

# Level 3 Diploma in Plumbing Studies (6035-03)

December 2017 Version 4.6



## Qualification at a glance

<b>Subject area</b>	<b>Plumbing</b>
<b>City &amp; Guilds number</b>	6035
<b>Age group approved</b>	16+
<b>Entry requirements</b>	Level 2
<b>Assessment</b>	Online test/practical assignment
<b>Fast track</b>	Available
<b>Support materials</b>	Qualification handbook Level 3 Assessment pack – practical task manual Level 3 Assessor guidance for Assessment pack – practical task manual Text Book Smartscreen
<b>Registration and certification</b>	Consult the Walled Garden/Online Catalogue for last dates

<b>Title and level</b>	<b>GLH</b>	<b>TQT</b>	<b>City &amp; Guilds number</b>	<b>Accreditation number</b>
Level 3 Diploma in Plumbing Studies	470	530	6035-03	600/5497/9

<b>Version and date</b>	<b>Change detail</b>	<b>Section</b>
1.1 Sep 2012	Amended information on where to obtain assessments. Amended the 'roles' and 'opportunities for progression' sections of the range for learning outcome one for unit 308.	<b>Assessment</b> <b>Units</b>
2.0 September 2012	Added permitted reference materials for Units 603, 604 and 606.	<b>Assessment</b>
2.1 December 2012	Added 'Learners must achieve QPs 1-5 and 20' to the assessment information for Unit 307.	<b>Assessment</b>
2.2 February 2013	Amended the wording of the assessment method for unit 307.	<b>Assessment</b>
2.3 March 2013	Added guidance for assessment of gas units	<b>Assessment</b>
4.0 October 2013	Replaced references to BS 6700 with BS EN 806	<b>Assessment,</b> <b>Units</b>
4.1 April 2014	Added range to Unit 606 A.C 3.2 'fan'. Proxy units for 30, 303, 304 and 306	<b>Units,</b> <b>Assessment</b>
4.2 September 2014	Added IQA guidance	<b>Centre</b> <b>requirements</b>
4.3 December 2015	Test specifications changed for Unit 604 Phone numbers deleted	<b>Test specs</b> <b>Last page</b>
4.4 January 2016	Changed unit 307 to 309, Changes to assessment info and test specs	<b>Test specs</b> <b>Assessment</b>
4.5 September 2017	Added TQT and GLH details  Deleted QCF	<b>Qualification</b> <b>at a Glance,</b> <b>Structure</b>  <b>Appendix</b>
4.6 December 2017	Additional information provided on e-volve tests.	<b>Test</b> <b>specifications</b>



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# 1 Introduction

This document tells you what you need to do to deliver the qualification:

<b>Area</b>	<b>Description</b>
Who is the qualification for?	For candidates who want to work as plumbers in the building services engineering sector. This qualification does <b>not</b> make candidates fully qualified plumbers or plumbing and heating engineers (see Appendix 2).
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the plumbing and heating sector. See Appendix 2 for further information.
What opportunities for progression are there?	It allows candidates to progress into employment, or to the following City & Guilds qualifications: <ul style="list-style-type: none"><li>• Level 3 NVQ Diploma in Plumbing and Heating.</li></ul>

## Structure

To achieve the **Level 3 Diploma in Plumbing Studies**, learners must achieve **53** credits from the mandatory units.

Unit accreditation number	City & Guilds unit number	Unit title	Credit value	Level	GLH
<b>Mandatory</b>					
T/503/9669	201/501	Health and safety in building services engineering	3	2	26
K/602/3138	301/802	Understand the fundamental principles and requirements of environmental technology systems	2	3	15
K/504/0236	302	Plumbing system installation planning	6	3	51
M/504/0237	303/603/811	Complex cold water systems	7	3	56
T/504/0238	304/604/812	Domestic hot water	8	3	59
A/504/0239	305	Sanitation and drainage systems	3	3	25
H/504/0235	306/606/813	Central heating systems	11	3	110
D/504/0234	309	Domestic gas principles	11	3	108
K/504/0253	308	Career awareness in building services engineering	2	3	20

## Total Qualification Time

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 Diploma in Plumbing Studies	470	530



## 2 Centre requirements

### Approval

#### Centres already offering City & Guilds qualifications

If your Centre is approved to offer **6129 Certificate in Domestic Plumbing Studies** you can apply for the new **Level 3 Diploma in Plumbing Studies (6035-02)** approval using the **fast track approval form**, available from the City & Guilds website.

Centres should use the fast track form if:

- there have been no changes to the way the qualifications are delivered, and
- they meet all of the approval criteria in the fast track form guidance notes.

Fast track approval is available for 12 months from the launch of the qualification. After 12 months, the Centre will have to go through the standard Qualification Approval Process. The centre is responsible for checking that fast track approval is still current at the time of application.

#### Centres NOT already offering City & Guilds qualifications

To offer this qualification, new centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual – Supporting Customer Excellence* for further information.

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

### Resource requirements

#### Physical resources and site agreements

Centres can use specially designated areas within a centre to assess the simulated practical assignments. The equipment, systems and machinery must meet industrial standards and be capable of being used under normal working conditions.

## Human Resources

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be technically competent in the area(s) for which they are delivering training and/or have experience of providing training
- hold appropriate qualifications detailed in this handbook
- have recent relevant experience in the specific area they are assessing
- be able to demonstrate occupational competence in the areas of the Building Services Engineering (BSE) for which they are delivering training and/or assessment. This competence must be at a level equal to, or above, the level of training being delivered and must include current knowledge and skills of each industry (for which the assessment is taking place), its techniques, settings, legislative and regulatory requirements, codes of practice and guidance
- have credible experience of providing training and/or assessment.

Centre staff may undertake more than one role, eg tutor and assessor or internal quality assurer, but must never verify their own assessments.

### Assessors must;

- hold, or be working towards TAQA (A1/A2 – D32/33 updated) standards and continue to practice to these standards and possess CPD evidence of personally maintaining these standards, or
- have other suitable equivalent assessor qualifications endorsed by the Sector Skills Council and/or the Awarding Organisation.

### Assessor Occupational Competence

For the purposes of this qualification, occupational competence will be deemed to have been demonstrated by the verifiable evidence of **one, preferably more**, of the following:

- **a relevant sector** qualification equal to or at a level above the training and/or assessment being delivered. Where earlier forerunner qualifications are held eg City & Guilds Craft or Advanced Craft Certificated, the assessor must demonstrate through CPD evidence a thorough knowledge of the qualification standards that they meet the required criteria
- **an up-to-date CPD record including relevant CPD qualifications.** Assessors must either be able to demonstrate that they are registered and up-to-date with their registration with an appropriate approved industry registration body (eg Gas Safe Register) or have one or more relevant occupational qualifications to demonstrate that they can be regarded as occupationally competent in terms of assessing or verifying the qualification and the unit contained
- **a verifiable CV** of industry experience and current knowledge of industry practice and techniques relevant to the occupational area in which they assess. This verifiable evidence must be **at or above the level being assessed**
- a thorough **knowledge and understanding** of the qualification standards and requirements



## **Internal Quality Assurers (IQAs) must:**

hold, or be working towards TAQA (A1/A2 – D32/33 updated). The ‘working towards’ IQA should be mentored by, and have his/her judgements and decisions counter signed by a qualified IQA.

## **IQA Occupational Competence**

For the purposes of this qualification, occupational competence will be deemed to have been demonstrated by the verifiable evidence of **one** of the following:

- Possession of a building services engineering sector related qualification such as a Level 3 NVQ in Plumbing
- Related building services qualification with proven technical expertise
- Related building services qualification with access to plumbing technical expertise during their IQA activities.

## **Assessor and Internal Quality Assurer continuing professional development (CPD)**

The occupational competence of assessors must be updated on a regular basis and be periodically reconfirmed via CPD evidence and quality assured by City & Guilds.

It is the responsibility of the assessor to make use of opportunities for CPD such as industry conferences and events, access to trade publications and journals, SSC and professional/Trade Association events, at least on an annual basis to enhance and upgrade their professional development and technical knowledge.

It is imperative that evidence records of these CPD opportunities/occasions are maintained and retained in a verifiable CPD record.

## **Guidance note**

Where questions arise about the occupational competence/qualification of an individual/trainer/assessor, these should be referred to the centre’s Qualifications Adviser for a decision. The Qualification Advisor may decide to refer the decision to the Portfolio/Group Portfolio Consultant for further consideration.

## **Candidate entry requirements**

Candidates should already hold the **Level 2 Diploma in Plumbing Studies** or equivalent in order to complete the qualification satisfactorily.

Without evidence of formal qualifications, candidates must demonstrate adequate prior knowledge and experience to ensure they have the potential to gain the qualification.

## **Age restrictions**

This qualification is approved for learners 16+.

## **Accreditation of prior learning (APL)**

Guidance on APL between this qualification and the 6189 qualification is available on the City & Guilds website.



### 3 Delivering the qualification

#### Initial assessment and induction

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

- if the candidate has any specific training needs
- support and guidance they may need when working towards their qualification
- any units they have already completed, or credit they have accumulated which is relevant to the qualification
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Induction should also be used to ensure that candidates are aware that this qualification does **not** make them qualified plumbers. **All candidates must complete a declaration confirming their understanding. This declaration can be found in Appendix 2.**

#### Support materials

The following resources are available for this qualification:

Description	How to access
Level 3 Assessment pack – practical task manual	City & Guilds website
Level 3 Assessor guidance for Assessment pack – practical task manual	City & Guilds website
Text Book	<a href="http://www.cityandguildsbookshop.com">www.cityandguildsbookshop.com</a>
Smartscreen	<a href="http://www.smartscreen.co.uk">www.smartscreen.co.uk</a>



## 4 Assessment

### Assessment of the qualification

Unit Number	Unit Title	Assessment method	Where to obtain assessment materials
201/501	Health and safety in building services engineering	Practical Assignment (201) City and Guilds on-line multiple choice test (501) The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Go to <b>www.cityandguilds.com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.
301/802	Understand the fundamental principles and requirements of environmental technology systems	City and Guilds on-line multiple choice test (301) The assessment covers the knowledge requirements of the unit and assesses all learning outcomes to verify coverage of the unit.	Test available for booking on the Walled Garden.
302	Plumbing system installation planning	Assignment The assessment covers the requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Go to <b>www.cityandguilds.com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.

303/603/ 811	Complex cold water systems	Practical Assignment (303) City and Guilds on-line multiple choice test (603) The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified. (811) Proxy unit	Go to <b>www.cityandguilds. com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.
304/604/ 812	Domestic hot water	Practical Assignment (304) City and Guilds on-line multiple choice test (604) The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified. (812) Proxy unit	Go to <b>www.cityandguilds. com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.
305	Sanitation and drainage systems	Practical Assignment The assessment covers the requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Go to <b>www.cityandguilds. com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.
306/606/ 813	Central heating systems	Practical Assignment (306) City & Guilds on-line multiple choice test (606) The assessment covers the requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified. (813) Proxy unit	Go to <b>www.cityandguilds. com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.

309	Domestic gas principles	City and Guilds on-line multiple choice test (309) The assessment covers the knowledge requirements of the unit and assesses all learning outcomes to verify coverage of the unit.	Go to <b>www.cityandguilds.com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.
308	Career awareness in building services engineering	Assignment The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Go to <b>www.cityandguilds.com</b> and navigate to the 6035 webpage. Password available on the Walled Garden.

## Test Specifications

**Test:** Unit 501 Health and safety in building services engineering

**Assessment method:** e-volve online multiple choice test

**Duration:** 75 minutes

**Grade boundaries:** The pass mark is set at approximately 60%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** Reference material is not permitted.

Unit	Outcome	Number of questions	%
501	01 Know health and safety legislation	4	10
	02 Know how to handle hazardous situations	14	33
	03 Know electrical safety requirements when working in the building services industry	7	17
	04 Know the safety requirements for working with gases and heat producing equipment	8	19
	05 Know the safety requirements for using access equipment in the building services industry	4	9
	06 Know the safety requirements for working safely in excavations and confined spaces in the building services industry	5	12
	<b>Total</b>	<b>42</b>	<b>100</b>

**Test:** Unit 301 Understand the fundamental principles and requirements of environmental technology systems

**Assessment method:** e-volve online multiple choice test

**Duration:** 75 minutes

**Grade boundaries:** The pass mark is set at approximately 60%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** Reference material is not permitted. A calculator is allowed.

<b>Unit</b>	<b>Outcome</b>	<b>Number of questions</b>	<b>%</b>
301	01 Know the fundamental working principles of micro-renewable energy and water conservation technologies	<b>10</b>	<b>37</b>
	02 Know the fundamental requirements of building location/building features for the potential to install micro-renewable and water conservation systems to exist	<b>9</b>	<b>33</b>
	03 Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies	<b>4</b>	<b>15</b>
	04 Know the typical advantages and disadvantages of micro-renewable energy and water conservation technologies	<b>4</b>	<b>15</b>
	<b>Total</b>	<b>27</b>	<b>100</b>



**Test:** Unit 309 Domestic Gas Principles

**Assessment method:** e-volve online multiple choice test

**Duration:** 90 minutes

**Grade boundaries:** The pass mark is set at approximately 70%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** The Gas Safety (Installation and Use) Regulations 1998 and a calculator.

<b>Unit</b>	<b>Outcome</b>	<b>Number of questions</b>	<b>%</b>
309	01 Know gas safety legislation	<b>6</b>	<b>14</b>
	02 Understand the characteristics of combustion	<b>11</b>	<b>25</b>
	03 Understand the principles of flues	<b>8</b>	<b>18</b>
	04 Understand the principles of ventilation	<b>8</b>	<b>18</b>
	05 Understand gas pipework	<b>6</b>	<b>14</b>
	06 Understand gas controls	<b>3</b>	<b>7</b>
	07 Understand how to calculate gas rates	<b>2</b>	<b>4</b>
	<b>Total</b>	<b>44</b>	<b>100</b>

**Test:** Unit 603 Complex cold water systems

**Assessment method:** e-volve online multiple choice test

**Duration:** 75 minutes

**Grade boundaries:** The pass mark is set at approximately 65%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** Details of permitted materials can be found on page 20 of this document. A calculator is allowed.

Unit	Outcome	Number of questions	%
603	01 Know the regulations relating to cold water supplied for domestic purposes	6	15
	02 Know the types of cold water system layouts used in buildings	10	25
	03 Know the requirements for backflow protection in plumbing services	10	25
	04 Know the uses of specialist components in cold water systems	4	10
	05 Know the fault diagnosis and rectification procedures for cold water systems and components	5	12.5
	06 Know the commissioning requirements of cold water systems and components	5	12.5
	<b>Total</b>	<b>40</b>	<b>100</b>

**Test:** Unit 604 Domestic hot water

**Assessment method:** e-volve online multiple choice test

**Duration:** 75 minutes

**Grade boundaries:** The pass mark is set at approximately 65%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** Details of permitted materials can be found on page 20 of this document. A calculator is allowed.

Unit	Outcome	Number of questions	%
604	01 Understand the types of hot water systems	12	30
	02 Understand the operating principles of components found in hot water systems	13	32.5
	03 Know the fault diagnosis and rectification procedures for hot water systems and components	6	15
	04 Know the commissioning requirements of hot water systems and components	9	22.5
	<b>Total</b>	<b>40</b>	<b>100</b>

**Test:** Unit 606 Central heating systems

**Assessment method:** e-volve online multiple choice test

**Duration:** 75 minutes

**Grade boundaries:** The pass mark is set at approximately 65%, however this may be adjusted to ensure consistency across cohorts (reliability).

**Permitted materials:** Details of permitted materials can be found on page 20 of this document.

<b>Unit</b>	<b>Outcome</b>	<b>Number of questions</b>	<b>%</b>
606	01 Understand complex domestic heating systems layouts and controls	<b>14</b>	<b>33</b>
	02 Understand the layouts and operating principles of sealed systems	<b>7</b>	<b>16</b>
	03 Understand the types of boiler in domestic central heating systems	<b>6</b>	<b>14</b>
	04 Understand the types of heat emitters used in under floor heating systems	<b>6</b>	<b>14</b>
	05 Know how to decommission, commission, and fault find on central heating systems	<b>10</b>	<b>23</b>
	<b>Total</b>	<b>43</b>	<b>100</b>

## Permitted reference materials

### Cold water (6035-603)

- 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), freely downloaded at [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 freely downloaded from [www.legislation.gov.uk](http://www.legislation.gov.uk)

### Hot water (6035-604)

- 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), freely downloaded at [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, freely downloaded at [www.planningportal.gov.uk](http://www.planningportal.gov.uk)
- The Water Supply (Water Fittings) Regulations freely downloaded from [www.legislation.gov.uk](http://www.legislation.gov.uk)

### Central heating (6035-606)

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- CIBSE Domestic Heating Design Guide, published by CIBSE, 2007
- Domestic Building Services Compliance Guide, freely downloaded at [www.planningportal.gov.uk](http://www.planningportal.gov.uk)

## Guidance on permitted reference materials

Candidates are permitted to take the stated reference materials into the online examinations. Candidates **must not** be permitted to communicate with each other or refer to any other materials.

Permitted reference materials taken into examinations **can** contain the following:

- bookmarks (eg blank post-it notes, post-it notes numbered to indicate chapters or corners of pages folded)
- highlighting of text.

Permitted reference materials taken into exams **must not** contain the following:

- sample exam questions, answers or diagrams
- any writing in the regulations or accompanying written notes
- notes, diagrams or any content that may in any way advantage the candidate in answering questions within the exam.

**It is the responsibility of the centre to ensure the material in the documents does not unfairly advantage candidates in anyway.**

## FAQs

Question 1. Do we have to access a copy of all these documents for each candidate?

Answer 1. No, these documents are not required to answer the questions. However, for some questions, access to these documents may be helpful for clarifying or referencing specific regulatory policy or codes of practice that candidates should have been taught in reference to the unit content. Centres may wish to make a single set of the documents concerned available for the candidates to refer to, rather than a set of documents per candidate.

Question 2. Can the relevant extracts from the documents be pulled out as reference for candidates they don't have to browse through lots of irrelevant pages?

Answer 2. This is acceptable as long as the originator/owner of the document deems this acceptable or has given permission. Please note that as stated in the guidance above, bookmarks or blank post-it notes to indicate chapters or folded corners of pages can be used.



## 5 Units

### Availability of units

The following units can also be obtained from The Register of Regulated Qualifications: <http://register.ofqual.gov.uk/Unit>

### Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number
- title
- level
- credit value
- unit aim
- health and safety information
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance, where applicable.

## Unit 201/501 Health and safety in building services engineering

<b>UAN:</b>	<b>T/503/9669</b>
<b>Level:</b>	Level 2
<b>Credit value:</b>	3
<b>GLH:</b>	26
<b>Aim:</b>	This combination unit provides learners with the essential health and safety knowledge and skills to demonstrate best practice in a business services engineering environment or sector. The unit provides learners with an awareness of relevant legislation and should underpin all business services engineering activities learners take part in.
<b>Health and safety:</b>	Health and safety behaviour learned in this mandatory unit should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Know health and safety legislation
<b>Assessment criteria</b>
The learner can: 1.1 State the aims of health and safety legislation 1.2 Identify the responsibilities of <b>individuals</b> under health and safety legislation 1.3 Identify statutory and non-statutory <b>health and safety materials</b> 1.4 Identify the different <b>roles</b> of Health and Safety Executive in enforcing health and safety legislation.

<p><b>Range</b></p> <p><b>Health and safety legislation</b> The Health &amp; Safety at Work Act, The Electricity at Work Regulations, Control of Substances Hazardous to Health (COSHH) Regulations, Working at Heights Regulations, Personal Protective Equipment at Work Regulations (PPE), Lifting and Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Control of Asbestos at Work Regulations, Health, Safety and Welfare Regulations, Health and Safety (First Aid) Regulations, Confined Spaces Regulations.</p> <p><b>Individuals</b> Employers, employees and contractors, visitors to site.</p> <p><b>Health and safety materials</b> Acts of Parliament, regulations, approved codes of practice, HSE Guidance notes.</p> <p><b>Roles</b> Improvement notice, prohibition notice, powers of prosecution, providing advice and guidance.</p>
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<p><b>Learning outcome</b></p> <p>The learner will:</p> <p>2. Know how to handle hazardous situations</p>
<p><b>Assessment criteria</b></p> <p>The learner can:</p> <p>2.1 Identify common <b>hazardous situations</b> found on site</p> <p>2.2 Describe safe systems at work</p> <p>2.3 Identify the <b>categories</b> of safety signs</p> <p>2.4 Identify <b>symbols</b> for hazardous substances</p> <p>2.5 List common <b>hazardous substances</b> used in the building services industry</p> <p>2.6 List <b>precautions</b> to be taken when working with hazardous substances</p> <p>2.7 Identify the <b>types of asbestos</b> that may be encountered in the workplace</p> <p>2.8 Identify the <b>actions</b> to be taken if the presence of asbestos is suspected</p> <p>2.9 Describe the <b>implications</b> of being exposed to asbestos</p> <p>2.10 State the application of different types of <b>personal protective equipment</b></p> <p>2.11 Identify the <b>procedures for manually handling</b> heavy and bulky items</p> <p>2.12 Identify the <b>actions</b> that should be taken when an accident or emergency is discovered</p> <p>2.13 State procedures for handling injuries sustained on-site</p> <p>2.14 State the <b>procedures for recording accidents</b> and near misses at work.</p>



## **Range**

### **Hazardous situations**

Trailing leads, slippery or uneven surfaces, presence of dust and fumes, handling and transporting equipment or materials, contaminants and irritants, fire, working at heights, malfunctioning equipment, improper use and storage of tools and equipment, potential presence of asbestos.

### **Safe systems at work**

Method statements, permit to work systems, risk assessments, safety signs and notices.

### **Categories**

Mandatory, prohibition, information, warning.

### **Symbols**

Toxic, harmful, corrosive, irritant, oxidising, extremely flammable.

### **Hazardous substances**

Lead - solid and fume, solvents and lubricants, fluxes, jointing compounds, sealants, gases – LPG, oxy-acetylene and carbon dioxide, cleaning agents.

### **Precautions**

PPE, ventilation, risk assessment, method statements, safe systems of work.

### **Types of asbestos**

White asbestos (Chrysotile), brown or grey asbestos (Amosite), blue asbestos (Crocidolite), asbestos cement materials.

### **Actions**

Stop working immediately, report to supervisor.

### **Implications**

Long-term health implications (mesothelioma, asbestosis).

### **Personal protective equipment**

Clothing protection including high visibility, eye protection, hand protection, head protection, foot protection, hearing protection, respiratory protection.

### **Procedures for manually handling**

Single, two-person lift, mechanical lift.

### **Actions**

Raising the alarm, contact emergency services, follow typical emergency evacuation procedures, inform supervisor.

### **Procedures for handling injuries**

Make self safe, make area safe, administer first aid where appropriate, contact emergency services, contact nominated first aid person, contact supervisor.

### **Procedures for recording accidents**

RIDDOR, the use of company accident books, details to be recorded.

<b>Learning outcome</b>
The learner will: 3. Know electrical safety requirements when working in the building services industry
<b>Assessment criteria</b>
The learner can: 3.1 Identify the common <b>electrical dangers</b> to be aware of on site 3.2 List different <b>sources</b> of electrical supply for tools and equipment 3.3 Describe <b>reasons</b> for using reduced low voltage electrical supplies for tool and equipment on site 3.4 Identify how to conduct a <b>visual inspection</b> of portable electrical equipment for safe condition before use 3.5 State <b>actions</b> to take when portable electrical equipment fails visual inspection 3.6 Outline the Safe Isolation Procedure 3.7 State the <b>procedures</b> for dealing with electric shocks.

<b>Range</b>
<p><b>Electrical dangers</b> Faulty electrical equipment, damaged electrical equipment, exposed conductors, damaged insulation, worn electrical cables and cords, trailing cables, proximity of cables, buried/hidden cables.</p> <p><b>Sources</b> Battery powered supplies, 110 volt supplies, 230 volt supplies, generating sets.</p> <p><b>Reasons</b> Increased likelihood for damage to equipment, operative in better contact with earth, protect from electric shock, reduces trailing leads.</p> <p><b>Visual inspection</b> Checking for a valid PAT test, Inspection for general condition.</p> <p><b>Actions</b> Remove from use, report to supervisor.</p> <p><b>Procedures</b> Removal from supply, CPR method, contact emergency services, report to supervisors, treatment of minor burns.</p>

<b>Learning outcome</b>
The learner will: 4. Know the safety requirements for working with gases and heat producing equipment
<b>Assessment criteria</b>
The learner can: 4.1 Identify different <b>types of gases</b> used on site 4.2 Describe how bottled gases and equipment should be safely transported and stored 4.3 Describe how to conduct a <b>visual inspection</b> on heat producing equipment for safe condition 4.4 Describe how <b>combustion</b> takes place 4.5 State the <b>dangers</b> of working with heat producing equipment 4.6 State the <b>procedures</b> to follow on discovery of fires on site 4.7 Identify different classifications of fires 4.8 Identify types of fire <b>extinguisher</b> for different classifications of fires.

<b>Range</b>
<b>Types of gases</b> Propane, butane, oxy-acetylene, nitrogen.
<b>Visual inspection</b> Inspection for general condition.
<b>Combustion</b> Three elements of the fire triangle.
<b>Dangers</b> Fires, burns, fumes, equipment damage, explosions.
<b>Procedures</b> Raise the alarm, follow safety evacuation procedures, fight fire if trained to do so.
<b>Classifications of fires</b> Class A, B, C, D, electrical fires.
<b>Fire extinguisher</b> Carbon dioxide, water, powder, foam.

<b>Learning outcome</b>
The learner will: 5. Know the safety requirements for using access equipment in the building services industry
<b>Assessment criteria</b>
The learner can: 5.1 Identify different types of access equipment 5.2 Select suitable equipment for carrying out work at heights based on the <b>work being carried out</b> 5.3 Describe the <b>safety checks</b> to be carried out on access equipment 5.4 Describe safe erection methods for <b>access equipment</b> .

<b>Range</b>
<b>Types of access equipment</b> Step ladders, ladders, roof ladders and crawling boards, mobile tower scaffolds, podiums fixed scaffolds and edge protection, mobile elevated work platforms including scissor lifts and cherry pickers, telescopic ladders.
<b>Work being carried out</b> Duration at work, action points for heights.
<b>Safety checks</b> Visual, tagging, fit for purpose, secure level ground.
<b>Access equipment</b> Step ladders, ladders, roof ladders, mobile tower scaffolds, podiums, telescopic ladders.

<b>Learning outcome</b>
The learner will: 6. Know the safety requirements for working safely in excavations and confined spaces in the building services industry
<b>Assessment criteria</b>
The learner can: 6.1 Identify the situations in which it may be necessary to work in excavations 6.2 Describe how excavations should be <b>prepared</b> for safe working 6.3 State <b>precautions</b> to be taken to make excavations safe 6.4 Identify areas where working in <b>confined space</b> may be a consideration 6.5 State <b>safety considerations</b> when working in confined spaces.

<b>Range</b>
<p><b>Prepared</b> Safe access into the excavation, trench support systems.</p> <p><b>Precautions</b> Use of warning signs, use of barriers, vehicle proximity to excavation edges.</p> <p><b>Confined space</b> Drainage systems, Plant rooms, Main service duct-rooms, In tanks, cylinders, boilers or cisterns, Under suspended timber floors, In roof spaces.</p> <p><b>Safety considerations</b> Ventilation, lighting, PPE, evacuation procedures, medical conditions, lone working.</p>

<b>Learning outcome</b>
The learner will: 7. Be able to apply safe working practice
<b>Assessment criteria</b>
The learner can: 7.1 Perform <b>manual handling</b> techniques 7.2 Manually handle loads using mechanical lifting aids 7.3 Demonstrate the safe method of assembly of <b>access equipment</b> 7.4 Use access equipment safely.

<b>Range</b>
<p><b>Manual handling</b> Single, two-person lift.</p> <p><b>Access equipment</b> Step ladders, ladders, mobile tower scaffolds.</p>

# **Unit 201/501 Health and safety in building services engineering**

## Supporting information

### **Guidance**

#### **Electrical equipment**

Includes power tools, lights etc

#### **Safe Isolation Procedure**

Recommend referring to JIB Safe Isolation Procedure

#### **On Site**

Where reference to 'on site' is made in this unit, the intention is that this covers building sites and domestic sites.

It is recommended that assessors cover employee rights in relation to Health and Safety.

This First Aid element of this unit is not intended to replicate a full First Aid course but to give learners the underpinning knowledge to understand the types of injuries they may come across in a work place.

## Unit 301/802 Understand the fundamental principles and requirements of environmental technology systems

<b>UAN:</b>	<b>K/602/3138</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	2
<b>GLH:</b>	15
<b>Aim:</b>	This knowledge unit provides learning in the fundamental working principles along with regulatory requirement relating to renewable energy. Be able to distinguish the potential type of building features that will meet the requirements to install renewable energy and water conservation along with typical advantages and disadvantages.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Know the fundamental working principles of micro-renewable energy and water conservation technologies
<b>Assessment criteria</b>
The learner can: 1.1 Identify the fundamental working principles for each of the following heat producing micro-renewable energy technologies: <ul style="list-style-type: none"> <li>• solar thermal (hot water)</li> <li>• ground source heat pump</li> <li>• air source heat pump</li> <li>• biomass</li> </ul> 1.2 Identify the fundamental working principles for each of the following electricity producing micro-renewable energy technologies: <ul style="list-style-type: none"> <li>• solar photovoltaic</li> <li>• micro-wind</li> <li>• micro-hydro</li> </ul> 1.3 Identify the fundamental working principles of the following co-generation technologies: <ul style="list-style-type: none"> <li>• micro-combined heat and power <ul style="list-style-type: none"> <li>o (heat-led)</li> </ul> </li> </ul> 1.4 Identify the fundamental working principles for each of the following water conservation technologies: <ul style="list-style-type: none"> <li>• rainwater harvesting</li> <li>• greywater re-use.</li> </ul>



<b>Learning outcome</b>
<p>The learner will:</p> <ol style="list-style-type: none"> <li>2. Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist</li> </ol>
<b>Assessment criteria</b>
<p>The learner can:</p> <ol style="list-style-type: none"> <li>2.1 Clarify the fundamental requirements for the potential to install a solar water heating system to exist</li> <li>2.2 Clarify the fundamental requirements for the potential to install a solar photovoltaic system to exist</li> <li>2.3 Clarify the fundamental requirements for the potential to install a ground source heat pump system to exist</li> <li>2.4 Clarify the fundamental requirements for the potential to install an air source heat pump system to exist</li> <li>2.5 Clarify the fundamental requirements for the potential to install a biomass system to exist</li> <li>2.6 Clarify the fundamental requirements for the potential to install a micro wind system to exist</li> <li>2.7 Clarify the fundamental requirements for the potential to install a micro hydro system to exist</li> <li>2.8 Clarify the fundamental requirements for the potential to install a micro-combined heat and power (heat led) system to exist</li> <li>2.9 Clarify the fundamental requirements for the potential to install a rainwater harvesting/greywater re-use system to exist.</li> </ol>

**Learning outcome**

The learner will:

3. Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies

**Assessment criteria**

The learner can:

- 3.1 Confirm what would be typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of the following technologies:
  - solar thermal (hot water)
  - solar photovoltaic
  - ground source heat pump
  - air source heat pump
  - micro-wind
  - biomass
  - micro-hydro
  - micro-combined heat and power (heat-led)
  - rainwater harvesting
  - greywater re-use
- 3.2 Confirm which sections of the current building regulations/building standards apply in relation to the deployment of the following technologies:
  - solar thermal (hot water)
  - solar photovoltaic
  - ground source heat pump
  - air source heat pump
  - micro-wind
  - biomass
  - micro-hydro
  - micro-combined heat and power (heat-led)
  - rainwater harvesting
  - greywater re-use.

**Learning outcome**

The learner will:

4. Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies

**Assessment criteria**

The learner can:

- 4.1 Identify typical advantages associated with each of the following technologies:
  - solar thermal (hot water)
  - solar photovoltaic
  - ground source heat pump
  - air source heat pump
  - micro-wind
  - biomass
  - micro-hydro
  - micro-combined heat and power (heat-led)
  - rainwater harvesting
  - greywater re-use
- 4.2 Identify typical advantages associated with each of the following technologies:
  - solar thermal (hot water)
  - solar photovoltaic
  - ground source heat pump
  - air source heat pump
  - micro-wind
  - biomass
  - micro-hydro
  - micro-combined heat and power (heat-led)
  - rainwater harvesting
  - greywater re-use.

## Unit 302

## Plumbing system installation planning

<b>UAN:</b>	<b>K/504/0236</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	6
<b>GLH:</b>	51
<b>Aim:</b>	This unit gives the learner the knowledge to design various plumbing systems by understanding design techniques and calculating components' sizes. It also gives the learner the knowledge to present the information in a professional manner.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Understand how to interpret and present design information
<b>Assessment criteria</b>
The learner can: 1.1 State the <b>criteria</b> used when selecting system and component types 1.2 Explain positioning <b>requirements</b> when designing plumbing systems 1.3 Describe the <b>importance</b> of sustainable design 1.4 Interpret <b>information</b> for system plans for plumbing 1.5 State additional <b>considerations</b> when carrying out systems planning 1.6 Identify <b>measurements</b> from design plans 1.7 Identify <b>methods</b> for presenting system designs 1.8 Identify cost of equipment used in plumbing systems using different <b>sources</b> 1.9 Describe how to compile quotations and tenders.

<b>Range</b>
<p><b>Criteria</b> Customer's needs, building layout and features, suitability of system energy efficiency, environmental impact.</p> <p><b>Requirements</b> Clearances, space, disabled access, legal, customer preference, system performance.</p> <p><b>Importance</b> Cost effective, carbon reduction, increased comfort, increased efficiency.</p> <p><b>Information</b> Manufacturer technical instructions, Building Regulations, British Standards, European Standards, industry standard, verbal and written feedback from the customer, Water Regs, Part L.</p> <p><b>Considerations</b> Electrical, gas, unvented regs.</p> <p><b>Measurements</b> Scale, area, volume, weight.</p> <p><b>Methods</b> Spreadsheets, documents, CAD, computer software, apps.</p> <p><b>Sources</b> Manufacturers, merchants, independent suppliers, catalogues, internet, web sites.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>2. Understand how to size plumbing systems and components</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>2.1 Calculate the size of system <b>pipework</b></p> <p>2.2 Calculate the size of <b>system components</b></p> <p>2.3 Select the size of <b>sanitary pipework</b> using manufacturer's specifications</p> <p>2.4 Select the size of <b>rainwater system components</b> using manufacturer's specifications.</p>

<b>Range</b>
<p><b>Pipework</b> Hot, cold.</p> <p><b>System components</b> Hot water storage vessel, secondary circulation pump, single/twin impellar pump, cold water storage cistern, pressure vessels.</p> <p><b>Sanitary pipework</b> Main stack, branch pipework, stack vent.</p> <p><b>Rainwater system components</b> Outlet, gutter, rainwater pipe.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>3. Understand how to calculate the size of central heating system components</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>3.1 Explain how <b>heat loss</b> from a building occurs</p> <p>3.2 State <b>methods</b> for calculating heat loss for buildings</p> <p>3.3 Calculate heat loss for rooms</p> <p>3.4 Calculate the size of central heating components.</p>

<b>Range</b>
<p><b>Heat loss</b> Fabric heat loss, U Values, ventilation heat loss.</p> <p><b>Methods</b> Long hand, Mears calculator, computer, whole house boiler sizing.</p> <p><b>Central heating components</b> Heat emitter, hot water heating load, pipe, circulator pump boiler, expansion vessels, underfloor heating pipe lengths.</p>

<b>Learning outcome</b>
The learner will: 4. Understand how to plan work schedules for a system installation
<b>Assessment criteria</b>
The learner can: 4.1 Identify <b>other trades</b> involved in the installation process 4.2 Describe effective working relationships between trades 4.3 Describe the <b>elements</b> of a plumbing system installation schedule for a domestic dwelling 4.4 Explain the <b>sequence of work</b> in a domestic dwelling plumbing system installation 4.5 Describe <b>difficulties</b> that may arise when supervising system installations 4.6 Describe handover procedures.

<b>Range</b>
<b>Other trades</b> Electrician, gas, plumber, tiler, carpenter, painter and decorator, plasterer, floor layer.
<b>Effective working relationships</b> Coordination, communication, alterations to schedule, consideration of customer requirements, negotiation, timing, first fix, second fix.
<b>Elements</b> Staffing, materials, storage, timescale.
<b>Sequence of work</b> Plan, design, order materials, first fix, second fix, commissioning, snagging, sign-off.
<b>Difficulties</b> Conflict (suppliers, trades, clients), poor performance of staff, resource shortages, quality of components, incomplete fittings, incorrect size, damage.
<b>Handover procedures</b> Walk-through with client, demonstrate operation of equipment and fittings, manufacturer's instructions, benchmarking documents, explain warrantee, agree final invoice.

# Unit 303/603/811 Complex cold water systems

<b>UAN:</b>	<b>M/504/0237</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	7
<b>GLH:</b>	56
<b>Aim:</b>	This combination unit provides 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.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Know the regulations relating to cold water supplied for domestic purposes
<b>Assessment criteria</b>
The learner can: 1.1 Describe the <b>purpose</b> of the water regulations 1.2 Describe how the water regulations impact the installation and use of <b>water systems</b> 1.3 Explain the <b>requirements</b> for advanced notification of work 1.4 Differentiate between installer and user responsibilities under water regulations 1.5 Define the <b>legal requirements</b> for drawing water from an undertaker's main using a pump or booster.

<b>Range</b>
<b>Purpose</b> To protect against: waste, misuse, undue consumption, erroneous measurement, contamination of drinking water.
<b>Water systems</b> Supplied by water undertaker, private source.
<b>Requirements</b> Refer to water regulations advisory scheme on notifiable works, notify water undertaker.
<b>Legal requirements</b> Drawing more than 12 litres per minute.



<b>Learning outcome</b>
The learner will: 2. Know the types of cold water system layouts used in buildings
<b>Assessment criteria</b>
The learner can: 2.1 Describe the principles of operation of cold water <b>system component layouts</b> used in multi-storey buildings 2.2 Describe the <b>requirements</b> for large scale storage cisterns 2.3 Explain function of <b>components</b> used in boosted cold water systems in multi-storey buildings 2.4 Describe alternative water supplies to buildings 2.5 Propose methods of <b>treating water</b> for use in buildings 2.6 Define the method of operation of different <b>types</b> of boosted cold water supply systems for buildings 2.7 Identify situations where rainwater harvesting may be appropriate.

<b>Range</b>
<b>System component layouts</b> Supplied direct from the main, boosted supply using a break cistern.
<b>Requirements</b> Warning/overflow pipe, alternative filling, methods using: float switches and solenoid valves, specialist inlet valves, interlinking multiple cisterns, use of sectional cisterns, alarms.
<b>Components</b> Booster pumps, sets with integral controls, self assembled sets, pressure/expansion vessels, pressure switch, float switch.
<b>Alternative water supplies</b> Pumped from wells and boreholes, streams and springs use of externally sited break cisterns, rain water harvesting.
<b>Treating water</b> Water softeners, localised water filtration units, localised water treatment units – ultra violet.
<b>Types</b> 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.

<b>Learning outcome</b>
The learner will: 3. Know the requirements for backflow protection in plumbing services
<b>Assessment criteria</b>
The learner can: 3.1 Determine the <b>fluid risk levels</b> as laid down in water legislation 3.2 Compare point of use protection with whole site and zone protection 3.3 Propose where <b>non-mechanical</b> backflow prevention devices may be used 3.4 Propose where <b>mechanical</b> backflow prevention devices may be used 3.5 Explain the regulations for RPZ or RPZD valves 3.6 Determine <b>methods</b> of preventing cross connection in systems that contain non-wholesome water sources 3.7 Analyse over the rim and ascending spray <b>sanitary appliances</b> in relation to the water regulations.

<b>Range</b>
<b>Fluid risk levels</b> Levels 1-5.
<b>Non-mechanical</b> Types AA, AB, AD, AG, AUK1, AUK2, AUK3, and DC pipe interrupter.
<b>Mechanical</b> Types BA, CA, DB, EA/EB, EC/ED, HA, HUK1 and HC (4.4).
<b>Methods</b> System plans, colour coding, labelling.
<b>Sanitary appliances</b> Bidet, toilet with cleansing device.

<b>Learning outcome</b>
The learner will: 4. Know the uses of specialist components in cold water systems
<b>Assessment criteria</b>
The learner can: 4.1 Explain the working principles of cold water system <b>specialist components</b> 4.2 Describe <b>factors</b> to consider when selecting specialist cold water components 4.3 Identify the <b>maintenance requirements</b> for specialist cold water components.

<b>Range</b>
<p><b>Specialist components</b> Proximity-sensor 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.</p> <p><b>Factors</b> Design requirements, customer preference, water conservation, time of use, anti-vandalism, accessibility, hygiene.</p> <p><b>Maintenance requirements</b> Regular servicing, manufacturer’s guidelines, inspection, testing.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>5. Know the fault diagnosis and rectification procedures for cold water systems and components</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>5.1 Interpret <b>documents</b> to identify diagnostic requirements of cold water system components</p> <p>5.2 Describe <b>diagnostic checks</b> on cold water system components</p> <p>5.3 Explain <b>reasons</b> a treatment device may not be operating as required</p> <p>5.4 Explain blue water corrosion.</p>

<b>Range</b>
<p><b>Documents</b> Manufacturer instructions and industry standards.</p> <p><b>Diagnostic checks</b> Pressures, flow rates, levels, correct operation.</p> <p><b>Reasons</b> Limescale build-up, salt crystals require replenishment, failure to backwash.</p>

<b>Learning outcome</b>
The learner will: 6. Know the commissioning requirements of cold water systems and components
<b>Assessment criteria</b>
The learner can: 6.1 Explain the commissioning <b>checks</b> required on boosted cold water systems 6.2 State the <b>requirements</b> for disinfection 6.3 State the <b>actions</b> to be taken when commissioning procedures identify faults 6.4 Describe <b>information</b> required on a commissioning record for a cold water system.

<b>Range</b>
<b>Checks</b> Soundness, flushing, filling, float level, low level switch, pressure vessel, pressure switch, flow rate, pressure.
<b>Requirements</b> Competent person, domestic, non-domestic, refer to BS EN 806.
<b>Actions</b> Investigate, rectify, recheck.
<b>Information</b> Type of appliance, location, pressures, flow rates, temperature, installation information (who, when), maintenance requirements, components.

<b>Learning outcome</b>
The learner will: 7. Be able to carry out commissioning and rectify faults on cold water systems
<b>Assessment criteria</b>
The learner can: 7.1 Install pressure reducing valves to cold water outlets 7.2 Set pressure reducing valves in accordance with manufacturers instructions 7.3 Install backflow protection devices 7.4 Rectify faults on cold water <b>components</b> .

<b>Range</b>
<b>Components</b> Concussive taps, flow limiting valves, pressure reducing valves.

## Unit 304/604/812 Domestic hot water

<b>UAN:</b>	<b>T/504/0238</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	8
<b>GLH:</b>	59
<b>Aim:</b>	This combination unit provides the learner with knowledge of hot water systems, components, storage cylinders, temperature control as well as the commissioning procedures and fault finding techniques. Learners will consider alternative fuel sources and new technologies.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Understand the types of hot water systems
<b>Assessment criteria</b>
The learner can: 1.1 Explain the working principles of different types of <b>centralised</b> hot water supply systems used in buildings 1.2 Identify types of <b>localised</b> hot water supply systems used in buildings 1.3 Compare thermal stores and unvented hot water storage systems 1.4 State the recommended design <b>temperatures</b> within hot water systems 1.5 Describe the <b>requirements</b> of Part G of the Building Regulations for Hot Water Installations 1.6 Evaluate the use of different <b>fuels</b> in domestic hot water systems 1.7 Explain the <b>operating principles</b> of hot water digital showers.

<b>Range</b>
<p><b>Centralised</b> Unvented hot water systems, open vented hot water systems, thermal stores.</p> <p><b>Localised</b> Unvented point of use heaters. Instantaneous heaters.</p> <p><b>Temperatures</b> Hot water storage vessel, hot water outflow, secondary return at point of use, maximum hot water temperature to Part G.</p> <p><b>Requirements</b> Blending valves, safety thermostat.</p> <p><b>Fuels</b> Gas, electric, solar thermal, oil, solid, fuel, geo-thermal, bio-mass.</p> <p><b>Operating principles</b> Pre-set temperatures, remote control activated, digital processor.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <ol style="list-style-type: none"> <li>2. Understand the operating principles of components found in hot water systems</li> </ol>
<b>Assessment criteria</b>
<p>The learner can:</p> <ol style="list-style-type: none"> <li>2.1 Explain the function of <b>safety devices</b> in unvented hot water systems</li> <li>2.2 Explain the method of operation of <b>functional devices</b> in unvented hot water systems</li> <li>2.3 Calculate the diameter of <b>discharge pipework</b></li> <li>2.4 Specify the <b>requirements</b> of discharge pipework from temperature and expansion relief valves</li> <li>2.5 Specify the layout <b>features</b> for pipework systems that incorporate secondary circulation</li> <li>2.6 Explain balanced and unbalanced supplies in unvented hot water storage systems.</li> </ol>

<b>Range</b>
<p><b>Safety devices</b> Control thermostat, overheat thermostat (thermal cut-out), temperature relief valve.</p> <p><b>Functional devices</b> Line strainer, pressure reducing valve, single check valve, expansion device (vessel or integral to cylinder), expansion relief valve, tundish arrangements, composite valves.</p> <p><b>Discharge pipework</b> D1, D2</p> <p><b>Requirements</b> Maximum dimensions, minimum dimensions, material, termination points, fall.</p> <p><b>Features</b> Pump type and location, timing devices, prevention of reverse circulation, methods of balancing circuits.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>3. Know the fault diagnosis and rectification procedures for hot water systems and components</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>3.1 Specify the periodic servicing requirements of hot water systems</p> <p>3.2 Interpret <b>documents</b> to identify diagnostic requirements of hot water system components</p> <p>3.3 Describe <b>diagnostic checks</b> on hot water system components</p> <p>3.4 Specify methods of repairing faults in <b>hot water system components</b>.</p>

<b>Range</b>
<p><b>Documents</b> Manufacturer instructions and industry standards.</p> <p><b>Diagnostic checks</b> Pressures , flow rates, levels, correct operation, temperatures, thermostats, pumps, timing devices, expansion and pressure vessels, gauges and controls.</p> <p><b>Hot water system components</b> Pumps, expansion/pressure vessels, safety valves, pressure reducing valves.</p>

<b>Learning outcome</b>
The learner will: 4. Know the commissioning requirements of hot water systems and components
<b>Assessment criteria</b>
The learner can: 4.1 Interpret <b>documents</b> required to carry out commissioning tasks 4.2 State the <b>commissioning checks</b> required on hot water systems 4.3 Explain how to balance a secondary circulation system during commissioning activities 4.4 State the <b>actions</b> to be taken when commissioning procedures identify faults 4.5 Describe <b>information</b> required on a commissioning record for a hot water system.

<b>Range</b>
<b>Documents</b> Manufacturer instructions and industry standards.
<b>Commissioning checks</b> Soundness, flushing, check operating pressures, temperatures and flow rates, check for correct operation of system components: thermostats, pumps, timing devices, expansion and pressure vessels, gauges and controls, checking for correct operation of system safety valves, temperature relief, expansion relief.
<b>Actions</b> Investigate, rectify, recheck.
<b>Information</b> Type of appliance, location, pressures, flow rates, temperature, installation information (who, when), maintenance requirements, components.



<b>Learning outcome</b>
The learner will: 5. Be able to install and inspect hot water systems
<b>Assessment criteria</b>
The learner can: 5.1 Install <b>components</b> and final pipework connections to unvented cylinders 5.2 Position and fix safety relief pipework from unvented cylinders to termination point 5.3 Carry out <b>commissioning checks</b> 5.4 Inspect faults on unvented <b>storage cylinder components</b> 5.5 Inspect faults on hot water shower pumps.

<b>Range</b>
<b>Pipework</b> Line strainer, pressure reducing valve, check valve (may be installed in a combination valve) expansion vessel, storage cylinder.
<b>Commissioning checks</b> Unvented cylinders, shower pumps.
<b>Storage cylinder components</b> Expansion vessel, pressure reducing valves, line strainers, discharge pipework, safety devices.

## Unit 305

## Sanitation and drainage systems

<b>UAN:</b>	<b>A/504/0239</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	3
<b>GLH:</b>	25
<b>Aim:</b>	This unit provides 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.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Understand design requirements of above ground drainage systems
<b>Assessment criteria</b>
The learner can: 1.1 State <b>documents</b> relating to sanitation and above ground drainage systems and components 1.2 Identify different types of above ground drainage system types 1.3 Explain the <b>reasons</b> for selecting above ground drainage system types 1.4 Describe <b>design specifications</b> of waste pipes 1.5 Describe the <b>design considerations</b> of stub stacks 1.6 Describe the operation of an air admittance valves 1.7 Explain the <b>benefits</b> of waste valves (mechanical traps) compared to traditional water seal trap.

<b>Range</b>
<p><b>Documents</b>  Manufacturer's instructions, Building Regs H, Building Regs G, Building Regs F, BS 6465 Sanitary Installations, BS EN 12056 Gravity drainage systems inside buildings.</p> <p><b>Above ground drainage system types</b>  Primary ventilated, secondary ventilated, ventilated branch, stub stack.</p> <p><b>Reasons</b>  Size of property, number of outlets, length of waste runs, occupancy.</p> <p><b>Design specifications</b>  Length of run, bore size, fall of pipe, cross flow, connection to main stack.</p> <p><b>Design considerations</b>  Must be connected to a drain with ventilating pipe, must be internal, requires minimum/maximum dimensions, use of AAV.</p> <p><b>Benefits</b>  Help prevent siphonage, more versatile, ease of installation.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <ol style="list-style-type: none"> <li>2. Know the requirements of installing sanitary appliances and associated drainage</li> </ol>
<b>Assessment criteria</b>
<p>The learner can:</p> <ol style="list-style-type: none"> <li>2.1 Identify types of <b>urinals</b></li> <li>2.2 Describe installation considerations of urinals</li> <li>2.3 Explain the spacing requirements of <b>sanitary appliances</b></li> <li>2.4 Interpret <b>documents</b> relating to disabled accommodation</li> <li>2.5 Explain the <b>importance</b> of ventilation in bathrooms</li> <li>2.6 Describe <b>design considerations</b> of macerators</li> <li>2.7 Explain <b>installation considerations</b> of sink waste disposal units.</li> </ol>

<p><b>Range</b></p> <p><b>Urinals</b> Bowl, troth, slab, waterless.</p> <p><b>Installation considerations</b> Connection to waste, dimensions of installation, fall, material.</p> <p><b>Sanitary appliances</b> WC, basin, bath and shower.</p> <p><b>Documents</b> Manufacturer's instructions, BS 6465 Sanitary Installations, Building Regs M.</p> <p><b>Importance</b> Prevents damp, air quality, comfort, prevents bacteria growth (health), Building Regs F compliant.</p> <p><b>Design considerations</b> Second bathrooms only, un-switched fused spur, maximum pipe runs, horizontal/vertical, 45 degree elbows required.</p> <p><b>Installation considerations</b> Sink mounting arrangement, swivel elbow connection, trap, fall of pipe, automatic, batch feed.</p>
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<p><b>Learning outcome</b></p> <p>The learner will:</p> <p>3. Understand commissioning and testing requirements of drainage systems</p>
<p><b>Assessment criteria</b></p> <p>The learner can:</p> <p>3.1 Explain the procedure for soundness testing above ground drainage systems</p> <p>3.2 Explain the procedure of <b>performance testing</b> above ground drainage pipework</p> <p>3.3 Describe the <b>commissioning procedure</b> for macerators</p> <p>3.4 Describe <b>potential reasons</b> for poor performance of drainage systems</p> <p>3.5 Describe common <b>faults</b> with macerators.</p>

<b>Range</b>
<p><b>Performance testing</b> Fill appliance/s to overflow level, release at same time, ensure all appliances retain 25mm water level.</p> <p><b>Commissioning procedure</b> Visual inspection, soundness test, ensure electrical connections to current standards (fused supply protected by RCD), set float operated valve, flush several times.</p> <p><b>Potential reasons</b> Incorrect fall, sagging, lack of ventilation, blockages, incorrect bore, incorrect traps, blocked traps.</p> <p><b>Faults</b> Intermittent running, crunching sounds, motor not running, slow discharge, incorrect pipe runs, no vents, blockage.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>4. Be able to carry out commissioning and fault finding of above ground drainage systems</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>4.1 Demonstrate <b>performance testing</b> of above ground drainage systems</p> <p>4.2 Perform <b>commissioning</b> of macerators</p> <p>4.3 Diagnose waste pipe faults</p> <p>4.4 Diagnose macerator faults.</p>

<b>Range</b>
<p><b>Performance testing</b> Fill appliance/s to overflow level, release at same time, ensure all appliances retain 25mm water level.</p> <p><b>Commissioning procedure</b> Visual inspection, soundness test, ensure electrical connections to current standards (fused supply protected by RCD), set float operated valve, flush several times.</p> <p><b>Waste pipe faults</b> Incorrect fall, sagging pipes, no traps seal, blocked traps.</p> <p><b>Macerator faults</b> Incorrect components (switched spare, no vent) 90 degree bends.</p>

## Unit 306/606/813 Central heating systems

<b>UAN:</b>	<b>H/504/0235</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	11
<b>GLH:</b>	110
<b>Aim:</b>	This unit provides 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.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Understand complex domestic heating systems layouts and controls
<b>Assessment criteria</b>
The learner can: 1.1 Identify <b>documents</b> relating to central heating design and installation 1.2 Describe pipework layouts for complex <b>central heating systems</b> 1.3 Describe the working principles of <b>key components</b> in a complex central heating system 1.4 Explain boiler interlock 1.5 Compare the relationship of positive and negative pressures in relation to feed, vent and pump positions 1.6 Describe the wiring arrangements required for S and Y plan heating systems and components 1.7 Identify <b>alternative methods</b> of wiring arrangements 1.8 Describe the <b>procedures</b> for safely isolating supplies 1.9 Describe <b>testing</b> of wiring in domestic heating systems 1.10 Describe the working principles of low loss headers 1.11 Explain the effect bore diameter of tube has on heat loads.

<b>Range</b>
<p><b>Documents</b>  Manufacturer's instructions, Part L building regs, CHeSS central heating specification, domestic heating compliance guide, gas safe installation and use regs, Part P.</p> <p><b>Central heating system</b>  S plan/Y plan/zoned.</p> <p><b>Key components</b>  Motorised valves, room stat, programmable room stat, cylinder stat and overheat stat, frost stat, pipe stat, timer, programmer, compensator, boiler energy management programmer , pump, auto bypass, feed and expansion cistern, automatic air vent, dirt separator.</p> <p><b>Alternative methods</b>  Plug-and-play, wireless.</p> <p><b>Procedures</b>  Prove device, isolate, test all phases, prove device, lock off isolator or remove fuse.</p> <p><b>Testing</b>  Earth continuity, short circuit, resistance to earth, continuity, polarity, fuse rating, voltage.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <ol style="list-style-type: none"> <li>Understand the layouts and operating principles of sealed systems</li> </ol>
<b>Assessment criteria</b>
<p>The learner can:</p> <ol style="list-style-type: none"> <li>Identify <b>components</b> required for sealed central heating systems</li> <li>Describe the <b>safety hazards</b> associated with sealed central heating systems</li> <li>Describe the <b>advantages</b> of sealed central heating systems</li> <li>Explain layout requirements for sealed system components</li> <li>Calculate the size of pressure vessels for sealed central heating systems.</li> </ol>

<b>Range</b>
<p><b>Components</b>  Expansion valve, expansion vessel, temperature relief valve, pressure gauge, filling loop, check valves.</p> <p><b>Safety hazard</b>  Explosion, high pressure, production of steam.</p> <p><b>Advantages</b>  Less pipework, fewer components, can come as a package installed inside boiler, less installation, quicker filling, fewer air locks.</p>

**Learning outcome**

The learner will:

3. Understand the types of boiler in domestic central heating systems

**Assessment criteria**

The learner can:

- 3.1 Identify **fuel sources** for central heating
- 3.2 Identify **components** of a gas central heating boiler
- 3.3 Describe the operating principles of **boilers**
- 3.4 Describe different **flueing** arrangements for boilers
- 3.5 Explain the reason for pump overrun on boilers.

**Range****Fuel sources**

Natural gas, LPG, oil, solid fuel, heat pumps.

**Components**

Heat exchanger, water to water heat exchanger, diverter valve, gas valve, fan, condense trap, air pressure switch.

**Boilers**

Combination, condensing, non-condensing, traditional, systems boiler.

**Flueing**

Open flue, balanced flue, fanned draft flues.

**Learning outcome**

The learner will:

4. Understand the types of heat emitters used in underfloor heating systems

**Assessment criteria**

The learner can:

- 4.1 Justify selection of **heat emitters** used in plumbing systems
- 4.2 Describe the **design considerations** for underfloor heating
- 4.3 Describe **components** required for installation with a range of heat emitters
- 4.4 Describe the **advantages** of underfloor heating systems
- 4.5 Describe the operating principles of underfloor heating systems.



<b>Range</b>
<p><b>Heat emitters</b> Panel radiators, column radiators, low surface temperature radiators, fan convectors, skirting convectors, towel warmers, towel radiators, underfloor heating.</p> <p><b>Design considerations</b> Room volume, retrofit, heat up times, floor covering, floor matting, aesthetics, useable floor area.</p> <p><b>Components</b> Thermostatic radiator valves, manual valves, lock shield valves, combined lock shield and drain off, blending valves, UFH manifold, UFH control units.</p> <p><b>Advantages</b> Lower operating temperature, warms from the floor up, even distribution of heat, operates effectively with condensing boilers, aesthetic appeal.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>5. Know how to decommission, commission, and fault find on central heating systems</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>5.1 Interpret <b>information</b> required when testing, commissioning and fault finding on central heating systems</p> <p>5.2 Describe means of <b>safeguarding</b> customer property</p> <p>5.3 Explain the <b>procedure for decommissioning</b> a central heating system</p> <p>5.4 Explain the use of <b>bespoke tools</b> in commissioning a central heating system</p> <p>5.5 Describe the procedure for commissioning a central heating system</p> <p>5.6 Describe the procedure for commissioning an underfloor heating system</p> <p>5.7 Identify <b>additives</b> used in central heating systems</p> <p>5.8 Describe the <b>procedure for power flushing</b> a central heating system</p> <p>5.9 Describe how to rectify <b>faults</b> in central heating systems.</p>

**Range****Information**

Manufacturer's instructions, component instructions, central heating design guide, component instructions, fault flow charts, helpline, internet.

**Safeguarding**

Dust sheets, warning notices, appropriate clothing, move delicate items.

**Procedure for decommissioning**

Isolate power, isolate incoming water supply, cap off, label, inform relevant people, attach hose, drain, vent, ensure system is fully drained.

**Bespoke tools**

Strap on thermostats, infrared thermometer, vent key.

**Procedure for commissioning a central heating system**

Remove thermostatic heads, cold flush, fill, vent, heat up system, hot flush, re-fill and add inhibitor, balance, adjust (as required) bypass, ensure operation of boiler interlock, handover to customer, complete documentation.

**Procedure for commissioning an underfloor heating system**

Connect to mains water supply, connect second hose to drain, fill, vent, balance each UFH zone.

**Additives**

Inhibitor, cleansing agent, restoring agent, anti-freeze, leak sealers.

**Procedure for power flushing**

Safeguard property, connect flushing machine between pump, boiler or heat emitter, flush system clear, reconnect, refill with additives.

**Common faults**

Pumping over, persistent venting, micro air leaks, radiators not getting warm at the top, cold spots, stuck TRVs, motorised valves not operating, heat when no demand, component failure, leaks.

<b>Learning outcome</b>
The learner will: 6. Be able to decommission, install, commission and fault find on sophisticated central heating systems and their components
<b>Assessment criteria</b>
The learner can: 6.1 Confirm safe isolation of all electrical and water supplies 6.2 Install pipework to s plan heating systems and underfloor heating manifolds 6.3 Install <b>components</b> required for a boiler interlock 6.4 Demonstrate <b>'dead' testing</b> of boiler interlock systems 6.5 Carry out visual inspections of pipework and components 6.6 Commission central heating systems and components 6.7 Commission underfloor heating system 6.8 Demonstrate procedures for <b>decommissioning</b> 6.9 Resolve <b>faults</b> in central heating systems.

<b>Range</b>
<b>Components</b> Motorised valves, auto bypass, room stat, programmer, cylinder stat.
<b>'Dead' testing</b> Earth continuity, resistance to earth, continuity, short circuit.
<b>Faults</b> Pumping over, dragging air in, motorised valves not operating, heat when no demand, component failure.

## Unit 309

## Domestic gas principles

<b>UAN:</b>	<b>D/504/0234</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	11
<b>GLH:</b>	108
<b>Aim:</b>	This unit gives underpinning knowledge of core domestic gas principles, covering legislation, combustion, flueing, ventilation, gas pipework, gas controls, meters and governors, let-by and tightness testing. The passing of this unit does not infer candidate competency to undertake any such work and is intended to introduce learners to the subject.
<b>Health and safety</b>	Healthy and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

<b>Learning outcome</b>
The learner will: 1. Know gas safety legislation
<b>Assessment criteria</b>
The learner can: 1.1 State <b>hierarchical responsibilities</b> for the gas industry in Great Britain, Northern Ireland, Isle of Man and Guernsey 1.2 State the <b>date</b> the Gas Safety (Installation and Use Regulations) 1998 came into force 1.3 State the competent persons <b>citation</b> 1.4 Describe the three families of gas 1.5 Describe the meaning of the term <b>gas fitting</b> 1.6 Define what constitutes <b>work on a gas fitting</b> .

**Range****Hierarchical responsibilities**

Government (The Gas Safety (Installation and Use) Regulations  
Health and Safety Executive (Reporting of Injuries, Diseases and  
Dangerous Occurrences Regulations  
Gas Safe Register (Accreditation and Registration)  
Gas Supplier (Pressure and Leakage Employer, Landlords, Consumers  
(Competency Using a Class of Person authorised to carry out such work)  
Gas operative (Responsibility to all of above).

**Date**

31st October 1998.

**Citation**

Protection of life and property, No person shall carry out any work in  
relation to a gas fitting or gas storage vessel unless they are competent  
to do so. Reg. 3(1).

**Three families of Gas**

Manufactured Gas man made gas derived from coal - Towns gas  
Natural Gas - Hydrocarbon predominantly Methane in Natural Gas  
Liquid Petroleum Gas- Butane or Propane for Liquid Petroleum Gas.  
(Gaseous state or as Products of Combustion).

**Gas fitting**

Any component that conveys or is in direct contact with gas. Pipes,  
valves, metres and their associated gas conveying connections or parts.

**Work on a gas fitting**

Install, service, maintain, repair, permanently adjust, disconnect, alter,  
renew, replace, purge any gas fitting.

<b>Learning outcome</b>
The learner will: 2. Understand the characteristics of combustion
<b>Assessment criteria</b>
The learner can: 2.1 State the <b>characteristics</b> of combustion for natural gas and liquid petroleum gas 2.2 State the combustion process 2.3 Describe complete and incomplete combustion 2.4 Identify the <b>causes</b> of incomplete combustion in gas appliances 2.5 State the <b>visual signs</b> of incomplete combustion 2.6 Identify stoichiometric ratios of natural gas and liquid petroleum gas 2.7 Compare the difference between net and gross KW output 2.8 Describe the characteristics of <b>flame type</b> 2.9 Explain the <b>dangers</b> of Carbon Monoxide (CO) 2.10 State the <b>symptoms</b> of carbon monoxide poisoning 2.11 State the <b>actions</b> to reduce the risk of Carbon Monoxide poisoning.

<b>Range</b>
<p><b>Characteristics</b> Odour, toxicity, calorific value, specific density, flame speed, flammability limits, Wobbe number.</p> <p><b>Combustion process</b> Fuel, air, ignition.</p> <p><b>Causes</b> Over-gassing, under-gassing, flame impingement, vitiation, insufficient air for combustion (linter, chimney detritus).</p> <p><b>Visual signs</b> Flame (size, shape, colour), signs of sooting, signs of staining, damp.</p> <p><b>Flame type</b> Post-aerated, pre-aerated.</p> <p><b>Dangers</b> Toxic, easily transported by the haemoglobin into the body, undetectable - colourless, tasteless, odourless, can cause brain damage and/or death.</p> <p><b>Symptoms</b> Flu-like symptoms, headaches, nausea, dizziness, burning eyes, confusion, runny nose, drowsiness, loss of consciousness, brain damage, death.</p> <p><b>Actions</b> Regular servicing and inspection of appliances, use of approved Carbon Monoxide (CO) detectors.</p>

**Learning outcome**

The learner will:

3. Understand the principles of flues

**Assessment criteria**

The learner can:

- 3.1 State the primary **purpose** of flues
- 3.2 Explain the working principles of different **flue types**
- 3.3 Distinguish different flue types in relation to **flue categories**
- 3.4 Identify flue terminal positions in accordance with BS5440 Part 1
- 3.5 Describe flue component **parts**
- 3.6 State the factors that can influence flue **performance**
- 3.7 Explain how to carry out a flue-flow test
- 3.8 Explain how to carry out a spillage test.

**Range****Purpose**

To remove products of combustion.

**Flue types**

Open flue, flueless, room sealed.

**Flue categories**

B11, B12, B13, B14, B22, C11, C12, C13, C32, C73, C21 'SE', C41 'U'.

**Parts**

Down draft diverter, primary, secondary, terminal, twin walled, single wall, builders opening, flexible liners, sealing plate, flue spigot, closure plate, chairbrick, lintel, catchment space, metal flue box, terminal guard, bird guard, pre-cast flueblock.

**Performance**

Flue route, length, number of 45° or 90° bends, climatic conditions, cross sectional area, terminal type, obstructions, dampers, parging, serviceable condition.

<b>Learning outcome</b>
The learner will: 4. Understand the principles of ventilation
<b>Assessment criteria</b>
The learner can: 4.1 State the reference <b>documents</b> to be used for air ventilation requirements for gas appliances 4.2 State the <b>reasons</b> for providing ventilation to gas appliances 4.3 Describe <b>requirements</b> for airvents 4.4 Define adventitious allowance 4.5 Calculate ventilation requirements for different <b>flued appliances</b> 4.6 Calculate ventilation requirements for <b>flued appliances in compartments</b> 4.7 Calculate vents in series for more than one room 4.8 Describe ventilation requirements for multiple appliances.

<b>Range</b>
<b>Documents</b> BS5440, Building Regulation Approved Document 'J', Manufacturer's instructions.
<b>Reasons</b> To enable combustion, dissipate heat from the appliance.
<b>Requirements</b> Continuous, hole dimension, mustn't have fly screen, must not be hit-and-miss type (closable).
<b>Adventitious allowance</b> 7KW / 35cm <sup>2</sup> The ingress of air through the fabric of the building, including door, windows, ceilings, floors, walls, vents.
<b>Flued appliances</b> Open, room sealed, flueless.
<b>Flued appliances in compartments</b> Open, room sealed.



<b>Learning outcome</b>
The learner will: 5. Understand gas pipework
<b>Assessment criteria</b>
The learner can: 5.1 Describe the <b>requirements</b> for gas pipework 5.2 Describe <b>materials</b> used in internal gas pipework 5.3 State common gas <b>pipework faults</b> 5.4 Calculate pipe sizing for domestic natural gas installations 5.5 Identify <b>tools</b> required to undertake a domestic let-by and tightness test 5.6 State the <b>procedure</b> for a domestic let-by and tightness testing.

<b>Range</b>
<b>Requirements</b> Clipping distances, sleeving, minimum depths, protection, bonding, location to other services, location of emergency/meter control valves (ECV/ MCV).
<b>Materials</b> Copper, steel, semi-rigid (Trac-pipe), stainless steel.
<b>Pipework faults</b> Gas Pipe passing through a wall un-sleeved, Gas Pipe passing through a wall sleeved but the annular space not sealed internally, insufficient clips, broken clips, unprotected pipe laid in a screed, inappropriate fitting, compression fitting installed in an inaccessible location, pipework passing too close to electrical cable or apparatus, swaged joint, pipework buried in ground put too shallow, undersized pipework, pipework restriction, no equipotential bonding within 600mm of the meter on customer's pipework, pipework running in a cavity wall, inappropriate use of a micro point, no or inaccurate signs and labels.
<b>Tools</b> Manometer with tube, flat bladed screwdriver, stopwatch, gas leak detector fluid, dry lint-free cloth.
<b>Procedure</b> (IGE/UP/1B).

<b>Learning outcome</b>
The learner will: 6. Understand gas controls
<b>Assessment criteria</b>
The learner can: 6.1 Identify gas controls 6.2 Describe the operation of <b>principal gas controls</b> 6.3 Describe common <b>faults</b> in gas controls.

<b>Range</b>
<p><b>Gas controls</b>  Gas tap, cooker safety cut off valve, mechanical thermostat, electrical thermostat, thermo-electric valve, flame rectification, zero governor, vitiation sensing device, bi-metallic strip, solenoid gas valve, relay valve, multi-functional valve, precision pilot, meter regulators, rod type thermostat.</p> <p><b>Principal gas controls</b>  Gas tap, cooker safety cut off valve, mechanical thermostat, electrical thermostat, multi-functional valve, vitiation sensing device, flame rectification, zero governor.</p> <p><b>Faults</b>  Mechanical thermostat (Blocked bypass), split diaphragm (regulator), stiff user control tap (dry tapered valve), thermocouple (pitted, burnt out, loose connection).</p>

<b>Learning outcome</b>
<p>The learner will:</p> <p>7. Understand how to calculate gas rates</p>
<b>Assessment criteria</b>
<p>The learner can:</p> <p>7.1 State the typical <b>calorific value</b> for natural gas</p> <p>7.2 Calculate gas rates of natural gas appliances with imperial and metric meters.</p>

<b>Range</b>
<p><b>Calorific value</b>  1040 Btu/ft<sup>3</sup> (38.79 MJ/m<sup>3</sup>)</p>

## **Unit 307            Domestic gas principles**

### Supporting information

#### **Guidance**

This is a knowledge only unit but if centres have gas facilities it is recommended that learners are provided with the opportunity to carry out some practical activities to support learning.

#### **AC 2.5**

Learners will be assessed on visual signs but it is recommended that tutors discuss the need to understand performance testing gas appliances using flue gas analysers in relation to combustion.

**Note:** The undertaking of gas related activity without qualification and registration is unlawful.

## Unit 308

## Career awareness in building services engineering

<b>UAN:</b>	<b>K/504/0253</b>
<b>Level:</b>	Level 3
<b>Credit value:</b>	2
<b>GLH:</b>	20
<b>Aim:</b>	<p>This unit will introduce learners to the concept of planning for own career development and setting goals to help realise plans. Learners will investigate the different crafts that make up Building Services Engineering.</p> <p>Learners are required to compile documents to support career plans including Curriculum Vitae and personal statements.</p> <p>The unit is designed to demonstrate to learners that there are many optional career pathways including becoming highly skilled in own craft or exploring supervisory responsibilities.</p>

<b>Learning outcome</b>
The learner will: 1. Understand how to plan for careers in building services engineering
<b>Assessment criteria</b>
The learner can: 1.1 Identify <b>resources</b> to support career planning 1.2 Describe <b>elements</b> of career planning 1.3 Describe <b>documents</b> to support career development 1.4 Explain the <b>principles</b> of goal setting 1.5 Describe how to set <b>goals</b> 1.6 Define the different <b>roles</b> in building services engineering 1.7 Explain <b>opportunities for progression</b> within building services engineering 1.8 Describe <b>types</b> of employment.

<b>Range</b>
<p><b>Resources</b> Internet, publications, professional bodies/organisations, educational support and guidance, independent research, mentors, networking, job descriptions, role models, job centres, recruitment agencies, awarding organisations.</p> <p><b>Elements</b> Goal setting, qualifications, Curriculum Vitae (CV), person specification, aspirations, work experience, SWOT analysis.</p> <p><b>Documents</b> Curriculum Vitae (CV), personal statement, portfolio, cover letter, references, business plans.</p> <p><b>Principles</b> SMART targets, SWOT analysis.</p> <p><b>Goals</b> Short, medium, long.</p> <p><b>Roles</b> Installation electrician, heating and ventilation service and maintenance engineer, plumber, heating and ventilation engineer, refrigeration engineer, maintenance electrician ductwork installer, air-conditioning engineer.</p> <p><b>Opportunities for progression</b> Supervisor, manager, business owner, highly skilled in craft, sideways moves to different crafts, assessor/trainer, designer, surveyor, estimator, apprenticeship, engineer, director.</p> <p><b>Types</b> Contract work, private, consultancy, sub-contractor, casual labour.</p>

<b>Learning outcome</b>
<p>The learner will:</p> <ol style="list-style-type: none"> <li>Understand the requirements to become a qualified operative in building services engineering</li> </ol>
<b>Assessment criteria</b>
<p>The learner can:</p> <ol style="list-style-type: none"> <li>Describe <b>specific requirements</b> for career choices in building services engineering</li> <li>Identify the <b>areas</b> in building services which run competent person schemes</li> <li>Define the <b>term competent person scheme (CPS)</b></li> <li>Identify the renewal requirements for being part of competent person schemes</li> <li>Describe the <b>consequences</b> of not being part of the competent person scheme when working in building services engineering.</li> </ol>

<b>Range</b>
<b>Specific requirements</b> Qualifications, experience, competency, legal.
<b>Areas</b> Gas, hot water, cold water, electrical, air conditioning, solid fuel, environmental technologies, oil.
<b>Term competent person scheme (CPS)</b> To enable self-certification of own work carried out.
<b>Consequences</b> Fines, imprisonment, loss of license to practice, injury.



## Appendix 1 Relationships to other qualifications

### Links to other qualifications

This qualification has connections to the:

- Level 2 Diploma in Plumbing Studies (6035)
- Level 2 NVQ in Plumbing and Heating (6189)
- Level 3 NVQ in Plumbing and Heating (6189)
- Level 3 NVQ in Electrotechnical Services (2357)
- Level 2 NVQ in Heating and Ventilating (6188)
- Level 3 NVQ in Heating and Ventilating (6188)
- Level 2 NVQ in Refrigeration and Air Conditioning (6087)
- Level 3 NVQ in Refrigeration and Air Conditioning (6087)
- Level 2 Diploma in Electrical Installations (Buildings and Structures) (2365)
- Level 3 Diploma in Electrical Installations (Buildings and Structures) (2365)
- Level 2 Diploma in Heating and Ventilating (7188)
- Level 3 Diploma in Heating and Ventilating (7188)
- Level 2 Diploma in Refrigeration, Air Conditioning and Heat Pump Systems (7189)
- Level 3 Diploma in Refrigeration, Air Conditioning and Heat Pump Systems (7189)

### Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see [www.cityandguilds.com/functionalskills](http://www.cityandguilds.com/functionalskills)
- Essential Skills (Northern Ireland) – see [www.cityandguilds.com/essentialskillsni](http://www.cityandguilds.com/essentialskillsni)
- Essential Skills Wales – see [www.cityandguilds.com/esw](http://www.cityandguilds.com/esw)

## Appendix 2 Disclaimer



This document must be completed by the candidate and the tutor as part of the qualification induction.

You have been enrolled on the **Level 3 Diploma in Plumbing Studies (6035-03)**. This is a qualification that tests both practical and knowledge based skills in a realistic working environment. When you have successfully completed this qualification you will be at an **Improver/Plumber's Mate** level.

In order to fully qualify as a Plumber you will need to fully meet the performance criteria as laid down in the National Occupational Standards put together by Summit Skills, the Sector Skills Council. This is covered in the City and Guilds 6189 Level 2 and 3 NVQ Diploma in Plumbing and Heating.

Your tutor/assessor will be able to explain how you may progress onto the City and Guilds 6189 Level 2 and 3 NVQ Diploma in Plumbing and Heating. **However, you should be aware that the relevant performance units will need to be carried out in industry.** Completion of the 6189 will enable you to apply to join a competent person's scheme.

**I can confirm that as part of my induction the above statement has been explained and I understand that completing the City and Guilds Level 3 Diploma in Plumbing Studies (6035-03) qualification will not make me a fully qualified Plumber.**

Candidate \_\_\_\_\_ Date \_\_\_\_\_

Tutor \_\_\_\_\_ Date- \_\_\_\_\_





## Appendix 3 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)**.

***Centre Manual - Supporting Customer Excellence*** contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. 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
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

***Our Quality Assurance Requirements*** encompasses all of the relevant requirements of key regulatory documents such as:

- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

***Access to Assessment & Qualifications*** provides full details of the arrangements that may be made to facilitate access to assessments and

qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- **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 GOLA/e-volve assessments.

## Useful contacts

**UK learners**  
**General qualification information** E: [learnersupport@cityandguilds.com](mailto:learnersupport@cityandguilds.com)

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**International learners** E: [intcg@cityandguilds.com](mailto:intcg@cityandguilds.com)  
General qualification information

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**Centres** E: [centresupport@cityandguilds.com](mailto:centresupport@cityandguilds.com)  
Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

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**Single subject qualifications** E: [singlesubjects@cityandguilds.com](mailto:singlesubjects@cityandguilds.com)  
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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**International awards** E: [intops@cityandguilds.com](mailto:intops@cityandguilds.com)  
Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

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**Walled Garden** E: [walledgarden@cityandguilds.com](mailto:walledgarden@cityandguilds.com)  
Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

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**Employer** E: [business@cityandguilds.com](mailto:business@cityandguilds.com)  
Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

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**Publications**  
Logbooks, Centre documents, Forms, Free literature

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

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)

## **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. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. 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 operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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