrate **writing** skills when producing a short **summary** about the importance of sustainable development when watching the video. Check that learners have used **informal/formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. • **Speaking and listening** skills in **presenting** can be developed during the presentation task based on the think-pair-share activity. Learners to use the **correct format** with an **introduction**, **supporting evidence** and **statements**, and **conclusions**. They should adapt the content to **suit the audience** and **purpose**. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about water supply sources in residential properties and about ground water.	**British values:** • Talk about how learners might be able to **contribute positively** to **wider society**, as they research the importance of sustainable development. **Employability:** • Learners can experience **working in a pairs** when completing the presentation in the **think-pair-share activity**. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately.

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Session 6: Water for single occupancy dwellings (Part 2)

Suggested Teaching Time: 3 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to describe:

- methods of sterilisation and filtration
- treatment of water for private supplies.

Topics: 2.3 – Water for single occupancy dwellings

Key learning activity/approach	Suggested materials and resources	Skills check
Active learning: • Tutor to show **Presentation 5** (on water for single occupancy dwellings – water treatment and filtration) and ask learners to split into groups to **discuss** point of entry water treatment processes for single occupancy dwellings. • Learners need to compare active carbon filters with reverse osmosis and list the potential risk of microorganisms developing within the filters. They also need to highlight the qualities of reverse osmosis and speed of processing. Groups to write up their findings on a **flip chart** to **present** to the class. • Tutor can ask questions during the presentations, and **discuss** the storage of treated water and the appropriate location of cisterns. • Learners to get into pairs to **brainstorm** about disinfection. They will need to make comparisons with BS 6700 processes, and the use of domestic ozone generators and UV sterilisation units. Tutor can then discuss their thoughts as a class. • **Make a list** of all types of filtration and treatment units.	**Materials** For the tutor to devise in advance: • **Presentation 5** **Resources** • Interactive whiteboard • Flip chart • Samples of components	• Appropriate water treatment can be verified by the tutor through a group discussion with learners, highlighting key points for each type. • Tutor to check that learners can identify limitations of ozone generators by asking them questions during the **brainstorm**. • Tutor can evaluate the general range of learners' knowledge by marking their answers in the quiz on sand filtration. • Tutor can effectively question learners across the topic. • Tutor can check more able learners' understanding by reviewing answers about the advantages and disadvantages of each type of filtration and treatment units.

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Key learning activity/approach	Suggested materials and resources	Skills check
Learners to then conduct **online research** individually into one type, and write a **report** on the advantages and disadvantages, stating what the unit actually does, eg slow and rapid sand filters, pressure filters and sedimentation tanks, including the schmutzdecke process. • Tutors to effectively **question** learners using oral questioning. Learners can write down their answers, and discuss and share ideas when providing feedback to the class. **Challenge focus:** • More able learners to make a **list** of all types of filtration and treatment units. Conduct **online research** and report back on the advantages and disadvantages of each, stating what each unit actually does. **Independent learning:** • Learners to **investigate** the effectiveness of ozone generators when cryptosporidium is present and **give examples** of alternative processes to the tutor. They can turn to the relevant page of their textbooks or do online research.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** during the brainstorm sessions by **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when producing a **report** about the types of filtration and treatment units. Check that learners	**Employability:** • Learners should have an understanding of the **wider current issues** in the plumbing industry from researching the effectiveness of ozone generators when cryptosporidium is present.

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have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about the types of filtration and treatment units and ozone generators when cryptosporidium is present.	

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Session 7: Components used for private water supplies to single occupancy dwellings

Suggested Teaching Time: 3 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to:

- explain the operation methods of components used in boosted cold water supplies
- describe small booster sets and separate controls
- explain the use of accumulators in increasing system flow rate.

Topics: 2.4 – Components used for single occupancy dwellings

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to conduct **online research** using www.Baxi.co.uk to find out about the application of accumulators in domestic dwellings. They should **write notes** and bring them into the session to discuss their findings. **Active learning:** • Tutor to show **Presentation 6** on components used in single occupancy dwellings and lead a **discussion** on boreholes with pressure control in conjunction with a submersible pump or surface mounted pump. • Learners to get into pairs and **explain** the operation of borehole installation with pressure control to each other. Tutor to then ask questions and **discuss** boreholes with level control slides, storage cistern monitored with a float switch to gravity, kitchen sink supply indirect. • Learners to identify the difference in application from pressure control, whereas the kitchen sink cannot be directly supplied from borehole. • Learners to get into groups and **discuss** level and pressure controls from streams and springs. Learners to show clear	**Materials** For the tutor to devise in advance: • **Presentation 6** **Resources** • Interactive whiteboard	• Tutor to verify learners' answers and range of their responses during discussions in class. • Tutor to check learners' understanding by examining the leaflets about the function and advantages of an accumulator, and give information, advice and guidance where appropriate. • Tutor to check more able learners' understanding by reviewing responses to the questions about the advantages of an accumulator on a private water supply.

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Key learning activity/approach	Suggested materials and resources	Skills check
difference in operation method between level and pressure controls. **Challenge focus:** • More able learners to complete tutor questions about the advantages of an accumulator on a private water supply. Learners to review notes from peer feedback. **Independent learning:** • Learners to get into pairs again and **create a leaflet** about the function and advantages of an accumulator in a private water supply (can refer to web pages).		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated during the **discussions** by **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when producing a **leaflet** about the function and advantage of an accumulator in a private water supply. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about the application of accumulators in domestic dwellings.	**Employability:** • Learners should gain an understanding of the **wider** plumbing **industry** when they are introduced to the **range of job roles** during the tutorial about the benefits of being qualified and gaining work experience in the common area of control of systems, alternative water supplies, and knowledge of pressure and switches in the control system.

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Session 8: Specialist cold water system components

Suggested Teaching Time: 3 hours

Learning Outcome: 2. Understand cold water system layouts

By the end of the session, learners will be able to:

- determine working principles of specialist components
- explain their use in overcoming the effects of pressure and temperature control in pressure and temperature
- effects caused by the installation of backflow devices.

Topics: 2.5 – Specialist components for cold water systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to look at home to **identify** bath and basin taps, and shower controls to discover if they are thermostatically controlled, eg learners can check showers to investigate operation of taps (non-concussive) and urinals to see how the flushing system works. Learners should **take photos and videos** of components in operation and bring them to the session. **Active learning:** • Tutor to show **Presentation 7** on specialist components for cold water systems, as per handbook, and lead a **discussion** about infra-red taps. Learners to explain the typical location and operation principle of this process by using their own photos and information. • Learners to get into groups to discuss the requirements of checking valves to shower mixers and **make a presentation**. Describe energy-efficient operation of washbasin spray taps and any other water conservation controls from urinals in college or the workplace. • Learners to get into pairs for the **think-pair-share** activity	**Materials** For the tutor to devise in advance: • **Presentation 7** **Resources** • Interactive whiteboard • Computers and hand-held devices • Photos and videos from home • CIPHE plumbing engineering service design (library) • Manufacturer's instructions • Stuart Pumps	• Tutor-led discussion on pre-learning exercise, check by tutor and help with identifying and organising information into photo reel sequence or video clip editing. • Group discussion for tutor to confirm accuracy of information and learners' knowledge of typical applications. Relate to pre-learning where appropriate. • Think-pair-share activity for tutor to confirm correct identification of components. Refer to manufacturer's instructions. • Tutor-led discussion where tutor can ask learners questions about terminology, ie upstream and downstream, to confirm understanding • Tutor to assess correct areas of research and information and case studies relevant to UK market.

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Key learning activity/approach	Suggested materials and resources	Skills check
and identify shower pumps – either twin or single impeller in bathroom installation. Some pre-learning references may be used by different learners. (See www.stuart-turner.co.uk/products and www.salamanderpumps.co.uk/.) • Learners to describe the purpose and function of a pressure reducing valve and its location within a dwelling, eg at entry of house or at appliance, in a tutor-led **discussion.** • **Learners** to use computers to look online for shock arrestors and mini expansion vessels using the CIPHE guide. They need to describe the problems and how they would solve them in plumbing installation, when providing feedback to the class. • Learners to respond to questions in pairs and provide feedback with their experiences from the pre-learning survey. **Challenge focus:** • More able learners to solve the problem of water hammer complaint from scenario, using information. **Independent learning:** • Learners to **read** CIPHE plumbing engineering service design guide manual and make notes. They can also turn to the relevant page in their textbooks, regarding acoustic transmission within buildings. (See http://media.wattswater.com/F-WHA.pdf and www.zilmet.co.uk/uploads/documents/27/INOX_PRO_V2.pdf.)		

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Opportunities to develop maths, English, ICT and wider skills:

English: • Learners to use **reading** skills in the independent learning task to **evaluate** the options given for acoustic transmission through components and pipework leading to water hammer. **ICT:** • Learners have the opportunity to engage in **blended learning** in the research of shock arrestor task, which makes use of case studies and manufacturer's instructions, and share information via email or in the college cloud (Moodle, etc). This is an example of **collaborative** technology.	**Employability:** • Learners can demonstrate their ability to **analyse problems** by **gathering**, **observing** and **analysing information** to increase their understanding of problems with shock arrestors and mini expansion vessels. Encourage learners to consider **different perspectives**, **define the problem** and **identify probable causes**. • Learners to suggest various **potential solutions** to the problems they identify with shock arrestors and mini expansion vessels, and **judge** if the proposed solutions will work or not. Encourage them to work out how to **prevent** the problem occurring in future.

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Session 9: Terminology

Suggested Teaching Time: 3 hours

Learning Outcome: 3. Understand requirements for backflow protection in plumbing systems

By the end of the session, learners to define terminology when selecting backflow devices, including:

- point of use protection
- whole site protection
- interpret five fluid risk categories.

Topics: 3.1 – Terminology

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Leaners to **make notes** about fluid categories as stated in Topic 1.1 and check which backflow devices are appropriate for each risk category. Learners should write down their thoughts about the risk category for their kitchen sink at home. **Active learning:** • Tutor to show **Presentation 8** on the requirements for backflow protection in plumbing systems (terminology) and lead a **discussion**. This can be an overview of water industry legislation, and learners can recall key information regarding the Water Act 2003, Water Regulations 1999 and the Private Supplies Regulations 2009. • Learners to get into pairs to **identify and explain** causes of contamination, wastage, misuse, undue consumption and erroneous measurement of water and typical causes. They can **write notes** and provide feedback to the rest of the class. • Learners to then lead the session by staying in pairs to describe backflow and back-siphoinage risk in a house. They can refer to the pre-learning exercise, when surveying their	**Materials** For the tutor to devise in advance: • **Presentation 8** • **Worksheet 5** **Resources** • Interactive whiteboard • Computers and hand-held devices	• Tutor to check accuracy of response form learners in discussions. • Tutor to confirm clear identification of categories and typical causes in group discussion. • Tutor to verify learners' evidence in relation to pre-learning experiences in group work. • Tutor to lead discussion on operation range and purpose of RPZ, and confirm with learners • Tutor to examine quality of feedback in relation to examples shown in online research presentation activity. • Group discussion to confirm learners' knowledge of application and purpose of prevention. • Tutor to assess and confirm range of learners' responses to questioning. • Tutor to assess more able learners in

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Key learning activity/approach	Suggested materials and resources	Skills check
own homes (can refer to information on the web or regulations). • Tutor to lead **discussion** for learners to identify whole site or zone protection where there is a high risk of contamination, even though the installation meets standards, and examine the purpose of a reduced pressure zone (RPZ). • Learners to get into pairs and conduct **online research** (using hand-held devices or computer) to identify applications of zoned protection in domestic environments or commercial installations. **Present** ideas and images back to the class – could be via upload to Moodle/VLE. Examples could include an RPZ fitted to point of entry in block of flats next to a chemical factory or zoned protection for individual flats in multi-storey housing. • **Group discussion** on domestic installation of hose union, mixer tap, globe tap, shower or combination boiler. Learners can recall this common application from surveys, and identify the category of risk and the protection required to prevent back-siphonage. • Learners to respond to questions in pairs and provide feedback with their experiences from pre-learning survey. **Challenge focus:** • More able learners to create an **online journal** to college media, ie Moodle, to record their opinions and experiences regarding protection of water supplies. Use pre-learning exercise form home to college survey of appliances. This is to be discussed and presented at tutorials and course review. **Independent learning:** • Learners to complete **Worksheet 5** on terminologies in cold water systems in preparation for sessions 10 and 11. This should involve a list of 'terminology' for which learners need to		blended learning activity in a tutorial. • Tutor to use **Worksheet 5** to identify terminology in preparation for the next sessions.

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Key learning activity/approach	Suggested materials and resources	Skills check
provide a definition, including: fluid category, dwelling, supply pipe, backflow, spill over level, etc.		

Opportunities to develop maths, English, ICT and wider skills:

English: • More able learners to demonstrate the **writing** skills of **planning** and **drafting** in the Moodle blog task. • **Speaking and listening** skills in **presenting** can be developed for more able learners during the Moodle blog feedback task. Learners to use the **correct format** with an **introduction**, **supporting evidence** and **statements**, and **conclusions**. They should adapt the content to **suit the audience** and **purpose**. **ICT:** • Learners have the opportunity to engage in **blended learning** when researching applications of zoned protection in domestic environments or commercial installations, which makes use of online and personal digital information. This is an example of **collaborative** technology.	**British values:** • Talk about how learners might be able to **contribute positively** to **wider society** as part of the discussion about causes of contamination, wastage, misuse, undue consumption and erroneous measurement of water and typical causes.

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Session 10: Non-mechanical backflow prevention

Suggested Teaching Time: 3 hours

Learning Outcome: 3. Understand requirements for backflow protection in plumbing systems

Learners to identify the installation situations in which non-mechanical backflow devices may be used.

Topics: 3.2 – Non-mechanical backflow prevention

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners should have completed **Worksheet 5** from the previous session. This relates to the aim of learners creating their own plumbing dictionary. Learners to **create their own dictionary** of plumbing with definitions, notes and photos – even videos – with the aim to collaborate with others to produce definitive reference guide. Post on the centre's Moodle/VLE and **present** to other learners during tutorials. **Active learning:** • Learners to get into pairs and describe how back-pressure and back-siphonage are caused, and give examples derived from their own research surveys. Tutor to show **Presentation 9** on the requirements for backflow protection in plumbing systems (non-mechanical backflow protection). • Tutor to ask learners where they should propose the installation situations in which non-mechanical backflow prevention devices may be used. Learners should **explain** the purpose of an air gap and why there are a range of different measurements for different applications. • Learners to get into small groups to **discuss** and draw a **mind map** of their thoughts about a typical application, stating the fluid category protection in commercial and	**Materials** For the tutor to devise in advance: • **Presentation 9** • **Handout 9** **Resources** • Interactive whiteboard • Computers • WRAS guide	• Tutor to check learners' dictionaries for accuracy by reviewing Moodle activity and commenting where appropriate. • Tutor to check accurate feedback form learners and whether they give clear and relevant examples in group discussions. • Pairs of learners correctly identify AA, AB, AD and AG gaps in domestic and commercial environments. Tutor to check use of photos or WRAS guide references and **Handout 9** about non-mechanical backflow protection. • Tutor to check that learners offer accurate examples and purpose of AUK gaps in common domestic situations, using photos or notes form surveys if possible. • Tutor to check that learners confirm the importance of correct specification of air gap, especially at domestic kitchen sink with the potential of category 5 water risk. • Tutor to ensure that learners give reasons for the importance of being qualified and gaining meaningful work experience

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Key learning activity/approach	Suggested materials and resources	Skills check
agricultural environments on drinking trough (can use the WRAS guide and **Handout 9**, which involves learners filling in a blank table with a variety of the non-mechanical backflow protection). They can also look at when a type AB air gap with a weir overflow is utilised in a dental surgery and an AD air gap with an injector is applied commercial laundry installation. • Learners to feed back their **mind maps** to the class. Tutor to ask learners to describe an AG air gap and give examples of its common use in Feed and Expansion cisterns (FE) on pumped heating circuits. • Tutor to lead **discussion** on the typical applications of AUK air gaps in relation to fluid categories, outlet size and distances above spill over level. Reference to pre-learning surveys and own survey at home in previous sessions, and make notes on the positions of taps at basins, baths and sinks in your home. • Tutor to discuss, as part of the pre-learning to Topic 1.1, by giving examples about common application for AUK 1 air gap with interposed cistern found on WC, where the cistern has an AG air gap and overflow, as it contains fluid category 1 and the pan is category 5. • Tutor lead learner **discussion** to describe the purpose and application AUK 2 air gaps on washbasin and over rim bidets located in bathrooms, and AUK 3 air gaps for taps located at a kitchen sink where category 5 water can be present because of food preparation. • Group **tutorial** to talk about the benefits of being qualified and gaining work experience in the common area of tap and cistern work with regard to improving employability and harmonising with British values. • Learners to answer questions in pairs, and tutor to go		applying knowledge of water regulations through discussion. • Tutor to check learners' responses to assessed quiz in **Presentation**. • Tutor to ensure that more able learners provide examples of DC pipe interrupter applications with critical dimension and comments about their findings.

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Key learning activity/approach	Suggested materials and resources	Skills check
through answers at the end of the session. **Challenge focus:** • Tutor to discuss DC pipe interrupter and more able learners to provide visual examples of the device from college environment or from online images. Provide critical distances and positioning. **Independent learning:** • Learners to **research** manufacturers of appliance components and see how they have added technical notes and any modifications to comply with the Water Regulations and WRAS fitting guide. Make comments and share opinions in tutorial sessions about how commercially competitive a company is in relation to the quality of information provided.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** in the tutorial about being qualified and gaining work, **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology. • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources	**British values:** • Talk about how learners may come into contact with wider **public institutions**, such as the local government building control officers, the need for learners to **respect** them, and why they are **important** in in monitoring and maintaining quality and control of water services in dwellings. **Employability:** • Learners can experience **working in a team** as part of the group mind map task. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately. • Learners should gain an understanding of the **wider** plumbing

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that provide suitable information about manufacturers of appliance components.	**industry** when they are introduced to the **range of job roles** during the tutorial about the benefits of being qualified and gaining work experience in the common area of tap and cistern work.

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Session 11: Mechanical backflow protection and preventing cross connection **Suggested Teaching Time**: 4.5 hours

Learning Outcome: 3. Understand requirements for backflow protection in plumbing systems

Learners are required to identify installation situations in which backflow prevention devices may be used and determine methods of preventing cross connection.

Topics: 3.3 – Mechanical backflow prevention; 3.4 – Preventing cross connection

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Conduct some **online research** to help explain common location and purpose of the CA device/valve, and **make notes** to bring into the session. **Active learning:** • Tutor to show **Presentation 10** on requirements for backflow protection in plumbing systems (mechanical backflow protection) and lead a **discussion**, so learners can identify mechanical backflow devices, and propose the installation situations that may be used. • Learners to read **Handouts 10**, which shows a table with pictures/diagrams/symbols of all mechanical backflow devices, as well as **Handouts 11** and **12**. • Learners to then get into pairs and **explain** the purpose and function of a BA valve to each other, ie reduced pressure valve (RPZ) and an example of its location within a building. Can refer to the Honeywell RPZ video resource: https://youtu.be/5u6O2oCQqZM?t=10. • Tutor to lead a discussion to **describe** the advantages of being able to install an RPZ valve; check out Southern Water RPZ info in class. • Tutor to describe how the valve operates and give details on	**Materials** For the tutor to devise in advance: • **Presentation 10** • **Worksheet 6** • **Handout 10** • **Handout 11** • **Handout 12** • **Handout 13** • **Activity 2**	• Tutor to confirm the correct identification of mechanical backflow devices and protection category in the tutor-led discussion. • Tutor to verify learners' understanding of the pressure zones within the BA valve by asking questions when giving details. • Tutor to check learners' understanding of the application of a permanent CA device when removable filling loops are mentioned in the online research task. • Tutor to check that learners know the advantages of the DB pipe interrupter compared with other devices located externally**.** Confirm that learners also know the meaning of verifiable EA and the ability to test the installation with this component. • Tutor to verify that learners are aware of the importance of protection with bidet installations. • Tutor to assess knowledge of EC and ED operation and function, application and link

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Key learning activity/approach	Suggested materials and resources	Skills check
training required to service and test them: www.southernwater.co.uk/rpz-valves. • Learners will need to compare advantages of the permanent fitting with a removable filling loop (can use manufacturer's instructions). • Learners then to match up with another pair to form a small group, and specify a DB pipe interrupter and **discuss** why it is a frost resistant device. • Tutor to give details on an EA and EB non-verifiable and verifiable single check valves, stating the difference between them and relevant British standards. Learners to write a **short report** on how these devices operate and give typical applications to comply with the Water Regulations. • Tutor to then lead a **discussion** with learners, specifying the purpose of EC verifiable and ED non-verifiable double check valves, how they operate, advantages and disadvantages, and where they can be used in a domestic environment. • As part of preparation for Topic 3.4, learners can **identify** suitable locations and purpose of an HA hose union backflow protector in an outside location, as well as giving details as to why an HUK 1 hose union bib tap is a common component serving a garden or recreation area. • Learners to complete **Activity 2,** which shows blank diagrams for learners to identify backflow prevention situations, and discuss answers in pairs before feeding back to the rest of the class. • Learners can prepare for Topic 3.4 by explaining the typical location and purpose of an HC diverter valve in pairs before the tutor asks them to provide feedback to the class. **Challenge focus:** • More able learners to complete written questions based on backflow prevention. Learners to give a clear explanation		to Unit 333 as part of a temporary filling loop. • Tutor to assess learners' understanding of the correct specification for an HA hose union backflow protector, backflow devices located within the envelope of the building and limitations of HUK 1 with a single check valve incorporated. Ensure accurate knowledge of locations for Topic 3.4. • Tutor to monitor learners' understanding in the online research activity and check that they can explain function of valve and relate to common domestic environments, by asking questions.. • Tutor to confirm accuracy of learners' responses to oral questions. • Tutor to verify independent designs in the scenario task to confirm learners' understanding of appropriate pipe labelling, location of components and practicality of design. • Examine practical and effective installation application which complies with Regulations.

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Key learning activity/approach	Suggested materials and resources	Skills check
about the performance range of an RPZ valve. **Independent learning:** • Learners to complete a **scenario** offered by the tutor in preparation as part of a synoptic assessment: '*The installation comprises of a ground floor flat with a WC, a washbasin, a bath with a shower mixer and a kitchen sink.* ***Draw*** *a simple plan line diagram (not to scale) of pipework routes for a cold water installation*.' Tutors to give learners **Handout 13** as a reference, which lists the identification markings for pipework, making reference to BS1710. • Learners to select components and include a pressure reducing valve after the main stop valve. They will need to specify the correct backflow prevention devices for each of the outlets.		

Opportunities to develop maths, English, ICT and wider skills:

English: • Learners can demonstrate **writing** skills when producing a **short report** about EA and EB non-verifiable and verifiable single check valves. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. • **Speaking and listening** skills can be demonstrated in developing the various **discussions** about mechanical backflow prevention and cross connection, **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**.	**British values:** • Talk about how learners may come into contact with wider **public institutions**, such as the Water Regulations, the need for learners to **respect** them, and why they are **important** with regard to EA and EB non-verifiable and verifiable single check valves. **Employability:** • Learners can experience **working in a team** as part of the design group. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately by presenting and sharing designs and other ideas.

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ICT: • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about specific CA valves.	

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Session 12: Information sources

Suggested Teaching Time: 3 hours

Learning Outcome: 4. Apply design techniques for cold water systems

Learner will locate, interpret and use information sources when undertaking design work on cold water systems.

Topics: 4.1 – Information sources

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to access: www.planningportal.gov.uk/buildingregulations to read approved document G3 in relation to water services within a dwelling. **Active learning:** • Learners to **identify** information sources when undertaking design work on cold water systems, such as statutory regulations, industry standards, manufacturer's technical instructions, and verbal and written feedback from the customer, from **Presentation 11** on applying design techniques for cold water systems (information sources). • Tutor to circulate **Handout 14,** which outlines the importance of BS 806 and its five parts; also includes the link to BS 8558. • Learners to get into small groups to **brainstorm.** They should **discuss** the importance of discovering customers' needs and how to interpret that into a particular job, with regard to initial survey, planning and advising on potential changes to schedule. They should then give examples of how they would begin to discover customer needs and effectively deal with their feedback. • Learners to search on www.planningportal.gov.uk to list out the building regulations affecting an installation. • Tutor to revisit the Water Regulation requirements and recall	**Materials** For the tutor to devise in advance: • **Presentation 11** • **Worksheet 7** • **Handout 14** **Resources** • Interactive whiteboard • Computers	• Tutor to confirm accuracy of feedback from learners by reviewing clear and relevant examples of how to research each topic. • Tutor to check learners' thoughts by monitoring discussions during the brainstorm task. • Tutor to verify access methodology and identification of the five major reasons for Water Regulation, and assess learners' awareness of important link of Part L to Unit 335, by asking questions. • Tutor to monitor progress of learners during group discussions by observing, asking and answering questions. • Tutor to check that learners use correct app/online tools to research radiator sizing tool effectively. • Tutor to observe learners' role play, and offer feedback and suggestions where appropriate. • Tutor to confirm accuracy of learners' responses to questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
the reason for their application to building design. • Learners to get into pairs and explain how to assess the suitability of system by testing existing pipework and component performance, and assess the environmental impact of any new planned system. • Tutor to identify manufacturer's literature relating to installation, including the legal requirements and the customer's preferences, and also identify specific appliance performance. • Tutor to **discuss** the cost-effectiveness of a specified appliance in relation to the outcome of a survey. Learners to conduct **online research** or use an app to find a radiator sizing tool, eg app to help specify appliances: www.buildersmerchantsjournal.net/news/news.asp?id=7292&title=Plumb+Center+launches+iPhone+App and an example link to size appliances: www.homesupply.co.uk/radiator_output_calculator.php. • Learners to get into pairs to **brainstorm** about the types of customer communication, advantages of each method and dealing with their feedback before feeding back to the class. Perform a **role play** to show best communication with customer. • Learners to complete written questions in pairs, and tutor to go through answers at the end of the session. **Challenge focus:** • More able learners to **plan** and **estimate** the price of a cold water installation of pipework and fittings to your kitchen sink at home, starting from the internal stop valve. Draw on a sheet of paper and label components. Research prices online.		

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Key learning activity/approach	Suggested materials and resources	Skills check
Independent learning: • Learners to complete **Worksheet 7** at home. This worksheet is based on creating a list of key factors around planning and quoting for an installation, eg customer needs, layout of the building, etc.		

Opportunities to develop maths, English, ICT and wider skills:

English: • Learners demonstrate the **writing** skills in letter and emails **when communicating** in the feedback from **customer exercise** task. • **Speaking and listening** skills can be demonstrated in a role play **discussion** when communicating with a customer by **giving an opinion or offering a solution,** as well as **allowing** and **responding** to **customers' preferences and their opinions** about a job. • More able learners demonstrate the **writing** skills of **planning** and **drafting** in cold water installation price researching task.	**British values:** • Talk about how learners may come into contact with wider **public institutions**, such as the Water Regulations, the need for learners to **respect** them, and why they are **important** with regard to the application to building design. **Employability:** • Learners show an understanding of the **wider** aspects of the **industry** when they are introduced to the **range of job roles** during the initial survey, by referencing manufacturer's information and building/water regulations. • Learners should demonstrate they can **actively listen** to a customer during their feedback, **understand** what has been said and **respond/act** accordingly by offering a solution or showing flexibility in responding to their request. Learners should be encouraged to use techniques to ensure that they understand the commercial benefits to a company through polite and professional communication with customers. • More able learners should gain **commercial awareness**, and an understanding of how to **identify competitors** and their **performance** in the plumbing industry, during the cold water installation price researching task. More able learners can be encouraged to **assess** and **compare competitors**.

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Session 13: Taking measurements

Suggested Teaching Time: 4.5 hours

Learning Outcome: 4. Apply design techniques for cold water systems

Learner to take measurements of building features, carry out design calculations and take measurements from plans, drawings, specifications and from on-site.

Topics: 4.2 – Taking Measurements

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to **take measurements** of building features in order to carry out design calculation directly from architect's scale drawings or from on site, or download from internet. Bring in findings into class for discussion. **Active learning:** • Tutor to show **Presentation 12** about applying design techniques for cold water systems (measurement and design calculations). Determine the purpose of scale on a drawing, and show learners how to use a scale ruler before trying it themselves. • Learners to identify the key features of a drawing and what information is contained, eg the legend and its content, the architect who drew it, the scale, the name of the drawing, what the drawing shows and any notes that should be considered by the person using the drawing, etc. • Learners to split into groups and **brainstorm** the range of scales used in drawings, and how they are typically applied, before feeding back to the class. • Tutor to demonstrate how to apply the scale rule to a drawing in order to determine the actual size. • Learners to **design their own drawings** of a pipe run in a	**Materials** For the tutor to devise in advance: • **Presentation 12** **Resources** • Computers • Scale rules • Copies of architect's drawings	• Tutor to assess learners' feedback on examples and provide feedback on their working drawings. • Tutor to check learners' examples relevant to site, ie 1:1000 site plans – 1:50 plans and elevations. • Tutor to check that learners have correctly identified the differences of measuring devices and give reasons for their preferences in the mind map task. • Tutor to check learners' answers in tutor-led discussion, eg small jobs require notes, larger ones more details, such as a work programme where the contractor can determine dates and times, and monitor progress of other trades involved. • Tutor to confirm accuracy of learners' responses to quiz questions. • Tutor to check that more able learners have answered the additional pre-set questions correctly, by marking the answers.

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Key learning activity/approach	Suggested materials and resources	Skills check
dwelling with scale set, verifying actual scale with design requirement. • Learners to get into pairs to **identify** the differences of measuring devices (eg architect's tape measure, standard tape measure, electronic laser measure, etc) and give reasons for their preferences by drawing a **mind map**, providing feedback to the class. • Tutor to **explain** the measurement of area and volume of an appliance and weight when it is operating. Tutor should explain manufacturer's instruction regarding location, access and maintenance. • Tutor to lead a **discussion** by describing the design and planning for small and large jobs. Ask learners their thoughts about differentiating between engineer's notes, job specification, time sheets and works programmes. • Tutor to **describe** the function of a work programme and the benefits to a contractor on site. • Learners to answer questions in pairs, and tutor to go through answers at the end of the session. **Challenge focus:** • More able learners to complete additional pre-set questions involving volume weight location and weight of appliances with reference to the regulations. Write down the answers and hand them to the tutor for marking. **Independent learning:** • Learners to write a **short summary** describing what CAD is, and how 3D drawings can benefit the customer. They need to explain digital virtual tours and specialist computer software, and provide some examples, as well as giving details about design reference resources.		• Tutor to review short summary about CAD and 3D tour resources for enhancing design conceptualisation for end user. Make sure that learners have highlighted the convenience of phone apps for specification from manufacturers and retailers; explain computer software, ie Sketchup 8 and Navisworks.

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Opportunities to develop maths, English, ICT and wider skills:

English: • Learners can demonstrate **writing** skills when producing a **short summary** about CAD and how 3D drawings can benefit the customer. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **Maths:** • Learners will need to **measure length/width/height** of an appliance in design context, as part of Topic 4.2. • Learners to practise creating, using and performing calculations with **percentages** as part of scale drawings exercise. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about CAD and 3D drawings.	**Employability:** • Learners should gain an understanding of the **wider** construction **industry** when they are introduced to the **range of job roles** during the analysis of an on-site works programme. • Learners should gain an understanding of **customer expectations** and be able to explain them as a result of researching how CAD and 3D drawings can benefit the customer. They should have an idea of how to **listen to** and **meet customer demands**, as well as dealing with those who are **dissatisfied**.

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Session 14: Calculating component size

Suggested Teaching Time: 6 hours

Learning Outcome: 4. Apply design techniques for cold water systems

Calculate the size of cold water system components in single occupancy dwellings, including cisterns, pipework, pumps and pressure vessels.

Topics: 4.3 – Calculating component size

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to join 'Copper Club' for free at copperplumbing.org.uk, and read the sessions on installation before class. **Active learning:** • Tutor to show **Presentation 13** on applying design techniques for cold water systems (calculating component sizes). • Tutor to download and print off leaflet from UK copper board; hand it out to learners to read and research topics on the web page strapline: http://copperplumbing.org.uk/node/558. • Learners to **draw** a basic pre-set example and refer to loading units criteria BS 6700. Separate cold from hot water demand and calculate loading units; can refer to **Handout 15,** explaining pressure loss through float valves. • Learners to then use a calculated figure and use a rule to calculate flow rate. • Learners to complete **Worksheet 9** in pairs. This is based on a diagram of a basic ground and first floor installation fed from the mains; learners will need to calculate pipe sizing. Tutor to then go through answers as a class. • Learners to complete pre-set loading units exercise as a class with tutor's explanation. • Learners to get into pairs to begin an exercise to work out	**Materials** For the tutor to devise in advance: • **Presentation 13** • **Handout 15** • **Worksheet 8** • **Worksheet 9** **Resources** • BS EN 8558 • BS EN 806 • BS 6700 • CIPHE design guide • Pen • Pencil • Plain drawing paper • Rule • Set square	• Tutor to verify feedback from learners, giving details about the superseded BS 6700 still being relevant for: testing, flushing and disinfection of new systems. • Tutor to check learners' knowledge of UK copper board design information (see link). • Tutor to check for evidence of accurate drawing and proof of correct calculation. Check for accurate use of rule on scale from BS 6700 to determine flow rate in l/s in relation to loading units required • Tutor to check learners' answers for **Worksheet 9** by going through answers as a class.. • Tutor to check learners' understanding by observing progress during calculating loading unit exercises and asking questions. • Tutor to check learners' drawings and ensure that they use equipment correctly by observation, and provide feedback to learners on calculations and decisions. • Tutor to observe learners during the think-

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Key learning activity/approach	Suggested materials and resources	Skills check
incoming main for itemised appliances in a two-storey dwelling. They will need to determine loading units and apply process of rule to graphs and charts to determine incoming pipe size. • Tutor to lead a **discussion** to determine cold distribution pipe from the cistern within the dwelling. Observe rule of thumb approach and compare these figures after group calculation. • Learners to **draw** diagram from **Worksheet** and work through the calculation individually. • Learners to complete a **think-pair-share activity.** They will need to determine suitable pipework diameter for the remaining distribution installation**.** Write down answers and provide feedback to the class. • Tutor to facilitate a **group discussion** by explaining the purpose and operation of a pressure vessel in a domestic installation. Ask learners to give reason why an accumulator can benefit certain installations. • Tutor to ask learners to **work out** capacity for a CWSC within a dwelling which has a hot water cylinder and one which provides cold water only. **Discuss** likely usage for a dwelling and diversity factor for different requirements, eg young family of four or two single persons. Use this link to work out recommended pumps sizing: http://productfinder.wilo.com/en/GB/productrange/000000090003cafe00040023/fc_range_description/. • Tutor to show the class a **video** about centrifugal force on a rotating water container: www.youtube.com/watch?v=Zip9ft1PgV0 • Ask learners to respond to key features in the video and performance criteria between the types of pumps, stating the application and the problem they overcome. Ask learners if		pair-share activity and review the original drawing whilst discussing the calculations. • Tutor to check learners' understanding during group discussions by asking and answering questions. • Tutor to check learners' answers for **Worksheet 8** by marking them. • Tutor to check that more able learners understand what is being asked of them in the challenge focus activity by reviewing their short summary.

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Key learning activity/approach	Suggested materials and resources	Skills check
they agree with the manufacturer's claims at the end of the session. • If possible, get a **guest speaker** in from a manufacturer, such as Salamander pumps, to discuss points raised in the video or in combination with the CIPHE, who invite companies to the college while offering learners student memberships to the institute. **Challenge focus:** • More able learners to compare BS 6700 sizing for distribution pipework, using the CIPHE design guide probability theory for likely demand. • They should download the Salamander pump installation and warranty guide for pumps RGP, RHP, RSP and ESP, and write a **short summary** about the pre-installation survey to see if they would be confident enough to try to install one in the workshop. Access link for cold water mains boosting and check if it complies with the Water Regulations and WRAS: www.salamanderpumps.co.uk/home. **Independent learning:** • Learners to get into pairs to complete **Worksheet 8**. This is based on a series of written questions about the sizing of a cold water storage cistern. Hand it in to the tutor for marking.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **presenting** can be developed during the various discussions on calculating component sizes.	**Employability:** • Learners should gain an understanding of the **wider** construction **industry** by talking with visiting manufactures and by joining

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Learners to use the **correct format** with an **introduction**, **supporting evidence** and **statements**, and own analysis of product and summing up with **conclusions**. They should adapt the content to **suit the class objectives** and **purpose**. • **Speaking and listening** skills can be demonstrated in developing the various **discussions** about calculating component sizes, **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**. • More able learners can demonstrate **writing** skills when producing a **short summary** about pre-installation survey. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **Maths:** • Learners to practise using and performing calculations with **graphs and tables** as part of the pipe sizing exercise.	CIPHE to engage at a higher technical level and gain credibility when applying for jobs or work experience • Learners should demonstrate they can **actively listen** during the video or if a guest speaker visits, **understand** what has been said and **respond/act** accordingly by asking relevant questions. Learners should be encouraged to use techniques to ensure that they understand the video/talk, eg **repeating back** what was said, **summarising** or **asking clarifying questions**.

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Sessions 15 and 16: Gathering information on faults/methods of repairing faults **Suggested Teaching Time**: 6 hours

Learning Outcome: 5. Diagnose and rectify faults in cold water systems and components

By the end of the session, learners will be able to:

- describe methods used for obtaining details of system faults from end users
- describe routine checks and diagnostics as part of a fault finding process
- derive and analyse technical information from the end user, manufacturer's information, fault diagnosis fault charts and system history
- explain methods of repairing faults.

Topics: 5.1 – Gathering information on faults; 5.2 – Methods of repairing faults

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to write down a **short summary** of the questions they would ask a customer in order to carry out a successful repair of a faulty cold water system, and bring to the session. **Active learning:** • Tutor to **discuss** learners' findings, and show the examples of questions to ask customers in **Presentation 14.** This will be based on diagnosing and rectifying faults on cold water systems and components, as per handbook. • Tutor to circulate **Handout 16**, which depicts a table giving the information on repairing basic faults to system components, including pumps, accumulators, pressure switches, flow switches, RPZ valve, gate valves, float operated valves and stop valves. • Tutor to then facilitate a group **discussion**, asking learners about the importance of reading and deciphering manufacturer's flow charts, and about the process of carrying performance charts to check pressure and flow.	**Materials** For the tutor to devise in advance: • **Presentation 14** • **Handout 16** **Resources** • Interactive whiteboard • Computers, hand-held devices • BS EN 8558 • BS EN 806 • BS 6700 • CIPHE design guide	• Tutor to verify method of questioning, including fault history dates, memorable events and characteristics of the problem. • Tutor to check learners' understanding through **group discussions**, asking about logical sequence of testing in accordance with the manufacturer's performance criteria. • Tutor to check learners' understanding by checking completed **Handout 16**. Check learners have modified the copy record sheet to suit approach to analysis and repair. • Tutor to review learners' answers in questioning to ensure that they are correct, and offer feedback and guidance where appropriate.

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Key learning activity/approach	Suggested materials and resources	Skills check
• Tutor to ask learners to download manufacturer's technical information: www.baxi.co.uk/documents/Baxi_EcoBlue_ErP_Range_Guide.pdf and facilitate a group **discussion.** Explain routine checks and diagnosis on cold water systems, cleaning of components and reassembly of filters, etc. • Tutor should also **describe** the manufacturer's commissioning procedures for a pump, give details on repair methods and **explain** checks for correct operation of pressure switches on booster pump set to a system and float switches. (See www.salamanderpumps.co.uk/home.) • Tutor to give details of procedures used for checking accumulators, gauges and controls: www.heatraesadia.com/index.htm. Explain process for checking for backflow into pumps via failed check valves. • Tutor to lead a **discussion** on routine checks for water treatment devices and water filters, explaining how base exchange water softeners are checked for correct operation. www.hydrotec.co.uk/hydroion HarveyWaterSofteners.co.uk www.Kinetico.co.uk/Water-Softeners www.kindwater.co.uk/service-repair Learners can also find more information on the WRAS website (www.wras.co.uk). • Tutor to state process for checking CWSCs and break cisterns in relation to domestic demand and larger installations. • Learners to split into groups and describe blue water corrosion, the reasons why it happens and the remedies to combat it in a **mind map** on a **flip chart.** Tutor to discuss their findings as a class. • Learners to answer pre-set questions in pairs, and tutor to go through answers at the end of the session.		

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • More able learners to conduct **online research** to explore reasons and DWI remedies to blue water corrosion. Consider if flushing to BS 6700 would remove problem. Explain how certain levels of copper in water can affect public health, and summarise findings in a **short report.** The following website can be used: http://dwi.defra.gov.uk/consumers/advice-leaflets/copper.pdf. **Independent learning:** • Learners to think about the activities in the workshop walk around regarding fault finding, and **make a list** of PPE and material that would be most appropriate.		

Opportunities to develop maths, English, ICT and wider skills:

English: • Learners demonstrate **reading** skills in manufacturer's literature tasks as they **identify** the **correct information** to answer the comprehension questions about routine checks and diagnostics. • **Speaking and listening** skills can be demonstrated in developing the various **discussions** about gathering information and repairing faults, **giving a point of view,** as well as **allowing** and **responding** to **others' opinions**. **ICT:** • More able learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about reasons and remedies for blue water corrosion.	**Employability:** • Learners should gain an understanding of the **wider** construction **industry** by communicating with manufacturers online and downloading fault finding information, which can improve knowledge of technical terms and common problems. This can gain credibility in discussion in interviews when applying for jobs or work experience. • Learners can experience **working in a team** as part of the corrosion brainstorm task. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately.

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Sessions 17 and 18: Isolate cold water systems/carry out diagnostic checks

Suggested Teaching Time: 9 hours

Learning Outcome: 5. Diagnose and rectify faults in cold water systems and components

- Learners to know how to isolate supplies and prevent them being brought back into use.
- Carry out diagnostic tests, locate faults and carry out repair work.

Topics: 5.3 – Isolate cold water systems; 5.4 – Carrying out diagnostic checks and repairs

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to **read** manufacturer's instruction for appliances and components, and then plan sequence and approach to activities in workshop. Think about what is required to work safely and in an organised way, in accordance with BS 8000. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. • Learners to carry out methods of safely isolating cold water systems or components to prevent them being brought into operation before the diagnostic processes and repairs have been fully completed. • Learners to use manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components. • Tutor to review plans and help learners to prepare plan for individual task and risk assess area. • Tutor to **discuss** how to carry out the diagnostic tests in accordance with **scenario/role play**, locate faults in cold water system components and carry out repair work on a **booster (pump) set to a system.**	**Resources** • BS EN 8558 • BS EN 806 • BS 6700 • CIPHE design guide • Manufacturer's instructions • PPE • Practical portfolio • Pens and paper • Dust sheet **For workshop appliances** • Booster pumps set • Single and twin impeller pumps • Bronze circulator • Expansion vessels and accumulator	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to monitor learners' progress during scenario/role play and ask questions or offer feedback where appropriate. • Tutor to ensure that learners have checked and recorded the following: 1. **Visual inspection** of each test area, identifying details and key points to observe. Survey job detail and record/make notes. 2. **Safe isolation** checks for power and water at appliance. 3. Test operation of **pumps** systems while following logical sequence of testing appliance, and measure water flow and pressure in accordance with the manufacturer's performance criteria. 4. **Read** technical information for pressure and flow rates in manufacturer's

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Key learning activity/approach	Suggested materials and resources	Skills check

Workshop:
• Introduce and identify (ID card) yourself to the client (tutor); notify them about work to be carried out and advising them about safety and interruption of supplies. Give expected duration of work and expected outcome.
• Learner to **record** diagnosis and faults on paper**. Read** and analyse performance flow chart in of manufacturer's instructions.
• Tutor to help learners to visually **inspect** the area and ensure that **safe isolation** of electrical supplies to the whole unit is possible.
• **Diagnose faults**
• **Test operation of pumps (including bronze circulators)**
  • Presence of air, noise transmission. leaks, casings
  • Measure at pressure, and flow inlets and outlets
  • Check capacitor, repair or replace
• **Transducer switches**
  • Open tap, operate pressure switch, pump, replace if sensor diaphragms ruptured/split
  • Check pressure reading; if incorrect, recalibrate
• **Inspect gauges**
  • Needle position: moving, static; if incorrect reading, replace
• **Float switches**
  • Manually operate float to activate switch, check operation of pump; if no response, replace micro switch if necessary
  • Float unresponsive to water level, ruptured float, drain down, replace
• **Check pressure of pressure vessels**
  • Check water flow and pressure at outlets
	For test instruments
	• Flow jug or gauge
	• Pressure gauge
	• Multimeter
	• pH meter or litmus test paper
	• Tools
		instructions.
		5. **Compare** performance with design criteria.
		6. **Bronze circulator**: analyse fault and test to see if rotor bar has snapped, or impeller is jammed or stuck. Action: release or replace.
		7. **Check** motor burnout or if case cracked. Action: replace. Capacitor may create slow starting; replace if competent to do so.
		8. **Check pressure (transducer)** and **float switches**, and safe isolation; confirm correct operations/accurate detection; replace or recalibrate faulty components.
		9. **Gauges** – observe needle action against working and static pressure, and replace if required.
		10. **Pressure vessels**. Testing of Schrader valve, leaks and let by. Confirm pressure as per manufacturer's instructions design. Operate pumps, check outcome and repair/replace components.
		11. **Electrolytic corrosion.** Inspect the specified location and obtain details of water quality. Test the water with papers or pH meter, analyse and clean/replace the components if required.
		12. **Backflow device** – check valve stuck in the open position and water

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Key learning activity/approach	Suggested materials and resources	Skills check
• Re-pressurise if pressure too low • Check condition /integrity of Schrader valve for let by/using leak detection fluid/replace • Remove and replace bladder/diaphragm if possible or replace with new vessel • **Specify remedy** • Describe manufacturer's parts list in relation to fault finding process • Decommission appliance • Ensure safe electrical isolation and recheck that water supply is isolated • Carry out repair • Re-commission appliance • Confirm system performance in accordance with the manufacturer's instructions • Clean area and remove tools and dust sheet • Explain outcome to customer and hand over any documents or paperwork • **Electrolytic corrosion** • Use litmus paper or pH meter to check the pH of the water within a designated vessel • Compare with the cold mains supply • Conform the manufacturer's advice regarding hard water areas and corrosion prevention • Make decision to remedy problem by scale reduction, water treatment device, or replace repair component • **Backflow prevention devices (connected to a system)** • Check for backflow of water into stand by pump circuit on boosted set • If there is backflow, safely isolate and drain local circuit, then remove and replace check valve.		circulating through standby pump on booster rig. Drain down and replace. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • More able learners to use calibrated multimeter on practice area, isolated by tutor or electrician. Practise dead testing for continuity on length of cable and a switching device. Then, using manufacturer's instructions, carry out dead test on contacts of cylinder thermostat to determine the switching contacts. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

Opportunities to develop maths, English, ICT and wider skills:

English: • Learners demonstrate **reading** skills in manufacturer's literature tasks, as they **identify** the **correct information** to answer the comprehension questions about routine checks and diagnostics. • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary and portfolio task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**British values:** • Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when carrying out diagnostic and successful repair processes to the required British Standards through study and personal research. **Employability**: • Learners can practise their **planning skills** by **identifying** and **estimating** the **time** and **resources** needed to complete the workshop activity on isolating cold water systems and diagnostic checks. • Learners should demonstrate they can **actively listen** during the effective communication/role play session in the workshop,

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	understand what has been said and **respond/act** accordingly by carrying out safe practices, and successful diagnosis and repair.

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Session 19: Visual inspections (Workshop session) **Suggested Teaching Time**: 3 hours

Learning Outcome: 6. Commission cold water systems and components

Learners to carry out visual inspections and interpret information sources to complete commissioning on boosted, direct and indirect systems.

Topics: 6.1 – Visual inspections

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Revision of fault finding and repair notes in Topic 5.3 and 5.4. Learners to read manufacturer's instruction for appliances and components to be commissioned. Plan sequence and approach to activities in workshop. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. **Discuss** what is required to work safely and in an organised way in accordance with British Standards. • Tutor to **demonstrate** to learners how to carry out methods of visually inspecting cold water systems or components. • Learners to use manufacturer's instructions, industry standards, Water Regulations and building regulations to establish the diagnostic requirements of cold water system components. **Prepare** plan for individual task and risk assess area. • Tutor to lead a **discussion** about how to carry out visual inspections and inspect appliances in a cold water system. **Workshop:** • Introduce and identify (ID card) yourself to the client (tutor); notify them about the work to be carried out and advise them about safety and interruption of supplies. Give expected	**Resources** • BS EN 8558 • BS EN 806 • BS 6700 • Water Regulations • WRAS guide to water regulations • Building regulations Approved Document G1 & G2 • CIPHE design guide • Manufacturer's instructions **For workshop appliances** • Booster pumps set • Single and twin impeller pumps • Bronze circulator	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during demonstration and discussion by asking questions and ensuring that they know what's required of them in the workshop task. • Tutor to ensure effective communication during workshop activity. Tutor to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
duration of work and expected outcomes. • Walk around the installation and check that it is **correctly located** and whether it meets industry standards. • Check that all **open ends** are capped off and that all valves are isolated; ensure that **capillary joints** are soldered and that all **compression** joints are fully tightened. • Inspect sufficiency of **pipe clips**, supports and brackets, and that they are installed and that all pipework is secure. • Check that all the **equipment** – boosting pumps, float switches, accumulators, etc – is installed correctly and that all **joints** and unions on and around the equipment are **watertight.** • Ensure that cisterns and tanks are **supported** correctly and that float-operated valves are provisionally set to the correct water level. • Consider **insulation** requirements. • Check that appliance **isolation valves** and taps are turned off. They can be turned on and tested when the system is filled with water. • Survey to see if **underground services** (scenario) have been installed; check that any pipework is at the minimum depth required by the Water Supply (Water Fittings) Regulations • Learners need to ensure that when visually inspecting on site, the water undertaker is given the opportunity to view and inspect the installation, preferably before it is tested and commissioned to ensure that the Water Supply (Water Fittings) Regulations have been complied with. Any remedial work pointed out by the water inspector can then be completed without the need to drain the system. **Challenge focus:** • More able learners to research online the precise lettering on ¼ turn lever ball valves handles and see if they are suitable	• Expansion vessels and accumulator **For test instruments:** • Flow jug or gauge • Pressure gauge • Multimeter • PH meter or litmus test paper • Tools • Materials • PPE • Pens and paper • Dust sheet	

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Key learning activity/approach	Suggested materials and resources	Skills check
for the same purpose. Look at colour and letter. Find out if the bores in the centre of the component are the same as the inlets. • **Discuss and provide feedback** during learner group session in tutorial/ upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary and portfolio task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**British values:** • Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when carrying out diagnostic and successful repair processes to the required British Standards through study and personal research. **Employability:** • Learners can practise their **planning skills** by **identifying** and **estimating** the **time** and **resources** needed to complete the workshop activity on visual inspections.

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Session 20: Filling and venting systems (Workshop session) **Suggested Teaching Time**: 3 hours

Learning Outcome: 6. Commission cold water systems and components

Leaners to be able to fill and vent the cold water systems at normal operating pressure and check for leakage.

Topics: 6.2 – Filling and venting systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Revision of visual inspection. Learners to read manufacturer's instruction for appliances and components to be filled and vented. Plan sequence and approach to activities in workshop. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. **Discuss** what is required to work safely and in an organised way in accordance with British Standards. • Learners to prepare plan for individual task, risk assess area and carry out filling of system in cold water system in accordance with tutor's discussion and demonstration, using **Handout 17**. This involves a list of visual inspection criteria for boosted cold water systems. **Workshop:** • **Fill** installation with fluid category 1 water directly from the water undertaker's mains cold water supply. • Fill in **stages** so that the filling process can be managed comfortably. • Check for **leaks** and when learners have established that the stage is **leak-free,** they should fill the next stage. When filled,	**Materials** For the tutor to devise in advance: • **Handout 17** **Resources** • BS EN 8558 • BS EN 806 • BS 6700 • Water Regulations • WRAS guide to water regulations • Building regulations Approved Document G1 & G2 • CIPHE design guide • Manufacturer's instructions • PPE • Practical Portfolio • Pens and paper	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during demonstration and discussion by asking questions and ensuring that they know what's required of them in workshop task. • Tutor to ensure effective communication during workshop activity. Tutor to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
stabilisation allowed and FOV isolated. • Learners to ensure that the system is at a **normal temperature**; check for **leaks** and **check airlocks** from cistern-fed supplies. • **Fill cisterns** to capacity and then open the gate valve to avoid airlocks. • Check that **full pressure** of the water is available and that the pipes are running at full bore. **Challenge focus:** • **Discuss and provide feedback** during learner group session in tutorial/ upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for tutor to review.	• Dust sheet **For workshop appliances** • Booster pumps set • Single and twin impeller pumps • Bronze circulator • Expansion vessels and accumulator	

Opportunities to develop maths, English, ICT and wider skills:

English:	British values:
• **Speaking and listening** skills can be demonstrated in developing the **discussion** about workshop session on filling and venting systems, **giving a point of view**, as well as **allowing** and **responding** to **others' opinions**.	• Talk about how learners may come into contact with wider **public institutions**, such as the British Standards, the need for learners to **respect** them, and why they are **important** in relation to filling and venting systems.

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ICT:	**Employability:**
• Learners have the opportunity to engage in **blended learning** in the plumbing dictionary and portfolio task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	• Learners can practise their **planning skills** by **identifying** and **estimating** the **time** and **resources** needed to complete the workshop activity on filling and venting systems.

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Session 21: Soundness testing (Workshop session) **Suggested Teaching Time**: 6 hours

Learning Outcome: 6. Commission cold water systems and components

Learners to conduct soundness test on different types of cold water systems, including metallic and plastic pipework and components.

Topics: 6.3 – Soundness testing

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to plan sequence and approach to activities in the workshop. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. **Discuss** what is required to work safely and in an organised way in accordance with British Standards. • Tutor to give out **Handout 18,** which outlines the procedure for filling and venting a cold water system. Learners to also use Water Regulations, manufacturer's instructions and industry standards. **Prepare plan** for soundness task and **risk assess** area, eg test hydraulic pump. • Tutor to **lead a discussion** with learners about agreeing a working pressure of the installation; can refer to **Handout 19,** which outlines the guidance on the soundness testing procedures. This needs to be tested by applying the formula of 1 ½ x Working pressure to determine test pressure. **Workshop:** • Introduce and identify (ID card) yourself to client (tutor); notify them about work to be carried out and advise them about safety risks of pressure testing, the possibility of blast and the potential hazards of high-velocity missile formation due to	**Materials** For the tutor to devise in advance: • **Handout 18** • **Handout 19** **Resources** • BS EN 8558 • BS EN 806 • BS 6700 • Water Regulations • WRAS guide to water regulations • CIPHE design guide • Manufacturer's instructions **For workshop appliances** • Booster pumps set • Single and twin	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during discussion by asking questions and ensuring that they know what's required of them in the workshop task. • Tutor to ensure effective communication during workshop activity. Tutor to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
pipe fracture and fitting failure. • Learners to **prepare test and** give client an **expected duration** of work and expected outcome. • **Walk around** the installation to ensure that there are no plastic components on the metallic pipework installation. • Check that the test to be used is **appropriate for the service of the building** and meets industry standards. • Check requirement to **divide** the vertical pipework into **sections** in the case of a multi-storey installation (scenario). Ensure it will not leave **pockets of water** that might cause frost damage or corrosion later. • Confirm all valves and equipment can **withstand the test** pressure. If not, remove and install temporary pipework. • Confirm whether there are **enough operatives** available to conduct the test safely. • Assess whether different services are to be **interconnected** as a temporary measure to enable simultaneous testing. • Assess **how long** it will take to fill the system using the available water supply and when to start the test. • Check that the **high points** of the system have an **air vent** or a tap to help with the **removal of air** from the system during the test. These should be closed to prevent accidental leakage. • Blank or **plug any open ends** and isolate any valves at the limit of the test where the test is being conducted in stages. • Remove any **vulnerable equipment** and components, and install temporary piping. • **Carry out test** on **copper or low carbon steel pipes. Open the valves** within the section to be tested. • Check that the **test pump is working** correctly and that the pressure gauge is calibrated and functioning correctly. • **Attach the test pump** to the pipework and install extra pressure gauges if necessary. Check that a **suitable hose** is	impeller pumps • Bronze circulator • Expansion vessels and accumulator **For test instruments** • Hydraulic Pressure pump • Tools • Materials • PPE • Practical portfolio • Pens and paper • Dust sheet	

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Key learning activity/approach	Suggested materials and resources	Skills check
available for draining-down purposes. • **Release air** from the high points of the system or section and completely fill the system with water. Ensure that the **system is full** and free of air. • When the pressure shows signs of rising, stop and **visually check** the route of the section under test. **Listen** for any sounds of escaping air and visually check for any signs of leakage. • **Pressurise** to 1 ½ times the (specified) normal operating pressure (1.5 times normal operating pressure or 50% above normal operating pressure). Check to see **if the pressure falls**; check whether any isolated valves are not passing water and visually check for leaks. • Leave system for a period of **30 minutes** to allow for temperature **stabilisation** and then for a further period of **1 hour** with no visible pressure loss. • Once the test has **proved that the system is sound**, it should be witnessed and a signature obtained on the **test certificate**. • When the pressure is released, open any air vents and taps to atmosphere before **draining down** the system. • Re-fit any **vulnerable pieces of equipment**, components and appliances. • **Carry out tests A and B on Elastomeric (plastic polybutylene) pressure pipe systems.** 1. **Test type A:** Follow the same **preparation and system check** as for copper and rigid pipe for both tests. **Slowly fill** the system with water and raise the pressure to **1 bar (100Kpa).** • Check and **re-pump** the pressure to 1 bar if the pressure drops during this period, provided there are **no leaks**.		

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Key learning activity/approach	Suggested materials and resources	Skills check
• **Check for leaks**. After **45 minutes**, **increase** the pressure to **1.5** times the normal operating pressure and let the system stand for **15 minutes**. • **Release** the pressure in the system to **one-third** of the previous pressure and let it **stand** for a further **45 minutes**. Confirm that the **test is successful** if there are no leaks • Once the test has **proved that the system is sound**, it should be witnessed and a signature obtained on the **test certificate**. **2. Test type B** • **Slowly fill** the system with water and pump the system up to the required pressure. Maintain the pressure for a period of **30 minutes** and note the pressure after this time. Continue with **no further** testing. • Check the pressure after a further **30 minutes.** If the pressure loss is **less than 60Kpa (or 0.6 bar),** the system has **no visible leakage**. • Visually check for leakage for a further **120 minutes**. The test is **successful** if the pressure loss is **less than 20Kpa (0.2 bar).** • Once the test has **proved that the system is sound**, it should be witnessed and a signature obtained on the **test certificate**. **Challenge focus:** • **Discuss and provide feedback** during learner group session in tutorial/ upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work		

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Key learning activity/approach	Suggested materials and resources	Skills check
carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**Employability:** • Learners can show **resilience** by sticking to the testing process even if it doesn't go well initially. They should be encouraged to remain **flexible**, **positive** and **motivated during a process which can be long and time-consuming.**

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Session 22: Flushing systems (Workshop sessions) **Suggested Teaching Time**: 4.5 hours

Learning Outcome: 6. Commission cold water systems and components

Learners to flush cold water systems, specify flushing requirements for new and existing water systems, including cold and hot water service and disinfection.

Topics: 6.4 – Flushing systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to plan sequence and approach to activities in the workshop. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. • **Discuss** what is required to work safely and in an organised way in accordance with British Standards. Consider the environment, with regard to chemical and discharge notification to the local water undertaker. • Tutor to give out **Handout 20**, outlining the flushing and disinfecting procedures, with an emphasis on health and safety. • Learners to get into pairs and prepare plan for the flushing and disinfection task, whilst risk assessing the area. • Tutor to lead a **discussion** about agreeing safe procedure to flush and disinfect. Learners to read **COSHH data sheets** on chemicals before workshop activity. (Data sheets should be visible on the containers/leaflets of the chemicals and should be kept in a file on site or in designated area in the college or training centre.)	**Materials** For the tutor to devise in advance: • **Handout 20** **Resources** • BS EN 8558 • BS EN 806 • BS 6700:1997, cause 3.1.10.1 • Water Regulations • WRAS guide to water regulations • CIPHE design guide (disinfection) • Manufacturer's instructions	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during discussion by asking questions and ensuring that they know what's required of them in the workshop task. • Tutor to ensure effective communication during workshop activity. Tutors to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
Workshop: • Introduce and identify (ID card) yourself to the client (tutor); notify them about work to be carried out and advise them about safety risks of human contact with chemicals and dangers to wildlife. • Learners to prepare for flushing. Walk around installation to **survey individual pipe runs, and** give the client an **expected duration** of work and expected outcome. • Check that **cisterns** are filled with clean water and that pipework is connected to undertaker's main to **fill break cisterns** on boosted cold water systems. • Carry out flushing to **every length of pipe** to remove debris, flux and swarf. • Before disinfection, learners to risk asses the area. Tutor to explain **disinfection process** using chlorine and highlight all risks to associated staff/persons present in the building. Ensure **no other household chemicals** such as bleaches come in contact with the process. **Post notices** that state 'Disinfection in process: Do Not Use' at all outlets and any points of risk of water being drawn off. • Estimate **pipework volume** and apply **chlorinated water** to system via the cistern. **Measure** concentration of chlorine; ensure minimum of **50ppm.** Check chlorine level at the end of the test period (1 hour +); **30ppm minimum concentration at furthest outlet.** • **Inform local water undertaker** or the Environment Agency if test water to be discharged directly into a water course or drain. • **Drain** pipework system, and f**lush** with clean water until the free residual chlorine content is no more than that in the water undertaker's mains cold water supply. • Complete the **disinfection record paperwork,** hand over to	**For workshop appliances** • Booster pumps set • Single and twin impeller pumps • Bronze circulator • Expansion vessels and accumulator **For test instruments and special equipment/materials** • Sterilisation chemicals • Chlorination testing kit • Tools • Materials/ sterilisation chemical/ chlorine • PPE, eg gloves, goggles, face mask, plastic apron, long arm gauntlets • Practical portfolio • Pens and paper • Dust sheet	

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Key learning activity/approach	Suggested materials and resources	Skills check
person in charge and **remove signs**. **Challenge focus:** • Discuss and provide feedback during learner group session in tutorial/upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**Employability:** • Learners are able to prove their **decision-making** skills during the disinfection process, ensuring that public health is not put at risk, by the correct volume of chemical being applied, and its safe and efficient disposal.

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Session 23: Operational checks (Workshop session) **Suggested Teaching Time**: 4.5 hours

Learning Outcome: 6. Commission cold water systems and components

Learners will be able to carry out operational checks required during commissioning, including flow rate, pressure, balancing, mechanical controls and functional testing.

Topics: 6.5 – Operational checks

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to plan sequence and approach to activities in the workshop. Read manufacturer's instruction for appliances and components. **Active learning:** • Learners to get into pairs and **compare** their plans/approaches to workshop activities. • **Discuss** what is required to work safely and in an organised way in accordance with BS 8000. Carry out operational checks on water systems or components to ensure correct performance in accordance with manufacturer's instructions and industry standards. **Prepare plan** for individual task and risk assess area. • Tutor to lead a **discussion** about carrying out an operational check in accordance with tutor brief/scenario discussion/role play in cold water system components and carry out repair work using **Handout 21**. This is an outline of operational checks that must be carried out on cold water systems, referencing manufacturer's instructions. **Workshop:** • Introduce and identify (ID card) yourself to client (tutor); notify	**Materials** For the tutor to devise in advance: • **Handout 21** **Resources for workshop appliances** • Booster pumps set • Single and twin impeller pumps • Bronze circulator • Expansion vessels and accumulator **Resources for test instruments** • Flow jug or gauge	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during discussion by asking questions and ensuring that they know what's required of them in the workshop task. • Tutor to ensure effective communication during workshop activity. Tutor to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
them about work to be carried out and advise them about safety and interruption of supplies. Give expected duration of work and expected outcome. • Learners to visually inspect area and ensure **safe isolation** of electrical supplies. Ensure **correct operation** of booster pump assembly of flow pressure, switching, noise transmission and backflow protection. • **Test operation of pumps (including bronze circulators) and check for** presence of air, noise transmission, leaks and casings. Measure at pressure and flow inlets and outlets with bourdon gauge • Check the capacitor and repair or replace using a multimeter. Use a flow jug to measure the water flow rate from the outlets in accordance with British Standard or refer to **Handout 21**. • Check pressure gauge to check operation of **pressure** at outlets. • Check balance at cold supplies of the appliance at the pressure reducing valve (diaphragm), and also at the outlet or inlet of the appliance or fitting. • **Functional test** of transducer switches by switching by opening tap to operate pressure switch, pump and check pressure reading on mechanical controls. • **Functional test** of float switches: operate float to activate switch, check operation of pump and check **pressure** of pressure vessels. • Check **water flow** and pressure at outlets and safety discharge device**. Check pressure** relief valve and test **backflow** at test point on double check valve. **Operate** gate valves and stop valve to appliances. • Confirm appliance and components operational performance in accordance with the manufacturer's instructions. • Explain outcome to customer, hand over any documents or	• Pressure gauge • Multimeter • Tools • Materials/ sterilisation chemical/ chlorine • PPE • Practical portfolio • Pens and paper • Dust sheet	

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Key learning activity/approach	Suggested materials and resources	Skills check
paperwork and clean area. **Challenge focus:** • Discuss and provide feedback during learner group session in tutorial/upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**Employability:** • Learners are able to prove their **decision-making** skills during the assessment of correct operation of controls to performance of appliance to the industry standard.

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Sessions 24 and 25: Commissioning records/handover procedures (Workshop session) **Suggested Teaching Time**: 3 hours

Learning Outcome: 6. Commission cold water systems and components

- Complete cold water system commissioning records with required information and outline of actions taken when commissioning reveals defects.
- Carry out procedures for notifying works carried out to relevant authority.
- Carry out handover procedures following the commissioning of cold water systems.

Topics: 6.6 – Commissioning records; 6.7 – Handover procedures

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to **research** CSCS card requirements and what level you could apply for as a student apprentice or when you are qualified after passing this diploma. **Active learning:** • Tutor to lead a **discussion** about carrying out operational tasks in accordance with tutor brief/scenario discussion /role play in cold water system components and carry out repair work, eg initial introduction of yourself to a client. • Tutor to circulate **Handout 22**, which outlines pressure and flow rates as stated in British Standards, **Handout 23**, which lists information that should be checked and recorded in the commissioning stage, and **Handout 24**, which outlines the procedure used when handing over to the customer, including paperwork, controls, demonstrations and benchmark certificate. **Workshop:** • Introduce and identify (ID card) yourself to the client (tutor); notify them about commissioning documentation to be carried	**Materials** For the tutor to devise in advance: • **Handout 22** • **Handout 23** • **Handout 24** **Resources** • BS EN 8558 • BS EN 806 • BS 6700:1997, cause 3.1.10.1 • Water Regulations • WRAS guide to water regulations • Manufacturer's instructions	• Tutor to check learners' understanding by discussing pre-learning activity in class whilst learners compare their plans/approaches to workshop activities. • Tutor to check learners' understanding during discussion by asking questions and ensuring that they know what's required of them in workshop task. • Tutor to ensure effective communication during workshop activity. Tutors to ensure that learners have fulfilled the appropriate criteria during the workshop activity through observation and offering feedback/suggestions for improvement and answering questions. • Tutor to review learners' dictionaries and personal course portfolios, correcting where appropriate, offering suggestions for improvement and answering any

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Key learning activity/approach	Suggested materials and resources	Skills check

out (role play).
• Learners to refer to jobs carried out by identifying tasks, and complete commissioning records to include the date and time, and their name as the commissioning engineer. Hand to colleague and then to tutor for verification.
• Write down the **location** of the installation and state the amount of **cold water storage** (if any).
• Identify the types and **manufacturer of equipment** and **components** installed.
• Explain the **type of pressure test** carried out and its **duration,** and give details of the **disinfection processes**, the disinfection **chemicals** used and the **disinfection readings** to prove outcome.
• Provide information about the **flow rates** and **pressures** at the outlets, and register the recorded **pressures** on both the **suction side** and the **discharge side** of any boosting pumps.
• State the accumulator pressure.
• Ensure that commissioning records are kept in a **file in a secure location.**
• Learners to then complete a **role play**, where they explain to the client:
  • that notification of the installation will be given **water undertakers**
  • that **their name** is included as installing plumber
  • that **location** is inserted
  • **type of work** carried out
  • that the local building control office (**BCO**)have been informed **five days** before the completion of the work
  • that completed work **complies** regulation requirements
  • that a **building regulations compliance certificate** has been issued.
• Learners to continue the role play but focus on when handing
	For workshop appliances
	• Booster pumps set
	• Single and twin impeller pumps
	• Bronze circulator
	• Expansion vessels and accumulator
	• PPE
	• Practical portfolio
	• Pens and paper
	• Commissioning, benchmark and notification sheets (www.wras.co.uk)
	• Dust sheet
		questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
over to the customer. They must remember to: • explain all **tests** carried out satisfactorily • give details on how the **system operates** as planned • describe that fittings are **clean and ready to use** • explain **how** the system works • **demonstrate** appliances in operation • **advise** of isolation, basic maintenance and safe operations • explain what to do in an **emergency** • provide **as fitted drawing**, showing the position of all isolation valves and backflow prevention devices • write job details, and complete **compliance certification** and commissioning records • complete **Benchmark book** • inform them that the system **complies** with manufacturer's instructions, relevant standards and regulations • state that this validates their manufacturer's **warranty** • ask client to add **their name** to theirs on the documentation • give **guarantee** of workmanship and company details. **Challenge focus:** • Discuss and provide feedback during learner group session in tutorial/ upload to Moodle. **Independent learning:** • Learners to record actions and outcomes, as well as any additional information, and add key features to the work carried out, including descriptions and processes. This should be added to learners' **plumbing dictionary and personal course portfolio** for the tutor to review.		

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Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills in **effective communication** can be developed during the workshop role play task with client/tutor. **ICT:** • Learners have the opportunity to engage in **blended learning** in the plumbing dictionary task, which makes use of the centre's Moodle/VLE. This is an example of **collaborative** technology.	**Employability:** • Learners can demonstrate how they change their communication style to suit their audience in handing over to the customer exercise rather than their everyday communication with their supervisor or workmates.

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