



# **Level 3 Advanced Technical Diploma in Plumbing (450) (8202-35)**

*Version 1.2 (June 2017)*

**Qualification Handbook**

## Qualification at a glance

|                                                           |                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Industry area</b>                                      | Building Service Industries                                                                                                                                                                                                                                                                 |
| <b>City &amp; Guilds qualification number</b>             | 8202                                                                                                                                                                                                                                                                                        |
| <b>Age group</b>                                          | 16-19 (Key Stage 5), 19+                                                                                                                                                                                                                                                                    |
| <b>Entry requirements</b>                                 | Centres must ensure that any prerequisites stated in the <i>What is this qualification about?</i> section are met.                                                                                                                                                                          |
| <b>Assessment</b>                                         | To gain this qualification, candidates must successfully achieve the following assessments: <ul style="list-style-type: none"> <li>• One externally set, externally moderated assignment</li> <li>• One externally set, externally marked exam, sat under examination conditions</li> </ul> |
| <b>Additional requirements to gain this qualification</b> | Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.                                                                                                                                        |
| <b>Grading</b>                                            | This qualification is graded Pass/Merit/Distinction/Distinction*<br>For more information on grading, please see Section 7: Grading.                                                                                                                                                         |
| <b>Approvals</b>                                          | These qualifications require full centre and qualification approval                                                                                                                                                                                                                         |
| <b>Support materials</b>                                  | Sample assessments<br>Guidance for delivery<br>Guidance on use of marking grids                                                                                                                                                                                                             |
| <b>Registration and certification</b>                     | Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.                                                                                                                                                                             |
| <b>External quality assurance</b>                         | This qualification is externally quality assured by City & Guilds, and its internally marked assignments are subject to external moderation. There is no direct claim status available for this qualification.                                                                              |

| Title and level                                      | Size (GLH) | TQT | City & Guilds qualification number | Ofqual accreditation number |
|------------------------------------------------------|------------|-----|------------------------------------|-----------------------------|
| Level 3 Advanced Technical Diploma in Plumbing (450) | 450        | 720 | 8202-35                            | 601/7201/0                  |

| Version and date | Change detail                                                                                                                           | Section                                                                                                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.1 May 2016     | Small typographical errors                                                                                                              | Throughout                                                                                                                                                                      |
|                  | TQT added for qualifications<br>Assessment component titles amended                                                                     | 1. Introduction                                                                                                                                                                 |
|                  | Employer involvement guidance updated throughout                                                                                        | 4. Employer involvement                                                                                                                                                         |
|                  | Summary of assessment methods and conditions                                                                                            | 5. Assessment                                                                                                                                                                   |
|                  | Moderation and standardisation of assessment updated throughout                                                                         | 6. Moderation and standardisation of assessment                                                                                                                                 |
|                  | Awarding individual assessments<br>Awarding grades and reporting results                                                                | 7. Grading                                                                                                                                                                      |
|                  | Enquiries about results<br>Re-sits and shelf-life of assessment results<br>Malpractice<br>Access arrangements and special consideration | 8. Administration                                                                                                                                                               |
| June 2017 V1.1   | Addition of the examination paper based module number                                                                                   | 1. Introduction – Assessment requirements and employer involvement<br>5. Assessment<br>5. Assessment – exam Specification<br>7. Grading – Awarding grades and reporting results |
|                  | Removal of AO 6-8 from Synoptic Assignments                                                                                             | 5. Assessment – Assessment Objectives                                                                                                                                           |
|                  | Addition of Provisional Grade Boundaries for the Synoptic Assignment                                                                    | 7. Grading                                                                                                                                                                      |
|                  | Revised Exam Specification, Exam Duration and AO weightings                                                                             | 5. Assessment – Exam Specification                                                                                                                                              |
|                  | Branding Changes                                                                                                                        | Throughout                                                                                                                                                                      |

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# 1 Introduction

## What is this qualification about?

The following purpose statement relates to the **Level 3 Advanced Technical Diploma in Plumbing (450) (601/7201/0)**

| Area                                                                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OVERVIEW                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Who is this qualification for?                                                             | This qualification is for you if you are a 16-19 year old learner, who wishes to work as a plumber in the building services industry. It has been designed to deliver a high level of occupational skills and provide a platform from which to progress through further learning or into employment. This vocational route at level 3 is a vital step towards becoming a competent plumber.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| What does this qualification cover?                                                        | <p>The qualification will help you gain an understanding of the skills required within the plumbing sector. You will cover compulsory aspects such as:</p> <ul style="list-style-type: none"><li>• working safely and effectively</li><li>• principles of environmental technology systems</li><li>• cold water system planning and design</li><li>• hot water system planning and design</li><li>• domestic central heating systems planning and design</li></ul> <p>Centres and providers work with local employers who will contribute to the knowledge and delivery of training. Employers will provide demonstrations and talks on the industry and where possible work placements will also be provided by the employers. This practically based training is ideal preparation for gaining employment in the plumbing industry or specialist further study.</p> |
| WHAT COULD THIS QUALIFICATION LEAD TO?                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Will the qualification lead to employment, and if so, in which job role and at what level? | This technical qualification focuses on the development of knowledge and practical skills needed for working in the Plumbing industry, and will prepare you to enter a plumbing apprenticeship programme. On completion of the apprenticeship, the learner will be recognised by the industry as a competent plumbing and domestic heating engineer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Why choose this qualification over similar qualifications?                                 | This qualification is aimed at learners who are not yet employed in the plumbing industry but wish to learn the skills needed to progress further, and help them embark on a plumbing apprenticeship programme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Will the qualification lead to further learning?                                           | This qualification prepares you for a plumbing apprenticeship programme, which fully qualifies you to work as a plumbing and domestic heating engineer. The apprenticeship will give                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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you an understanding of suitable on-site skills and further knowledge required to work in the plumbing industry. Once qualified, there are many specialist qualifications available, such as environmental technology systems and designing and planning complex water systems.

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#### WHO SUPPORTS THIS QUALIFICATION?

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Employer/Higher Education Institutions

This qualification is supported by the APHC (Association of Plumbing & Heating Contractors). Since being established in 1925 APHC have been representing employers of all sizes within the plumbing sector. They work closely with key organisations such as Government, Local Authorities, Training Bodies and Consumer Organisations to ensure that best practice in the industry is promoted and that quality plumbing and heating contractors are fairly represented. They are also at the heart of maintaining vocational standards within the sector. APHC supports the above qualification as being important for employment within the industry.

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## Qualification structure

For the **Level 3 Advanced Technical Diploma in Plumbing (450)** the teaching programme must cover the content detailed in the structure below:

| Unit number      | Unit title                                 | GLH |
|------------------|--------------------------------------------|-----|
| <b>Mandatory</b> |                                            |     |
| 331              | Cold water system planning and design      | 90  |
| 332              | Hot water system planning and design       | 90  |
| 333              | Central heating system planning and design | 90  |
| 334              | Sanitation system planning and design      | 90  |
| 335              | Environmental technology systems           | 30  |
| 336              | Site procedures and planning               | 60  |
|                  | <b>Total GLH</b>                           | 450 |

## Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

| Title and level                                | GLH | TQT |
|------------------------------------------------|-----|-----|
| Level 3 Advanced Technical Diploma in Plumbing | 450 | 720 |

## Assessment requirements and employer involvement

To achieve the **Level 3 Advanced Technical Diploma in Plumbing (450)** candidates must successfully complete **both** the mandatory assessment components.

| Component number | Title                                       |
|------------------|---------------------------------------------|
| <b>Mandatory</b> |                                             |
| 035 or 535       | Level 3 Plumbing - Theory exam (1)*         |
| 036              | Level 3 Plumbing - Synoptic assignment (1)* |

In addition, candidates **must** achieve the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

### Employer involvement

| Component number | Title                |
|------------------|----------------------|
| <b>Mandatory</b> |                      |
| 835              | Employer involvement |

*\*Number of mandatory assessments per assessment type*

## 2 Centre requirements

### Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' **full** Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: [www.cityandguilds.com](http://www.cityandguilds.com)

### Resource requirements

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

### Centre staffing

Staff delivering this qualification must be able to demonstrate that they meet the following requirements:

- be technically competent in the areas in which they are delivering
- be able to deliver across the breadth and depth of the content of the qualification being taught
- have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- demonstrate continuing CPD.

### Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessments.

### Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of tutors and markers. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

### Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

### Age restrictions

This qualification is approved for learners aged 16 – 19, 19+.

## 3 Delivering technical qualifications

### Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

### Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

### Support materials

The following resources are available for this qualification:

| Description                      | How to access                                                             |
|----------------------------------|---------------------------------------------------------------------------|
| Sample assessments               |                                                                           |
| Guidance for delivery            | Available 2016 on the qualification pages on the City & Guilds            |
| Guidance on use of marking grids | Website: <a href="http://www.cityandguilds.com">www.cityandguilds.com</a> |

## 4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

*Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and students and furthers collaboration between the learning and skills sector and industry.*

*[Technical qualifications] must:*

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: **Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90**

City & Guilds will provide support, guidance and quality assurance of employer involvement.

### Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planner a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

### Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

### **Types of involvement**

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning. Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows<sup>1,2</sup>:

#### ***The following activities meet the requirement for meaningful employer involvement:***

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification<sup>3</sup>;*
- *students undertake project(s), exercise(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

*In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.*

#### ***The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:***

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*

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<sup>1</sup> As extracted from: Vocational qualifications for 16 to 19 year olds 2017 and 2018 performance tables: technical guidance for awarding organisations

<sup>2</sup> This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**

<sup>3</sup> **DfE work experience guidance**

- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*
- *employers providing students with job references.*

### **Types of evidence**

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. Eg for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

### **Quality assurance process**

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer Involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

### **Sufficiency of involvement for each learner**

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry. Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

### **Live involvement**

Learners will gain most benefit from direct interaction with employers and/or their staff; however the use of technology (eg the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

### **Timing**

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

## 5 Assessment

### Summary of assessment methods and conditions

| Component numbers | Assessment method      | Description and conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 035/535           | Externally marked exam | <p>The exam is <b>externally set and externally marked</b>, and can be taken either online through City &amp; Guilds' computer-based testing platform (035) or as a paper based test (535)</p> <p>The exam is designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details:<br/><b><a href="http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations">http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations</a></b></p> <p>The exam specification shows the coverage of the exam across the qualification content.</p> <p>Candidates who fail the exam at the first sitting will have <b>one</b> opportunity to re-sit. If the re-sit is failed the candidate will fail the qualification. For exam dates, please refer to the Assessment and Examination timetable.</p>                                                                                                                                                                                                |
| 036               | Synoptic assignment    | <p>The synoptic assignment is <b>externally set, internally marked and externally moderated</b>. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification.</p> <p>Please note that for externally set assignments City &amp; Guilds provides guidance and support to centres on the marking and moderation process.</p> |

## **What is synoptic assessment?**

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high quality outcome.

## **How the assignment is synoptic for this qualification**

The typical assignment brief could be to design and plan a plumbing system, considering client requirements and the specific restraints of an installation within a site. Candidates will also need to draw on skills and understanding developed across the qualification content in order to install and commission a significant part of a domestic plumbing system, including hot water, cold water, central heating etc. This will require the candidate to work safely, follow correct process sequences, select and use tools, equipment and appliances, as well as record work done and hand over to a client.

## **External exam for stretch, challenge and integration**

The external assessment will draw from across the mandatory content of the qualification, using a range of shorter questions to confirm breadth of knowledge and understanding. Extended response questions are included, giving candidates the opportunity to demonstrate higher level understanding and integration through discussion, analysis and evaluation, and ensuring the assessment can differentiate between 'just able' and higher achieving candidates.

## Assessment objectives

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including weightings for the synoptic assignments. In some cases, due to the nature of a qualification's content, it is not appropriate to award marks for some AOs. Where this is the case these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

| Assessment objective                                                                                                                                                 | Level 3 Advanced Technical Diploma in Plumbing (450)<br>Typical expected evidence of knowledge, understanding and skills                                                                                                                                                      | Approximate weighting |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>AO1</b> Recalls knowledge from across the breadth of the qualification.                                                                                           | Recall of knowledge is covered extensively in the written test and therefore does not contribute to the marking of the synoptic assignment.                                                                                                                                   | 10%                   |
| <b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.                                              | Workplace risks assessments, interpretation of diagnostic test results, Explanations/comparisons related to material and component specifications and performance, why and when different methods, techniques, materials are used, principles.                                | 20%                   |
| <b>AO3</b> Demonstrates technical skills from across the breadth of the qualification.                                                                               | Working in a safe manner, interpreting test results, use of tools and equipment, use of diagnostic equipment.                                                                                                                                                                 | 40%                   |
| <b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes. | Examples of bringing it all together: Applying knowledge and understanding to a particular scenario/ problem – justifying decisions/approaches taken e.g. materials, techniques, adapting practice to meet contextual challenges.                                             | 20%                   |
| <b>AO5</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.            | Accuracy and detail of drawings, attention to accuracy during work, thinking about and attending to specific requirements of the task, completeness and attention to usability of documentation, attention to detail in risk assessment and risk reduction/method statements. | 10%                   |

## Exam specification

AO weightings per Exam

| Assessment Objective                                                                                                                                          | Exam 035/535 weighting (approx. %) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| AO1 Recalls knowledge from across the breadth of the qualification.                                                                                           | 33                                 |
| AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.                                              | 52                                 |
| AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes. | 15                                 |

The way the exam covers the content of the qualification is laid out in the table below. The learning outcomes in the table identify the content that the theory exam will be based on. Please be aware that there are additional learning outcomes in the units and the below learning outcomes should not be delivered in isolation.

**Assessment type:** Examiner marked, written exam, usually delivered online \*

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

| 035/535  | Duration: 2 hour 15 minutes                                                                                                                                                                                                                                                                                                       |                 |    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|
| Unit No. | Unit Title                                                                                                                                                                                                                                                                                                                        | Number of marks | %  |
| 331      | <ol style="list-style-type: none"> <li>1. Know the legislation relating to the installation and maintenance of cold water systems</li> <li>2. Understand cold water systems</li> <li>3. Understand requirements for backflow protection in plumbing systems</li> <li>4. Apply design techniques for cold water systems</li> </ol> | 15              | 25 |
| 332      | <ol style="list-style-type: none"> <li>1. Understand hot water systems and their layout requirements</li> <li>2. Use design techniques for hot water systems</li> </ol>                                                                                                                                                           | 10              | 17 |
| 333      | <ol style="list-style-type: none"> <li>1. Know types of central heating system and their layout requirements</li> <li>2. Use design techniques for central heating systems</li> </ol>                                                                                                                                             | 10              | 17 |
| 334      | <ol style="list-style-type: none"> <li>1. Know types of sanitation system and their layout requirements</li> <li>2. Understand design techniques for sanitation and rainwater</li> </ol>                                                                                                                                          | 10              | 17 |
| 335      | <ol style="list-style-type: none"> <li>1. Understand operating principles of micro-renewable energy and water conservation technologies</li> </ol>                                                                                                                                                                                | 6               | 10 |

|     |                                                                                                                    |           |            |
|-----|--------------------------------------------------------------------------------------------------------------------|-----------|------------|
|     | 2. Understand the installation requirements relating to micro-renewable energy and water conservation technologies |           |            |
|     | 3. Compare advantages and disadvantages associated with micro-renewable energy and water conservation technologies |           |            |
| N/A | Applied knowledge and understanding                                                                                | 9         | 15         |
|     | <b>Total</b>                                                                                                       | <b>60</b> | <b>100</b> |

\*These exams are sat under invigilated examination conditions, as defined by the JCQ:  
<http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>.

Entry for exams can be made through the City & Guilds Walled Garden.

## 6 Moderation and standardisation of assessment

City & Guilds' externally set assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation. This process is outlined below. For more detailed information, please refer to 'Marking and moderation - Technicals centre guidance' available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

### **Supervision and authentication of internally assessed work**

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

### **Internal standardisation**

For internally marked work<sup>4</sup> the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

### **Provision for reworking evidence after submission for marking by the tutor**

It is expected that in many cases a candidate who is struggling with a specific piece of work may themselves choose to restart and rectify the situation during their normal allocated time, and before it gets to the stage of it being handed in for final marking by the tutor.

In exceptional circumstances however, where a candidate has completed the assignment in the required timescales, and has handed it in for marking by the tutor but is judged to have significantly underperformed, may be allowed to rework or supplement their original evidence for remarking prior to submission for moderation. For this to be allowed, the centre must be confident that the candidate will be able to improve their performance without additional feedback from their tutor and within the required timescales ie the candidate has shown they can perform sufficiently better previously in formative assessments.

The reworked and/or supplemented original evidence must be remarked by the tutor in advance of the original moderation deadline and the moderator informed of any candidates who have been allowed to resubmit evidence.

The process must be managed through the IQA. The justification for allowing a resubmission should be recorded and made available on request. The use of this provision will be monitored by City & Guilds.

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<sup>4</sup> For any internally assessed optional unit assignments, the same process must be followed where assessors must standardise their interpretation of the assessment and grading criteria.

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## Internal appeal

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, ie the synoptic assignment and any optional unit assignments. This must take place before the submission of marks for moderation. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

Centres cannot appeal the outcome of moderation for individual candidates, only the moderation process itself. A request for a review of the moderation process should be made to **appeals@cityandguilds.com**.

## Moderation

Moderation is the process where external markers are standardised to a national standard in order to review centre marking of internally marked assessments. These markers are referred to as 'moderators'. Moderators will mark a representative sample of candidates' work from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria correctly, centre marks for the whole cohort will be accepted.

Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment will be made to the marks of the whole cohort, retaining the centre's rank ordering.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances a complete remark of the candidate work may be necessary. This may be carried out by the centre based on feedback provided by the moderator, or carried out by the moderator directly.

Moderation applies to all internally marked assignments. Following standardisation and marking, the centre submits all marks and candidate work to City & Guilds via the moderation platform. The deadline for submission of evidence will be available on Walled Garden. See the *Marking and moderation - Technicals Centre Guidance* document for full details of the requirements and process.

In most cases candidate work will be submitted directly to the moderator for moderation. This includes written work, photographic and pictorial evidence, or video and audio evidence. For some qualifications there will be a requirement for moderators to visit centres to observe practical assessments being undertaken. This will be for qualifications where the assessment of essential learner skills can only be demonstrated through live observation. The purpose of these visits is to ensure that the centre is assessing the practical skills to the required standards, and to provide the moderators with additional evidence to be used during moderation. These visits will be planned in advance with the centre for all relevant qualifications.

## Post-moderation procedures

Once the moderation process has been completed, the confirmed marks for the cohort are provided to the centre along with feedback from the moderator on the standard of marking at the centre, highlighting areas of good practice, and potential areas for improvement. This will inform future marking and internal standardisation activities.

City & Guilds will then carry out awarding, the process by which grade boundaries are set with reference to the candidate evidence available on the platform.

**Centres retaining evidence**

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

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## 7 Grading

### Awarding individual assessments

Individual assessments will be graded, by City & Guilds, as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (eg archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the Merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the Merit grade for the qualification overall.

### Grade descriptors

#### To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

#### To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.
- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan, that would credibly achieve an outcome that is highly fit for purpose.

- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
  - Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.
-

## Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The **Level 3 Advanced Technical Diploma in Plumbing** will be reported on a four grade scale: Pass, Merit, Distinction, Distinction\*.

All assessments **must** be achieved at a minimum of Pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade Pass for an assessment(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundary(ies) for the synoptic assignment(s) in this qualification are:

| Synoptic Assignment | Pass Mark (%) |
|---------------------|---------------|
| 036                 | 43            |

Please note that each synoptic assignment is subject to an awarding process before final grade boundaries are confirmed.

The contribution of assessments towards the overall qualification grade is as follows:

| Assessment method         | Grade scale | % contribution |
|---------------------------|-------------|----------------|
| Synoptic assignment (036) | X/P/M/D     | 60%            |
| Theory exam (035/535)     | X/P/M/D     | 40%            |

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. A range of points between the Pass, Merit and Distinction boundaries will be accessible to candidates. For example a candidate that achieves a middle to high Pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle Merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

|                          | Pass | Merit | Distinction |
|--------------------------|------|-------|-------------|
| Theory exam: 40%         | 6    | 12    | 18          |
| Synoptic assignment: 60% | 6    | 12    | 18          |

The candidate's points for each assessment are added together, and the overall grade of the **Level 3 Advanced Technical Diploma in Plumbing (450)** will then be determined using the following qualification grade boundaries.

| <b>Qualification Grade</b> | <b>Minimum points</b> |
|----------------------------|-----------------------|
| Distinction*               | 20.5                  |
| Distinction                | 17                    |
| Merit                      | 11                    |
| Pass                       | 6                     |

Candidates achieving Distinction\* will be the highest achieving of the Distinction candidates.

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## 8 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation.

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

### External quality assurance

City & Guilds will undertake external moderation activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to:

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make secure arrangements to receive, check and keep assessment material secure at all times, maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

### Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for internally marked assessments.

For further details on enquiries and appeals process and for copies of the application forms, please visit the **appeals page** of the City & Guilds website at **[www.cityandguilds.com](http://www.cityandguilds.com)**.

## Re-sits and shelf-life of assessment results

Candidates who have failed an assessment or wish to re-take it in an attempt to improve their grade, can re-sit assessments **once only**. The best result will count towards the final qualification. See guidance on individual assessment types in Section 5.

## Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

## Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (eg disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*.

## Access arrangements and special consideration

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

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Please refer to the *JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds* for more information. Both are available on the City & Guilds website: <http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>

### **Special consideration**

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, *A guide to the special consideration process*. This document is available on the City & Guilds website: <http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>

## Unit 331

## Cold water system planning and design

|               |            |
|---------------|------------|
| <b>UAN:</b>   | K/507/3804 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 90         |

### What is this unit about?

The purpose of this unit is to provide the learner with knowledge of the Water Regulations. It also provides the knowledge of cold water systems, specialist components, commissioning procedures and fault finding techniques. Learners will acquire practical skills in commissioning and rectifying faults.

Learners should consider the following questions as a starting point to this unit:

- What different types of boosted cold water supply systems are there?
- How is cross connection in systems prevented?
- Which pieces of information are recorded on commissioning records?

### Learning outcomes

In this unit, learners will:

1. know the legislation relating to the installation and maintenance of cold water systems
2. understand cold water system layouts
3. understand requirements for backflow protection in plumbing systems
4. apply design techniques for cold water systems
5. diagnose and rectify faults in cold water systems and components
6. commission cold water systems and components

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved. In order to fully understand this unit, learners need to have level 2 knowledge of health and safety.

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

**Topic 1.1:** Cold water system legislation

**Topic 1.2:** Notification requirements

#### Topic 1.1

Learners will identify legislation controlling the installation and use of water systems and interpret the key points of each including:

- supplied from a water undertaker
- supplied from a private source.

Learners will differentiate between installer and user responsibilities under water legislation.

#### Topic 1.2

Learners will describe the notification requirements for work on wholesome and recycled water systems with consideration of:

- water undertaker
- building control or self-certification.

### Learning outcome: 2. Understand cold water system layouts

**Topic 2.1:** Layout features for multi-storey dwellings

**Topic 2.2:** Components of systems in multi-storey dwellings

**Topic 2.3:** Water for single occupancy dwellings

**Topic 2.4:** Components for single occupancy dwellings

**Topic 2.5:** Specialist components for cold water systems

#### Topic 2.1

Learners will describe cold water system component layout features for multi-storey dwellings and state the system layout features for large scale storage cisterns used in multi-store cold water systems for dwellings.

Component layout features including:

- supplied direct from the main
- using break cistern arrangements
- providing drinking water.

System layout features including:

- warning/overflow pipe
- alternative filling methods using
- float switches and solenoid valves
- specialist inlet valves
- interlinking multiple cisterns
- sectional cisterns.

## Topic 2.2

Learners will explain the function of components used in boosted cold water systems in multi-storey dwellings including:

- booster pumps
- sets with integral controls
- self assembled sets
- pressure/expansion vessels
- pressure switches (transducer)
- float switches
- accumulators.

## Topic 2.3

Learners will describe methods of providing private water supplies and treating water for single occupancy dwellings including:

Methods of providing

- pumped from wells and boreholes
- collected from surface water sources – streams and springs
- use of externally sited break cisterns.

Methods of treating

- localised water filtration units
- localised water treatment units – ultra violet.

Learners will also describe system layout features for cold water systems fed from private water supplies including:

- conventional direct or indirect systems from an incoming supply
- boosted (pumped) supply from a well or borehole
- boosted (pumped) supply from a low level internal or external break cistern.

## Topic 2.4

Learners will explain the operation methods of components used in boosted (pumped) cold water supply systems from private sources for single occupancy dwellings with consideration of:

- small booster pump sets which incorporate all controls and components
- boosted system with separate controls and components
- use of accumulators in increasing system flow rate.

## Topic 2.5

Learners will determine the working principles of specialist cold water system components and explain their use in overcoming temperature and pressure effects caused by the installation of backflow prevention devices where relevant.

Specialist cold water system components including:

- infra-red operated taps
  - concussive taps
  - combination bath tap and shower head
  - flow limiting valves
  - spray taps
  - urinal – water conservation controls
  - shower pumps – single and twin impellor
  - pressure reducing valves
  - shock arrestors/mini expansion vessels.
-

## **Learning outcome: 3. Understand requirements for backflow protection in plumbing systems**

**Topic 3.1:** Terminology

**Topic 3.2:** Non-mechanical backflow prevention

**Topic 3.3:** Mechanical backflow prevention

**Topic 3.4:** Preventing cross connection

### **Topic 3.1**

Learners will define terminology used when selecting and applying backflow prevention devices including:

- point of use protection
- whole site or zone protection.

Learners will also interpret the five fluid risk levels as laid down in water legislation.

### **Topic 3.2**

Learners will identify the installation situations in which non-mechanical backflow prevention devices may be used with consideration of:

- Type AA – air gap with unrestricted discharge above spill over level
- Type AB – air gap with weir overflow
- Type AD – air gap with injector
- Type AG – air gap with minimum size circular overflow
- Type AUK1 – air gap with interposed cistern
- Type AUK2 – air gaps for taps and combination taps
- Type AUK3 – air gaps for taps and combination taps
- Type DC pipe interrupter with permanent atmospheric vent.

### **Topic 3.3**

Learners will identify the installation situations in which mechanical backflow prevention devices may be used with consideration of:

- Type BA – reduced pressure zone valve
- Type CA – non verifiable disconnecter
- Type DB – pipe interrupter with permanent atmospheric vent and moving element
- Type EA/EB – single check valves
- Type EC/ED – double check valves
- Type HA – hose union backflow preventer
- Type HUK1 – hose union tap with double check valves
- Type HC – diverter with automatic return.

### **Topic 3.4**

Learners will determine methods of preventing cross connection in systems that contain non-wholesome water sources.

## **Learning outcome: 4. Apply design techniques for cold water systems**

**Topic 4.1:** Information sources

**Topic 4.2:** Taking measurements

**Topic 4.3:** Calculating component size

### **Topic 4.1**

Learners will locate, interpret and use information sources needed when undertaking design work on cold water systems including:

- statutory regulations
- industry standards
- manufacturer technical instructions
- verbal and written feedback from the customer.

### **Topic 4.2**

Learners will take measurements of building features in order to carry out design calculations. Measurements will be taken from relevant areas including:

- plans
- drawings
- specifications
- site.

### **Topic 4.3**

Learners will calculate the size of cold water system components used in single occupancy dwellings including:

- cisterns
- pipework
- pumps
- pressure vessels.

Learners will present design calculations following industry format conventions for quotation and tender using basic line drawings.

## **Learning outcome: 5. Diagnose and rectify faults in cold water systems and components**

**Topic 5.1:** Gathering information on faults

**Topic 5.2:** Methods of repairing faults

**Topic 5.3:** Isolating cold water systems

**Topic 5.4:** Carrying out diagnostic checks and repairs

### **Topic 5.1**

Learners will describe methods used for obtaining details of system faults from end users and describe routine checks and diagnostics on cold water system components used part of a fault finding process. Including obtaining from:

- end user
- manufacturers' information
- fault diagnosis flow charts
- system history.

Learners will also interpret manufacturer instructions and industry standards to establish the diagnostic requirements of specific system components.

### **Topic 5.2**

Learners will explain methods of repairing faults in cold water system components including:

- pumps
  - expansion/pressure vessels
  - pressure switches (transducers)
  - float switches
  - gauges and controls
  - booster (pump) set to a system
-

- backflow prevention devices.

### **Topic 5.3**

Learners will isolate cold water systems and/or components to prevent them being brought into operation before work has been fully completed.

### **Topic 5.4**

Learners will carry out diagnostic checks to locate faults in cold water system components and carry out required repair work. Diagnostic checks to include:

- checking components for correct operating pressures and flow rates
- checking booster (pump) set to a system
- checking backflow prevention devices
- checking electrolytic corrosion.

System Components to include:

- pumps
- expansion/pressure vessels
- pressure switches (transducers)
- float switches
- gauges and controls
- booster (pump) set to a system
- backflow prevention devices.

Learners will carry out repair work following a systematic procedure with consideration of:

- diagnosis
- notifying client
- safely isolating
- decommissioning
- rectifying
- re-commissioning
- handing over.

## **Learning outcome: 6. Commission cold water systems and components**

**Topic 6.1:** Visual inspections

**Topic 6.2:** Filling and venting systems

**Topic 6.3:** Soundness testing

**Topic 6.4:** Flushing systems

**Topic 6.5:** Operational checks

**Topic 6.6:** Commissioning records

**Topic 6.7:** Handover procedures

### **Topic 6.1**

Learners will carry out visual inspections interpreting relevant information sources required to complete commissioning. Systems to include:

- boosted
- direct
- indirect.

### **Topic 6.2**

Learners will fill and vent the cold water systems with water at normal operating pressure and check for leakage.

### **Topic 6.3**

Learners will conduct soundness tests on different types cold water systems including:

- metallic pipework and components
- plastic pipework and components.

### **Topic 6.4**

Learners will flush cold water systems, specifying flushing requirements for new and existing cold water systems.

Flushing requirements:

- cold
- hot
- disinfection.

### **Topic 6.5**

Learners will carry out the operational checks required during commissioning including:

- flow rate
- pressure
- balancing
- mechanical controls
- functional testing.

### **Topic 6.6**

Learners will complete cold water system commissioning records with required information and outline the actions that must be taken when commissioning reveals defects:

- procedures for notifying works carried out to the relevant authority.

### **Topic 6.7**

Learners will carry out handover procedures following the commissioning of cold water systems.

## **Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

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## Unit 332

## Hot water system planning and design

|               |            |
|---------------|------------|
| <b>UAN:</b>   | M/507/3805 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 90         |

### What is this unit about?

The purpose of this unit is to provide the learner with knowledge of hot water systems, components, storage cylinders and temperature control as well as the commissioning procedures and fault finding techniques. Learners will consider alternative fuel sources and new technologies.

Learners should consider the following questions as a starting point to this unit:

- What are the recommended design temperatures for hot water systems?
- What safety devices are required in hot water systems?
- How is legionella prevented in hot water systems?
- Where can faults occur in hot water systems?

### Learning outcomes

In this unit, learners will:

1. understand hot water systems and their layout requirements
2. use design techniques for hot water systems
3. commission hot water systems and components
4. diagnose and rectify faults in hot water systems and components

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved. In order to fully understand this unit, learners need to have level 2 knowledge of health and safety.

### Learning outcome: 1. Understand hot water systems and their layout requirements

**Topic 1.1:** Types of hot water supply system

**Topic 1.2:** Design temperatures

**Topic 1.3:** System components

**Topic 1.4:** Safety devices

#### Topic 1.1

Learners will compare types of hot water supply systems used in dwellings and describe their applicable pipework layout features. Hot water systems including:

- centralised systems - unvented hot water systems and vented hot water systems
- localised systems - unvented point of use heaters and instantaneous heaters
- indirect storage systems
- direct storage systems:
  - electrically heated
  - gas or oil fired
  - small point of use (under sink)
  - bulk storage heaters (combination tank)
  - solar thermal hot water systems
  - combination boilers.

Pipework layout features including:

- unvented hot water
- secondary circulation
- solar thermal
- thermal stores
- combination boilers.

#### Topic 1.2

Learners will identify the recommended design temperatures within hot water systems with consideration of:

- flow
- return
- storage
- appliance outlet.

#### Topic 1.3

Learners will describe the layout and operational requirements of hot water system components including the location and safety features for unvented/vented hot water systems with consideration of standard components:

- line strainers
  - pressure reducing valves
  - single check valves
  - expansion devices (vessel or integral to cylinder)
  - expansion relief valves
  - tundish arrangements
  - application of composite valves
-

- safety features – including expansion and temperature relief pipework, vent pipes
- thermostatic mixing valve (TMV2 and TMV3).

Learners will also explain the working principles of specialist components used in systems including:

- infra-red operated taps
- concussive taps
- combination bath tap and shower head
- flow limiting valves
- spray taps
- shower pumps – single and twin impellor
- pressure reducing valves,
- shock arrestors/mini expansion vessels.

Learners will also describe how trace heating can be used as an alternative to a secondary circulation system.

#### **Topic 1.4**

Learners will describe the function of safety devices used in unvented hot water systems including:

- control thermostats
- overheat thermostats (thermal cut-out)
- temperature relief valves.

### **Learning outcome: 2. Use design techniques for hot water systems**

**Topic 2.1:** Factors affecting hot water systems

**Topic 2.2:** Information sources

**Topic 2.3:** Calculating system requirements

**Topic 2.4:** Installation requirements

#### **Topic 2.1**

Learners will describe factors which affect the selection of hot water systems for dwellings with consideration of:

- customer needs
- building layout and features
- energy efficiency
- environmental impact
- occupancy and purpose
- appliance location
- cost
- storage type/location
- legislation.

#### **Topic 2.2**

Learners will identify and use information sources that should be referred to when designing hot water systems including:

- statutory regulations
- industry standards
- manufacturer technical instructions
- verbal and written feedback from the customer

- plans
- drawings and specifications.

### **Topic 2.3**

Learners will calculate hot water system requirements for single occupancy dwellings and select hot water components in accordance with design calculations.

System requirements including:

- storage requirements
- expansion
- pipe size
- pump size.

Components including:

- storage vessels
- pipes
- pumps
- expansion vessels
- safety devices
- booster pumps.

Learners will present design calculations in a format suitable for quotation and tender.

### **Topic 2.4**

Learners will identify hot water system installation requirements to ensure adherence to current legislations including:

- pipe location
- supply pressures
- secondary circulation
- insulation
- temperature control
- outlet requirements
- safety relief pipework.

## **Learning outcome: 3. Commission hot water systems and components**

**Topic 3.1:** Visual inspections

**Topic 3.2:** Filling and venting systems

**Topic 3.3:** Soundness testing

**Topic 3.4:** Flushing systems

**Topic 3.5:** Operational checks

**Topic 3.6:** Commissioning records

**Topic 3.7:** Handover procedures

### **Topic 3.1**

Learners will carry out visual inspections interpreting relevant information sources required to complete commissioning.

### **Topic 3.2**

Learners will fill and vent the hot water systems with water at normal operating pressure and check for leakage.

### **Topic 3.3**

Learners will conduct soundness tests on different types hot water systems including:

- metallic pipework and components
- plastic pipework and components.

### **Topic 3.4**

Learners will flush hot water systems, specifying flushing requirements for new and existing hot water systems.

Flushing requirements:

- cold
- hot
- disinfection.

### **Topic 3.5**

Learners will carry out the operational checks required during commissioning including:

- temperature
- flow rate
- pressure
- balancing
- electrical controls
- mechanical controls
- functional testing.

### **Topic 3.6**

Learners will complete hot water system commissioning records with required information and outline the actions that must be taken when commissioning reveals defects.

### **Topic 3.7**

Learners will carry out handover procedures following the commissioning of hot water systems.

## **Learning outcome: 4. Diagnose and rectify faults in hot water systems and components**

**Topic 4.1:** Obtaining information on system faults

**Topic 4.2:** Carrying out diagnostic checks

**Topic 4.3:** Performing repair and rectification procedures

### **Topic 4.1**

Learners will obtain information required for working on hot water system faults including:

- end user
- manufacturers instructions
- fault diagnosis flow chart
- service history.

### **Topic 4.2**

Learners will carry out diagnostic checks required for common faults in hot water systems including:

- motorised valves not operating
- incorrect pressures
- expansion vessel failure

- heat exchanger
- leaks
- blockages
- pump failure
- thermostat
- programmer
- expansion valve
- pressure relief valve
- shower booster pump failure.

### **Topic 4.3**

Learners will carry out repair and rectification procedures when dealing with faults with consideration of:

- diagnosing
- notifying client
- safely isolating
- decommissioning
- rectifying
- re-commissioning
- handing over.

### **Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

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## Unit 333

# Central heating system planning and design

|               |            |
|---------------|------------|
| <b>UAN:</b>   | Y/507/3801 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 90         |

### What is this unit about?

The purpose of this unit is to provide the learner with the knowledge, understanding and skills associated with complex central heating systems and associated controls. Learners will be introduced to complex systems including their design considerations, boiler types, control systems, underfloor heating, decommissioning and commissioning requirements. Learners will also carry out installation of pipework and controls used in complex central heating systems with testing and commissioning procedures.

Learners should consider the following questions as a starting point to this unit:

- What pipework layout options are there for central heating systems?
- What safety hazards are associated with sealed central heating systems?
- How are central heating systems decommissioned?
- Which components make up underfloor heating systems?

### Learning outcomes

In this unit, learners will:

1. Understand types of central heating system and their layout requirements
2. Use design techniques for central heating systems
3. Follow installation requirements of central heating systems and components
4. Understand installation, connection and testing requirements of electrically operated central heating components
5. Install, connect and test electrically operated central heating systems
6. commission central heating systems and components
7. diagnose and rectify faults in central heating systems and components

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning Outcome 1: Understand types of central heating system and their layout requirements

**Topic 1.1:** Zoning requirements

**Topic 1.2:** Control systems

**Topic 1.3:** Underfloor heating

**Topic 1.4:** Multiple boiler installations

#### Topic 1.1

Learners will describe zoning requirements for central heating systems in relation to legislations and guidance documents including:

- Part L building regs
- CHeSS central heating specification
- domestic heating compliance guide
- gas safe installation and use regs
- Part P building regs.

#### Topic 1.2

Learners will recognise control systems and their components and be able to describe their various functions and operating principles.

Systems to include:

- combination boiler
- S-plan
- Y-plan
- S-plan plus
- sealed
- multi-zone
- W-Plan.

Components include:

- zone valves (2 port, 3 port, mid position and diverter)
  - programmer
  - timer
  - thermostats
  - programmable room stat
  - optimizer
  - frost stat
  - wiring centre
  - cylinder stat
  - expansion vessel
  - automatic by-pass.
-

Operating principles to include:

- time
- temperature weather compensation
- delayed start
- optimum start
- home automation systems
- multiple boiler controls
- zoning requirements.

### **Topic 1.3**

Learners will describe the features and working principles of underfloor heating systems components including:

- manifolds
- pump control unit
- insulation
- pipework
- manifold isolation ball valves
- supports
- controls.

Learners will also describe the layout and installation requirements of underfloor heating pipework.

### **Topic 1.4**

Learners will describe the system layout requirements for multiple boiler installations and low loss headers.

## **Learning Outcome 2: Use design techniques for central heating systems**

**Topic 2.1:** Factors affecting design

**Topic 2.2:** Principles of heat loss and gain

**Topic 2.3:** Calculating central heating system requirements

**Topic 2.4:** Selecting components

### **Topic 2.1**

Learners will define factors which affect the selection of central heating systems for dwellings with consideration of:

- customer needs
- building layout and features
- energy efficiency
- environmental impact
- building size
- occupancy and purpose
- fuel availability
- cost
- emitter type
- legislation.

Learners will also identify and use the range of sources of information that are considered when undertaking design work on central heating systems including:

- statutory regulations
- industry standards

- manufacturer technical instructions
- verbal and written feedback from the customer
- plans
- drawings and specifications.

### **Topic 2.2.**

Learners will describe how the principles of heat loss and gain affect heating requirements in a dwelling with consideration of:

- electrical equipment
- occupancy
- solar
- building fabric
- ventilation
- internal and external temperatures
- pipework heat loss.

### **Topic 2.3**

Learners will calculate central heating system requirements used in single occupancy dwellings with consideration of:

- total heat load
- emitter load
- hot water load
- pipe size
- pump size
- expansion.

Learners must present design calculations to meet formats suitable for quotation and tenders

### **Topic 2.4**

Learners will select central heating components in accordance with design calculations including:

- emitters
- boilers
- pipes
- pumps
- expansion vessels.

## **Learning Outcome 3: Follow installation requirements of central heating systems and components**

**Topic 3.1:** Positioning, fixing and connection requirements

**Topic 3.2:** Connecting sealed central heating systems

### **Topic 3.1**

Learners will specify the positioning, fixing and connection requirements for new central heating components for central heating systems including:

- boilers
  - pumps
  - motorised valves
  - expansion vessels
  - isolation valves
  - fill points
  - radiators
-

- UFH manifolds
- UFH pipework
- cylinders
- automatic by pass.

### **Topic 3.2**

Learners will position, fix and connect new central heating components for sealed central heating systems including all components as identified in topic 3.1 where required.

## **Learning Outcome 4: Understand installation, connection and testing requirements of electrically operated central heating components**

**Topic 4.1:** Pre-installation checks from fused spurs

**Topic 4.2:** Wiring diagrams

**Topic 4.3:** Connections, termination and cabling

**Topic 4.4:** Electrical testing procedures

### **Topic 4.1**

Learners will identify pre-installation checks when supplying control circuits from a fused spur connection unit including:

- current certification
- rating
- signs of mechanical damage.

### **Topic 4.2**

Learners will draw wiring diagrams for different types of central heating circuits including:

- S-plan
- Y-plan
- multi-zone.

### **Topic 4.3**

Learners will specify methods of connection and termination on central heating wiring and identify suitable cables for central heating systems components.

### **Topic 4.4**

Learners will explain the purpose of electrical testing procedures for new and existing circuits including:

- polarity
- earth continuity.

## **Learning outcome 5: Install, connect and test electrically operated central heating systems**

**Topic 5.1:** Carrying out pre-installation checks for control circuits

**Topic 5.3:** Electrical wiring on control systems

**Topic 5.4:** Inspecting and testing central heating controls

### **Topic 5.1**

Learners will carry out pre-installation checks and safe isolation procedures when supplying control circuits. Pre-installation checks to include:

- safe isolation

- current certification
- rating
- signs of mechanical damage.

### **Topic 5.2**

Learners will carry out electrical wiring of central heating control systems.

### **Topic 5.3**

Learners will carry out inspections and testing of completed central heating controls systems with consideration of:

- visual inspections
- polarity
- earth continuity
- functional testing.

## **Learning Outcome 6: Commission central heating systems and components**

**Topic 6.1:** Visual inspections

**Topic 6.2:** Filling and venting systems

**Topic 6.3:** Soundness testing

**Topic 6.4:** Flushing systems

**Topic 6.5:** Operational checks during commissioning

**Topic 6.6:** Handover procedures following commissioning

### **Topic 6.1**

Learners will carry out visual inspections required when commissioning central heating systems, interpreting information from required sources.

### **Topic 6.2**

Learners will fill and vent central heating systems with water at normal operating pressure, checking for leakage. Types to systems to include:

- metallic systems
- plastic pipework systems
- UFH.

### **Topic 6.3**

Learners will conduct soundness testing on central heating systems. Types of systems as identified in topic 6.2.

### **Topic 6.4**

Learners will flush central heating systems and explain treatment requirements including the use of system additives for new and existing central heating systems. Requirements including:

- cold
- hot
- power flush
- system additives including:
  - neutralisers
  - cleanser

- corrosion inhibitors.

### **Topic 6.5**

Learners will carry out required operational checks during commissioning and identify the actions that must be taken when commissioning reveals defects

Operational checks including:

- temperature
- flow rate
- pressure
- balancing
- electrical controls
- mechanical controls
- functional testing.

Following commissioning, learners will complete central heating commissioning records.

### **Topic 6.6**

Learners will carry out handover procedures following commissioning of central heating systems. This will also include an explanation around the requirements for Energy related Products (ErP) directive.

## **Learning Outcome 7: Diagnose and rectify faults in central heating systems and components**

**Topic 7.1:** Obtaining information of system faults

**Topic 7.2:** Diagnostic checks

**Topic 7.3:** Repair and rectification procedures

### **Topic 7.1**

Learners will identify and obtain information on system faults with consideration of:

- end user
- manufacturer instructions
- fault diagnosis flow charts
- service histories.

### **Topic 7.2**

Learners will carry out diagnostic checks on central heating system faults including:

- pumping over
- persistent venting
- emitter cold spots
- stuck TRVs
- motorised valves not operating
- heat when no demand
- leaks
- blockages
- pump failure
- thermostat
- programmer

- expansion valve
- specialist control faults.

### **Topic 7.3**

Learners will carry out repair and rectification procedures to deal with central heating system faults as identified in Topic 7.2, procedures to include where appropriate:

- diagnosis
- notifying client
- safely isolating
- decommissioning
- rectifying
- re-commissioning
- handing over.

### **Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

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## Unit 334

## Sanitation system planning and design

|               |            |
|---------------|------------|
| <b>UAN:</b>   | H/507/3803 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 90         |

### What is this unit about?

The purpose of this unit is to provide the learner with the knowledge, understanding and skills associated with complex sanitation and drainage systems. Learners will be introduced to complex systems including their design and commissioning requirements. Learners will also carry out complex testing and commissioning tasks used in plumbing.

Learners should consider the following questions as a starting point to this unit:

- What are air admittance valves used for?
- What are the common faults with macerators?
- How are waste pipe faults diagnosed?
- Which documents and regulations relate to sanitation systems?

### Learning outcomes

In this unit, learners will:

1. Understand types of sanitation system and their layout requirements
2. Understand design techniques for sanitation and rainwater systems
3. Understand fault diagnosis and rectification procedures for sanitary pipework systems and components
4. Understand commissioning requirements of sanitary pipework systems and components
5. Commission sanitary pipework systems and components

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved. In order to fully understand this unit, learners need to have level 2 knowledge of health and safety.

### Learning outcome: 1. Understand types of sanitation system and their layout requirements

**Topic 1.1:** Above ground drainage and sanitation systems

**Topic 1.2:** Sanitary facilities and equipment

**Topic 1.3:** Foul tanks

#### Topic 1.1

Learners will describe the installation requirements for sanitation pipework with consideration of:

- type of system e.g. stub stacks, primary vented stacks, secondary ventilated, fully ventilated
- air admittance valves
- multi occupancy dwellings
- minimum and maximum distances.

#### Topic 1.2

Learners will explain the working principles and system layout features of specialist sanitary components including:

- WC macerators
- waste water lifters
- sink waste disposals
- wet rooms.

#### Topic 1.3

Learners will explain the working principles and layout features of foul tanks used in in sanitation systems including their periodic maintenance and cleaning requirements. Foul tank types including:

- cesspits
- septic tanks.

### Learning Outcome: 2. Understand design techniques for sanitation and rainwater systems

**Topic 2.1:** Selecting sanitation systems and appliances

**Topic 2.2:** Designing sanitary pipework systems

**Topic 2.3:** Rainwater systems components

#### Topic 2.1

Learners will describe the factors which affect the selection of sanitation systems and appliances with consideration of:

- occupancy and appliance requirements
  - building layout and features
  - underground drainage/sewer system
-

- access/maintenance requirements
- sources of information – for example manufacturer's instructions, building regulations, British standards, customer information
- requirements for fire stops
- space requirements e.g. for disabled access.

### Topic 2.2

Learners will calculate sanitary provision requirements for dwellings and design sanitary pipework systems, including primary ventilated (inc. branches) and stub stacks, with consideration of:

- gradient
- diameter
- length
- material
- system type.

Learners will need to present design calculations to meet industry formatting conventions:

- using basic not to scale line drawings
- providing quotations or tenders for work in a small-scale dwellings.

### Topic 2.3

Learners will calculate the size of rainwater system components used with single occupancy and multiple terraced properties including:

- outlets
- gutters
- rain water pipes.

## Learning Outcome: 3. Understand fault diagnosis and rectification procedures for sanitary pipework systems and components

**Topic 3.1:** System faults

**Topic 3.2:** Diagnostic checks

**Topic 3.3:** Repair and rectification procedures

### Topic 3.1

Learners will describe methods of obtaining information on system faults including:

- end user
- manufacturer information
- fault diagnosis flow chart
- documented history.

### Topic 3.2

Learners will explain diagnostic checks for common faults to sanitary components including:

- WC macerators
- sink waste disposal units
- air admittance valves
- pipework / traps.

### **Topic 3.3**

Learners will explain the repair and rectification procedures for dealing with common faults to sanitary components. Stages of repair and rectification procedure to include:

- diagnosis
- notifying client
- safely isolating
- decommissioning
- rectifying
- re-commissioning
- handing over.

## **Learning Outcome: 4. Understand commissioning requirements of sanitary pipework systems and components**

**Topic 4.1:** Commissioning procedures

**Topic 4.2:** Notifying authorities

### **Topic 4.1**

Learners will describe how to carry out each stage of the commissioning procedure for sanitary components to meet industry standards including:

- interpreting information
- visual inspections
- safe isolation (electrical/mechanical)
- air testing sanitary pipework
- performance testing
- setting up appliances
- handing over.

Sanitary components to include:

- WC macerators
- sink waste disposal units
- air admittance valves
- pipework.

Learners will also describe the information that must be detailed on sanitation system commissioning records.

### **Topic 4.2**

Learners will describe procedures for notifying works carried out to the relevant authorities to comply with building regulations.

## **Learning Outcome: 5. Be able to commission sanitary pipework systems and components**

**Topic 5.1:** Carrying out visual inspections

**Topic 5.2:** Performing air tests

**Topic 5.3:** Carrying out performance tests

**Topic 5.4:** Commissioning a WC with macerator pump

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**Topic 5.1**

Learners will carry out visual inspections on sanitation systems to confirm they are ready for operation.

**Topic 5.2**

Learners will perform air tests on sanitary pipework systems to meet industry requirements.

**Topic 5.3**

Learners will carry out performance tests on a sanitary pipework systems to check for effective trap seal retention. Performance tests to include:

- branch discharge pipework
- test for self siphonage
- test for induced siphonage
- test for compression.

**Topic 5.4**

Learners will commission WC's with macerator pump installation to meet industry requirements.

**Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Unit 335

## Environmental technology systems

|               |            |
|---------------|------------|
| <b>UAN:</b>   | D/507/3802 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 30         |

### What is this unit about?

The purpose of this unit is to provide learning in the fundamental working principles along with regulatory requirement relating to renewable energy. Learners will cover how to distinguish the potential type of building features that will meet the requirements to install renewable energy water conservation along with typical benefits and limitations.

Learners should consider the following questions as a starting point to this unit:

- What methods of water conservation are available?
- What is heat producing micro-renewable energy?
- How do building regulations affect the use of renewable energy?
- Where does biomass energy come from?

### Learning outcomes

In this unit, learners will:

1. understand operating principles of micro-renewable energy and water conservation technologies
  2. understand the installation requirements relating to micro-renewable energy and water conservation technologies
  3. compare benefits and limitations associated with micro-renewable energy and water conservation technologies.
-

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved. In order to fully understand this unit, learners need to have level 2 knowledge of health and safety.

### Learning outcome 1: Understand working principles of micro-renewable energy and water conservation technologies

**Topic 1.1:** Heat producing micro-renewable energy

**Topic 1.2:** Water conservation

#### Topic 1.1:

Learners must describe basic operating principles of heat producing micro-renewable energy technologies including:

- solar thermal (hot water)
- ground source heat pump
- air source heat pump.

#### Topic 1.2:

Learners must explain working principles of water conservation technologies including:

- rainwater harvesting
- greywater re-use.

### Learning outcome 2: Understand requirements relating to micro-renewable energy and water conservation technologies

**Topic 2.1:** Factors influencing installation of systems

**Topic 2.2:** Permitted developments

**Topic 2.3:** Building regulations and building standards

In this learning outcome technologies and systems includes the following:

- solar thermal (hot water)
- ground source heat pumps
- air source heat pumps
- rainwater harvesting
- greywater re-use.

#### Topic 2.1

Learners must explain how building location and features influence the suitability of installing micro-renewable energy and water conservation systems with consideration of:

- structural
- orientation
- listed buildings
- environmental conditions
- adjacent structures and obstructions.

#### Topic 2.2

Learners must describe what is typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of technologies.

### **Topic 2.3**

Learners must know the regulations and standards affecting installation of micro-renewable energy and water conservation systems including:

- building regulations
- town and country planning regulations.

Learners must explain which building regulations apply in relation to the installation of the following technologies i.e. parts A, E, G, H, and L.

## **Learning outcome 3: Compare benefits and limitations associated with micro-renewable energy and water conservation technologies**

**Topic 3.1:** Benefits of systems

**Topic 3.2:** Limitations of systems

### **Topic 3.1 & 3.2:**

Learners must describe, compare and contrast the benefits and limitations associated with micro-renewable energy and water conservation technologies including:

- solar thermal (hot water)
- ground source heat pump
- air source heat pump
- rainwater harvesting
- greywater re-use.

## **Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

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## Unit 336

## Site procedures and planning

|               |            |
|---------------|------------|
| <b>UAN:</b>   | Y/507/4527 |
| <b>Level:</b> | 3          |
| <b>GLH:</b>   | 60         |

### What is this unit about?

The purpose of this unit is for learners to develop their knowledge and understanding of site procedures in the building services engineering sector.

In this unit learners familiarise themselves with different client types found in building services engineering, the responsibilities of individuals who might be on site as well as potential opportunities for progression within the industry to bigger and better roles. Learners will consider the different communication methods used on site, both between employees and with clients.

Within the unit learners will investigate the different opportunities and methods used in the building services engineering industry for planning, monitoring and pricing work to make a profit.

Learners should consider the following questions as a starting point to this unit:

- What is the difference between a hazard and a risk?
- How can environmental conditions impact on work schedules?
- What types of communication are used with clients and on site?
- What are the considerations when preparing quotes for a customer?

### Learning outcomes

In this unit, learners will:

1. Understand the responsibilities of those working in the building services industry
2. Understand how to carry out risk assessments and method statements for small works jobs
3. Understand how to supervise and oversee building services work
4. Understand how to plan work programmes

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome: 1. Understand the responsibilities of those working in the building services industry

**Topic 1.1:** Types of client

**Topic 1.2:** Communication methods

**Topic 1.3:** Job roles and site responsibilities

**Topic 1.4:** Legislation for building services engineering

#### Topic 1.1

Learners will describe and define types of client that are encountered when working including:

- private customer - direct communication through customer representatives managing agents
- contracting customer
- internal customer – within same company.

#### Topic 1.2

Learners will describe methods of communication that may be required with clients and the site management team throughout the progress of a job with consideration of:

- variation orders
- site meetings/toolbox talks
- safety memos/ briefings
- work quality management systems
- ordering plant and materials
- customer liaison and hierarchy systems – chain of command
- co-ordination and liaison with other trades
- site procedures.

#### Topic 1.3

Learners will describe the job roles and responsibilities associated with work in the building services environment including:

- architect
  - quantity surveyor
  - buyer/estimator
  - site engineer
  - project manager/clerk of works
  - structural engineer
  - building services engineer
  - contracts manager
  - construction manager
  - health and safety manager
  - trade supervisor
  - apprentices/trainees
  - level 2 craft level qualified staff (limited self responsibility)
  - level 3 craft level qualified staff (supervision of self and other staff members).
-

### Topic 1.4

Learners will describe key legislation and processes which BSE companies must follow including where to reference information and key responsibilities for employers with consideration of:

- Health and Safety at Work Act (HASWA)
- Construction Design and Management (CDM)
- Management of Health and Safety at Work Regulations
- Control of Substances Hazardous to Health (COSHH)
- Provision and Use of Work Equipment Regulations (PUWER)
- Electricity at Work Regulations
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)
- Building regulations.

Learners will explain responsibilities when supervising staff with consideration of:

- duty of care and application of Construction Design and Management (CDM) regulations/Health and Safety at Work Act (HASWA)
- identifying when direct supervision or detailed direction is required - correct training and allocation of work
- inductions for site
- checking of competences.

## Learning outcome: 2. Understand how to carry out risk assessments and method statements for small works jobs

**Topic 2.1:** Risk assessments

**Topic 2.2:** Method statements

### Topic 2.1

Learners will explain the methods used to carry out risk assessments for building service engineering tasks with consideration of:

- information to be provided in risk assessment:
  - levels of hazard/risk
  - persons affected
  - risk calculation formula
- presentation of risk assessments – e.g. formats, forms, paperwork
- requirements for reviewing risk assessments – frequency and action in case of accidents.

### Topic 2.2

Learners will explain how to produce method statements for areas of work with safety risks with consideration of:

- information to be provided in a method statement
- presentation methods - e.g. formats, forms, paperwork.

## Learning outcome: 3. Understand how to supervise and oversee building services work

**Topic 3.1:** Variations to works

**Topic 3.2:** Monitoring work

### Topic 3.1

Learners will describe how to deal with variations to works with consideration of:

- changes prescribed by the work environment – e.g. client specification changes, materials
- methods/processes of agreement to extra time and costs prescribed by the customer.

### Topic 3.2

Learners will explain how to undertake on-going monitoring of work progress against the work programme to with consideration of:

- safety – safety management systems and how performed
- cost effectiveness – management of monthly payments, correct storage of materials and wastage monitoring
- progress monitoring against the schedule
- quality – method of checking work, responsibility allocation of work to areas
- methods of staff management - actions to be taken when deficiencies in work progress (formal and informal).

## Learning outcome: 4. Understand how to plan work programmes

**Topic 4.1:** Types of work programme

**Topic 4.2:** Planning work

**Topic 4.3:** Project delays

**Topic 4.4:** Pricing work

### Topic 4.1

Learners will describe the types of work programme that would be used for building service engineering work with consideration of:

- private installation work
- private service/maintenance work
- new-build installation contract work
- service/maintenance contract work.

### Topic 4.2

Learners will explain the process for planning work activities against job specifications with consideration of:

- the scope, purpose and requirements of the work
- identification of work responsibilities
- external factors that affect timeframe:
  - labour resources
  - planning work with other trades
  - material deliveries/availability
- resources required against job specification – materials, plant, vehicles, equipment
- contingency planning.

### Topic 4.3

Learners will describe causes and reasons for project delays including:

- weather
  - availability of resources
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- site conditions
- defective workmanship
- lack of co-ordination/communication
- change in specification.

#### **Topic 4.4**

Learners will explain how to price work and present quotes for work with consideration of:

- methods of contract management – fixed cost, variable cost, cost plus
- methods of pricing works:
  - creating materials take off from drawing
  - using bill of quantity
  - schedule of rates
  - additions of profit margin
- presentation to customer – professional format including cover letter, email, tender.

#### **Guidance for delivery**

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Appendix 1 Suggested learning resources

### Cold water

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- BS EN 806- Specification for installations inside buildings conveying water for human consumption (parts 1-5)
- BS 8558- Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806
- Building Regulations Approved Document G (P in Northern Ireland), downloadable from [www.planningportal.gov.uk](http://www.planningportal.gov.uk) ([www.dfpni.gov.uk](http://www.dfpni.gov.uk) in Northern Ireland)
- The Water Supply (Water Fittings) Regulations downloadable from [www.legislation.gov.uk](http://www.legislation.gov.uk)

### Hot water

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- BS EN 806- Specification for installations inside buildings conveying water for human consumption (parts 1-5)
- BS 8558- Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806
- Building Regulations Approved Document G (P in Northern Ireland), downloadable from [www.planningportal.gov.uk](http://www.planningportal.gov.uk) ([www.dfpni.gov.uk](http://www.dfpni.gov.uk) in Northern Ireland)
- Domestic Building Services Compliance Guide, downloadable from [www.planningportal.gov.uk](http://www.planningportal.gov.uk)
- The Water Supply (Water Fittings) Regulations downloadable from [www.legislation.gov.uk](http://www.legislation.gov.uk)

### Central heating

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- CIBSE Domestic Heating Design Guide, published by CIBSE
- Domestic Building Services Compliance Guide, downloadable from [www.planningportal.gov.uk](http://www.planningportal.gov.uk)

### Sanitation

- BS 6465 part 2 - Code of practice for space requirements for sanitary appliances
  - BS EN 12056 part 2 - BS EN 12056: 2 - Gravity drainage systems inside buildings, Sanitary pipework, layout and calculation
  - Building Regulations Approved Document H (N in Northern Ireland), downloadable from [www.planningportal.gov.uk](http://www.planningportal.gov.uk) ([www.dfpni.gov.uk](http://www.dfpni.gov.uk) in Northern Ireland)
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## Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on [www.cityandguilds.com](http://www.cityandguilds.com).

### ***City & Guilds Centre Manual***

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

### ***Our Quality Assurance Requirements***

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on **Walled Garden**: how to register and certificate candidates on line  
**Events**: dates and information on the latest Centre events  
**Online assessment**: how to register for e-assessments.

## Useful contacts

### UK learners

General qualification information

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**E: [learnersupport@cityandguilds.com](mailto:learnersupport@cityandguilds.com)**

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### International learners

General qualification information

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**E: [intcg@cityandguilds.com](mailto:intcg@cityandguilds.com)**

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### Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

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**E: [centresupport@cityandguilds.com](mailto:centresupport@cityandguilds.com)**

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### Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

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**E: [singlesubjects@cityandguilds.com](mailto:singlesubjects@cityandguilds.com)**

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### International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

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**E: [intops@cityandguilds.com](mailto:intops@cityandguilds.com)**

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### Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

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**E: [walledgarden@cityandguilds.com](mailto:walledgarden@cityandguilds.com)**

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### Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

**E: [business@cityandguilds.com](mailto:business@cityandguilds.com)**

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If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: **[feedbackandcomplaints@cityandguilds.com](mailto:feedbackandcomplaints@cityandguilds.com)**

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## About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

## City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

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