City & Guilds Level 3 Diploma in Plumbing & Domestic Heating

(9289-01/02/03/91/92/93)

Version 1.0 (September 2024)

Qualification Handbook

Qualification at a glance

Subject area	Plumbing and domestic heating
City & Guilds number	9289
Age group approved	16-19 19+
Entry requirements	n/a
Assessment	Multiple choice exams, practical assignments, portfolio of evidence (work log)
Grading	Pass/Fail
Approvals	See Centre requirements (Approvals) section
Support materials	Sample exam questions, practical assignment packs, work logs, SmartScreen (Phases 1-3 only)
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Regulatory reference number	GLH	TQT
City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Gas	9289-01/91	610/4672/3	1550	1927
City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Environmental Technologies	9289-02/92		1400	1800
City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Non-domestic Plumbing	9289-03/93		1572	1928

Version and date	Change detail	Section
1.0 September 2024	Initial version	All

Contents

1 Introduction

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

Area	Description
Who are the qualifications for?	These qualifications are for learners who want to become competent to industry standards in plumbing and domestic heating. Learners are required to develop their knowledge, skills, and behaviour to be able to plan, select, install, test, commission, service and maintain plumbing and domestic heating systems. Learners will specialise in one of the pathway options: Gas, Environmental Technologies, or Non-domestic Plumbing. This qualification should be delivered as the on-programme part of the Plumbing and Domestic Heating Technician Level 3 Apprenticeship (ST0303).
What do the qualifications cover?	These qualifications cover cold water, hot water, central heating, sanitary pipework and rainwater systems. The qualifications include measuring, marking, cutting, bending and jointing metallic and non-metallic pipework. Appliances and equipment can include gas, boilers as well as pumps, heat emitters, bathroom furniture or controls as part of the systems.
What opportunities for progression are there?	On successful completion learners can progress onto End-point Assessment for the apprenticeship, CPD qualifications within this sector, and management qualifications. Learners can progress into supervisory job roles and/or into areas such as design and planning.
Who did we develop the qualifications with?	The content of this qualification is based on the knowledge, skills and behaviours within the Plumbing and Domestic Heating Technician Level 3 Apprenticeship Standard (ST0303) that has been designed by an Employer Group. The qualification was designed and developed by City & Guilds in association with EAL, BPEC, and LCL Awards.
Is it part of an apprenticeship framework or initiative?	Yes, ST0303/AP01.1 Plumbing and Domestic Heating Technician Level 3 Apprenticeship.

Structure

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Gas (9289-01/91), learners must achieve:

City & Guilds unit number	Unit title	GLH
Core units		
301	Health and safety systems	88
302	Common installation processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water treatment and routing	61
306	Plumbing and domestic central heating system layouts	81
307	Plumbing and domestic central heating systems	166
308	Decommission plumbing and domestic central heating systems	26
309	Test plumbing and domestic central heating systems	65
310	Commission and handover plumbing and domestic central heating systems	86
311	Fault diagnosis and rectification on plumbing and domestic central heating systems	38
312	Service and maintenance on plumbing and domestic central heating systems	32
313	Size and select plumbing and domestic central heating systems	70
314	Environmental technology systems	15
315	Domestic fuel systems	30
316	Electrical work and the control of plumbing and domestic heating systems	70

317	Install, commission, service and maintain plumbing and domestic heating systems (On site portfolio evidence)	60
Specialist pathway units		
318	Combustion and properties of gas	57
319	Buildings, services and structures	86
320	Gas safety	119
321	Specific core gas safety	109
322	Install, service, repair and remove gas water heating and wet central heating	67
323	Install and maintain gas water heating and wet central heating appliances (On-site portfolio evidence)	12

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Environmental Technologies (9289-02/92), learners must achieve:

City & Guilds unit number	Unit title	GLH
Core units		
301	Health and safety systems	88
302	Common installation processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water treatment and routing	61
306	Plumbing and domestic central heating system layouts	81
307	Plumbing and domestic central heating systems	166
308	Decommission plumbing and domestic central heating systems	26
309	Test plumbing and domestic central heating systems	65
310	Commission and handover plumbing and domestic central heating systems	86
311	Fault diagnosis and rectification on plumbing and domestic central heating systems	38
312	Service and maintenance on plumbing and domestic central heating systems	32
313	Size and select plumbing and domestic central heating systems	70
314	Environmental technology systems	15
315	Domestic fuel systems	30
316	Electrical work and the control of plumbing and domestic heating systems	70

317	Install, commission, service and maintain plumbing and domestic heating systems (On site portfolio evidence)	60
Specialist pathway units		
324	Air source heat pump systems	160
325	Solar thermal hot water systems	130
326	Install and maintain air source heat pump and solar thermal hot water systems (On site portfolio evidence)	10

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Non-domestic Plumbing (9289-03/32), learners must achieve:

City & Guilds unit number	Unit title	GLH
Core units		
301	Health and safety systems	88
302	Common installation processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water treatment and routing	61
306	Plumbing and domestic central heating system layouts	81
307	Plumbing and domestic central heating systems	166
308	Decommission plumbing and domestic central heating systems	26
309	Test plumbing and domestic central heating systems	65
310	Commission and handover plumbing and domestic central heating systems	86
311	Fault diagnosis and rectification on plumbing and domestic central heating systems	38
312	Service and maintenance on plumbing and domestic central heating systems	32
313	Size and select plumbing and domestic central heating systems	70
314	Environmental technology systems	15
315	Domestic fuel systems	30
316	Electrical work and the control of plumbing and domestic heating systems	70

317	Install, commission, service and maintain plumbing and domestic heating systems (On site portfolio evidence)	60
Specialist pathway units		
327	Common processes and techniques in non-domestic plumbing systems	91
328	Cold water supply to non-domestic premises	34
329	Installation of non-domestic plumbing systems	197
330	Decommission non-domestic plumbing systems	16
331	Test and commission non-domestic plumbing systems	60
332	Fault diagnosis and rectification on non-domestic plumbing systems	30
333	Service and maintenance of non-domestic plumbing systems	28
334	Install, commission, service and maintain non-domestic plumbing systems (On site portfolio evidence)	16

Total Qualification Time (TQT)

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT comprises of the following two elements:

1) the number of hours that an awarding organisation has assigned to a qualification for guided learning
2) an estimate of the number of hours a learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by – but, unlike guided learning, not under the immediate guidance or supervision of – a lecturer, supervisor, tutor or other appropriate provider of education or training.

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2 Centre requirements

Approval

Full approval

To offer this qualification, **new** centres will need to gain both centre and qualification approval. Please refer to the document **Centre Approval Process: Quality Assurance Standards** for further information.

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

Automatic approval

If your centre is already approved to offer 9189-04/05/06/07 you will be automatically approved to offer 9289-01/02/03/91/92/93.

Please refer to the document **Centre Approval Process: Quality Assurance Standards** for further information.

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

Resource requirements

Centre staffing

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

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training (this knowledge must be to the same level as the training being delivered)
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training (minimum of 2 years).

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and quality assurance, and that it takes account of any national or legislative developments.

Assessors

Assessors for all units must:

- Be vocationally and occupationally competent in the areas they are assessing
- Have knowledge and understanding of the assessment criteria they are assessing
- Have knowledge and understanding of the qualification structure, content and assessment components
- Understand the assessment process

Centre Based Assessors must hold:

- Level 3 Award Assessing Vocationally Related Achievement

or

- Level 3 Certificate Assessing Vocationally Related Achievement

or

- A1* or D32 /D33 with an Upgrade to A1 as a minimum

or

- SQA Accredited Learning and Development Unit L&D 9DI – Assess workplace competence using direct and indirect methods (replaces Units A1)*

Workplace Assessors must hold:

- Level 3 Award Assessing Competence in the Work Environment

or

- Level 3 Certificate Assessing Vocationally Related Achievement

or

- SQA Accredited Learning and Development Unit L&D 9D Assess workplace competence using direct methods

or

- A2 or D32 with an upgrade to A2 as a minimum *

* The Teaching Qualification for Secondary Education (TQSE) or the Teaching Qualification for Further Education (TQFE) (which is recognised in Scotland) these awards are acceptable providing they are the versions that are recognised as equivalents to the A1 award plus appropriate CPD.

Assessors holding D units must have evidence of Continuing Professional Development (CPD) to demonstrate compliance with the A units.

Note: 'Candidate Assessors' who are working towards their Assessor qualifications and who do not have the requisite 2 years' experience must be supervised by a Qualified Assessor. Candidate Assessors must have a clear action plan for achieving the Assessor qualification(s). Assessor approval will be withdrawn if a relevant qualification has not been attained within 18 months.

Occupational competence for assessors

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 or have one or more of a relevant occupational qualification (See example list below) to ensure that they can be regarded as occupational competent in terms of assessing or verifying this qualification, and units therein.

In addition assessors must demonstrate occupational competence – that is, provide verifiable evidence of all the following:

- a level 3 or equivalent NVQ plumbing*
- industry experience
- current knowledge of industry practice and techniques relevant to the occupational area in which they assess.
- a thorough knowledge and understanding of the qualification standards and requirements
- current registration with an appropriate professional body or a relevant qualification to demonstrate competence to act as an assessor for a specific occupational pathway.

*Assessors holding a City & Guilds Advanced Craft Certificate must provide CPD evidence sufficient to demonstrate knowledge of current best practice.

*Assessors holding Level 3 NVQ-related qualifications in:

- Domestic Gas (Wet Central Heating),
- Heating and Ventilating Installation (Domestic)
- Domestic Heating

must provide CPD evidence sufficient to demonstrate competence in related plumbing systems. Equivalent SNVQs will be accepted in all instances.

Industry experience

Assessors must have verifiable evidence of industry experience and current knowledge of the industry, including its settings, working practices and techniques, legislative and regulatory requirements, Codes of Practice and guidance that are relevant to the occupational area. The verifiable evidence must be at or above the level being assessed and include one or more of the following:

- A relevant qualification (See Occupational competence for assessors section)
- Registration with the appropriate industry registration body at the relevant occupational level and grade.

For particular units, the verifiable evidence may need to be above the level of the unit being assessed. Where this is the case, the requirement will be detailed within the unit.

The occupational competence of assessors must be updated on a regular basis and will be periodically reconfirmed by the Awarding Organisation as part of the quality assurance arrangements.

Assessor continuing professional development

The occupational competence of assessors must be updated on a regular basis and be periodically confirmed via continuing professional development (CPD) via the Assessment Centre. Evidence of CPD will be sought by the External Quality Assurer (EQA) for all approved Assessors at the Centre.

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

It is imperative that records are kept of all such CPD opportunities/occasions and that they provide evidence of cascading such technical knowledge and industry intelligence to all relevant colleagues.

Further Requirement for Assessors of unit 316 Electrical Work and the Control of Plumbing and Domestic Heating Systems

The person responsible for assessing unit: Electrical work and controlling plumbing and domestic heating systems must be competent in the technical areas of the unit. This means that assessors must have an NVQ in the technical area and/or relevant up-to-date CPD. An assessor without this evidence of competence must engage a qualified electrician to directly observe all the critical safety aspects of the assessment.

Quality assurance staff

This relates to staff undertaking internal verification of assessment. The Centre MUST provide the Awarding Organisation with the names of any Internal Quality Assurers who will undertake internal quality assurance, so that these can be approved prior to them carrying out this role.

Internal quality assurance staff for all units must:

- be familiar with the occupation(s) covered by this qualification
- have knowledge and understanding of the qualification structure and content
- understand the assessment process and the role of quality assurance.

Internal quality assurance staff must also hold the following:

- Level 3 Certificate Assessing Vocationally Related Achievement

or

- A1 or D32/D33 with an upgrade to A1 as a minimum

or

- Learning and Development Unit L&D 9DI – Assess workplace competence using direct and indirect methods

And

- Level 4 Award Internal Quality Assurance of Assessment Processes and Practice

or

- Level 4 Certificate Leading the Internal Quality Assurance of Assessment Processes and Practice

or

- V1 or D34 with an upgrade to V1 as a minimum*

*The Teaching Qualification for Secondary Education (TQSE) or the Teaching Qualification for Further Education (TQFE) (which is recognised in Scotland) these awards are acceptable providing they are the versions that are recognised as equivalents to the A1 award plus appropriate CPD.

Internal Quality Assurers holding D units must have evidence of CPD to demonstrate compliance with the A and V units

or

SQA Accredited Learning and Development Unit L&D 11 Internally monitor and maintain the quality of workplace assessment

It is recommended that Candidate Internal Quality Assurers have a clear action plan for achieving the IQA qualification(s).

IQA approval will be withdrawn if the qualification / units have not been attained within 18 months.

Internal Quality Assurers must demonstrate occupational competence – that is, provide verifiable evidence of one of the following:

- a level 3 NVQ in plumbing
- a related building services engineering qualification with proven technical expertise
- a related building services engineering qualification with access to plumbing technical expertise to support IQA activities.

Continuing professional development of internal quality assurance staff

The occupational experience of quality assurance staff must be updated on a regular basis and be periodically confirmed via continuing professional development (CPD) via the Assessment Centre. This will be quality assured by the Awarding Organisation.

It is the responsibility of each internal quality assurance staff member to identify and make use of opportunities for CPD, such as industry conferences, access to trade journals, and Professional Body/Trade Association events, at least on an annual basis to enhance and upgrade their professional development and technical knowledge. It is imperative that records are kept of all such CPD opportunities/occasions and that they provide evidence of cascading such technical knowledge and industry intelligence to all relevant colleagues.

Expert Witnesses

Witness testimony evidence can only be accepted if the testimony is completed by a technically and occupationally competent witness and will normally be in the form of a completed and signed Work Log with other supporting evidence (e.g. company or employer job sheets, photographic evidence).

The evidence provided by witness testimony and other non-observed sources must be substantiated by an Assessor (e.g. by confirming the suitability of the witness and by professional discussion). Once the evidence has been substantiated and suitably documented, then it can be referenced appropriately by the Assessor.

Where expert witnesses are used in the assessment process they must be:

- Sector competent individuals who can attest to the learner's performance in the workplace.
- It is not necessary for expert witnesses to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by an expert witness.
- Evidence from expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency.
- Expert witnesses will need to demonstrate:
    - they have relevant current knowledge of industry working practices and techniques
    - that they have no conflict of interest in the outcome of their evidence.

Where either expert witnesses and mentors are the same person the centre must identify, record and mitigate any conflicts of interest and risk to impartiality.

The External Quality Assurer will be able to give further advice on the use of witness testimony.

Pathway Direct Observations (Gas, Environmental Technologies, Non-Domestic Plumbing)

Direct observation evidence from the workplace may be gathered by a trained, but not necessarily qualified, assessor to form a portfolio that is then assessed as diverse evidence, by a qualified assessor.

The evidence provided by the workplace assessor must be substantiated by an assessor (e.g. by confirming the suitability of the witness and by professional discussion). Once the evidence has been substantiated and suitably documented, then it can be referenced appropriately by the Assessor.

Where workplace assessors are used in the assessment process they must be:

- Sector competent individuals who can attest to the learner's performance in the workplace.
- It is not necessary for workplace assessors to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by a workplace assessors.
- Evidence from workplace assessors must meet the tests of validity, reliability, authenticity and sufficiency.
- Workplace assessors will need to demonstrate they have:
    - qualification/s in the technical area,
    - verifiable CV indicating experience in the technical area,
    - current registration with an appropriate professional body to demonstrate competence to act as an assessor for the specific occupational pathway,
    - had training and mentoring in the assessment methods they will be using,
    - relevant current knowledge of industry working practices and techniques,
    - no conflict of interest in the outcome of their evidence.

Evidence of training and mentoring for the assessor must be kept and made available to the External Quality Assurer.

Staff invigilating assessments under controlled conditions

Members of staff with responsibility for invigilating on-screen tests must know, understand and comply with the Procedures for Conducting the Exam Component. These members of staff must also:

- Have experience in conducting and controlling exam sessions

or

- Be supervised by an individual experienced in conducting and controlling exam sessions

Note: A teacher/tutor who has prepared the learners for the subject of the exam must not be the sole supervisor at any time during an exam for that subject(s).

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City and Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

Standards and rigorous quality assurance are maintained by the use of:

- Internal quality assurance
- City & Guilds external quality assurance.

In order to carry out the quality assurance role, Internal Quality Assurers must:

- have appropriate teaching and vocational knowledge and expertise
- have experience in quality management/internal quality assurance
- hold or be working towards an appropriate teaching/training/assessing qualification
- be familiar with the occupation and technical content covered within the qualification.

External quality assurance for the qualification will be provided by City & Guilds EQA process. EQAs are appointed by City & Guilds to approve centres, and to monitor the assessment and internal quality assurance carried out by centres. External quality assurance is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres.

The role of the EQA is to:

- provide advice and support to centre staff
- ensure the quality and consistency of assessments and marking/grading within and between centres by the use of systematic sampling
- provide feedback to centres and to City & Guilds.

Internal assessments

Internal assessment consists of assignments and/or practical tests, which have been designed to assess the knowledge, understanding and skills of learners for individual units. The internal assessment for each unit is set by the Awarding Organisation and marked by members of the delivery team at the Centre. All assessment decisions are then subject to internal standardisation and external quality assurance.

Internal assessments involve collecting and evaluating evidence that demonstrates the achievement of the learning outcomes in each unit. The internal assessments are accompanied by the Awarding Organisation supporting materials to ensure that the delivery team is consistent in their approach to internal assessments across learners. The internal assessments and the accompanying assessment criteria can be found in the documentation provided by the Awarding Organisation.

Centres are responsible for ensuring that internal assessment is suitably controlled to ensure that assessment decisions are valid and reliable, and that work submitted for assessment by learners is prepared and produced by them independently, without assistance from others, and free of plagiarism.

Where the assessment takes the form of written/short answer or multiple choice question papers, these should be treated as controlled assessments therefore imposing the necessary restrictions on the learner as necessary.

All learning outcomes of the qualification must be assessed. In order to help meet this requirement it is advised that learners should produce a logbook/portfolio where they can file and make reference to evidence that shows their achievements against the learning outcomes. Centres should also maintain an assessment and feedback record for each learner, which details the evidence evaluated against the learning outcome and the feedback given to the learner. These records must be available to the External Quality Assurer.

Simulations

Simulations (designed situations for producing artificially generated evidence) may only be used where candidates are prevented from gathering direct evidence normally from the workplace because:

- there are hazards
- it is difficult to distinguish individual performance in team situations
- circumstances occur infrequently or long term results are involved
- confidentiality is important
- there are organisational constraints
- Where stipulated in the unit document i.e. Simulated practical and knowledge units.

Where simulation is allowed as an alternative (to direct workplace evidence) as a means of generating evidence; this will be indicated on the cover of qualification unit documents. Where this an acceptable alternative for producing evidence which is considered to be rare/infrequent, but key/critical to demonstrating competence, the following realistic working environment and contexts must be adopted for the simulation:

- appropriate: tools
- equipment and instruments
- materials
- types of contingencies
- standards and quality specifications
- real timescales
- quantities of work
- physical conditions
- relationship with people
- type of interaction
- communication methods and media
- information and data.

Where simulated evidence is allowed in the unit, the circumstances and requirements for the simulation needs to be confirmed by discussions between the learner and the assessor. This then needs to be agreed by the internal and external quality assurers, in line with the guidelines for assessment in the assessment strategy document.

Work based assessments

Direct evidence produced through normal performance in the workplace is the primary source for meeting the requirements. This includes naturally occurring documentary evidence (hard copy and electronic), direct observation of activities and witness testimony as relevant. Where simulation is allowed this will be indicated on the cover of the qualification unit documents.

Workplace evidence must be supported by the required evidence of knowledge and understanding.
This evidence may be identified by:

- questioning the candidate
- recognised industry education and training programme assessment or professional interview assessment that has been matched to NOS requirements
- performance evidence

A holistic approach towards the collection of evidence should be encouraged. The focus should be on assessing activities generated by the whole work experience rather than focusing on specific tasks. This would show how evidence requirements could be met across the qualification to make the most efficient use of evidence.
Taken as a whole, the evidence must show that the candidate consistently meets all the performance criteria across the scope/range.

There must be workplace evidence against each performance criterion. Where the workplace evidence does not cover the whole scope/range, knowledge evidence must be provided to cover the remaining items of scope/range for each relevant performance criterion.

Knowledge evidence may be established by questioning the candidate, from industry-recognised industry education and training programme assessment, or professional interview assessment, that has been matched to the requirements of the Plumbing and Heating Standard. Such assessments should also have their own independent external assessment, moderation or verification.

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

Age restrictions

These qualification are approved for learners aged 16 or above.

Access arrangements and reasonable adjustments

City & Guilds has considered the design of these qualifications and their assessments in order to best support accessibility and inclusion for all learners. We understand however that individuals have diverse learning needs and may require reasonable adjustments to fully participate. Reasonable adjustments, such as additional time or alternative formats, may be provided to accommodate learners with disabilities and support fair access to assessment.

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

The Equality Act 2010 requires City & Guilds to make reasonable adjustments where a disabled person would be at a substantial disadvantage in undertaking an assessment.

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

Please refer to the JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds for more information. Both are available on the City & Guilds website: City & Guilds website

3 Delivering the qualification

Initial assessment and induction

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

- if the learner has any specific 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 learner fully understands the requirements of the qualification, their responsibilities as a learner and the responsibilities of the centre. This information can be recorded on a learning contract.

Inclusion and diversity

City & Guilds is committed to improving inclusion and diversity within the way we work and how we deliver our purpose which is to help people and organisations develop the skills they need for growth.

More information and guidance to support centres in supporting inclusion and diversity through the delivery of City & Guilds qualifications can be found here:

Inclusion and diversity | City & Guilds (cityandguilds.com)

Sustainability

City & Guilds are committed to net zero. Our ambition is to reduce our carbon emissions by at least 50% before 2030 and develop environmentally responsible operations to achieve net zero by 2040 or sooner if we can. City & Guilds is committed to supporting qualifications that support our customers to consider sustainability and their environmental footprint.

More information and guidance to support centres in developing sustainable practices through the delivery of City & Guilds qualifications can be found here:

Our Pathway to Net Zero | City & Guilds (cityandguilds.com)

Centres should consider their own carbon footprint when delivering this qualification and consider reasonable and practical ways of delivering this qualification with sustainability in mind. This could include:

- reviewing purchasing and procurement processes (such as buying in bulk to reduce the amount of travel time and energy, considering and investing in the use of components that can be reused, instead of the use of disposable or single use consumables)

- reusing components wherever possible
- waste procedures (ensuring that waste is minimised, recycling of components is in place wherever possible)
- minimising water use and considering options for reuse/salvage as part of plumbing activities wherever possible.

Phased training delivery

The assessments for this qualification are divided into four phases. Phases 1–3 cover core content and Phase 4 covers the specialist pathway content.

Candidates must successfully complete all of the assessments for each Phase.

To help centres ensure that all relevant content has been delivered before candidates attempt the assessments, the tables below indicate how unit content is divided between the core Phases 1-3.

Phase 1

Unit	Learning outcome	Assessment criteria
301 Health and safety systems	1. Health and safety legislation that applies to the building services industry	1.1-1.5
	2. Hazardous situations working in the building services industry	2.1-2.7
	3. Personal protection measures	3.1-3.4
	4. How to respond to accidents	4.1-4.5
	5. Procedures for electrical safety	5.1-5.6
	6. How to work safely with heat producing equipment	6.1-6.7
	7. Safe use of access equipment	7.1-7.4
	8. Working safely in excavations and confined spaces	8.1-8.4
302 Common installation processes and techniques	1. Use of hand and power tools in plumbing and domestic heating work	1.1-1.2
	2. Types of plumbing and domestic heating pipework, requirements and their jointing principles	2.1-2.6
	3. Site preparation techniques for plumbing and domestic heating work	3.1-3.4
	4. Use of clips and brackets to support plumbing and domestic heating pipework and components	4.1-4.4
	5. Plumbing and domestic heating system pipework installations	5.1-5.5

Unit	Learning outcome	Assessment criteria
303 Scientific principles	1. Units of measurement used in the plumbing and heating systems industry	1.1-1.3
	2. Properties of materials	2.1-2.6
	5. Mechanical principles in the plumbing and heating systems industry	5.1-5.2
304 Planning and supervision	1. Role of the construction team within the plumbing and heating systems industry	1.1-1.3
	2. Information sources in the building services industry	2.1-2.2
	3. How to communicate with others	3.1-3.4
	4. Responsibilities of relevant people in the building services industry	4.1-4.3
305 Cold water treatment and routing	1. Cold water supply to dwellings	1.1-1.9
306 Plumbing and domestic central heating system layouts	1. Recognition of the layouts plumbing and domestic heating systems	1.1-1.5

Phase 2

Unit	Learning outcome	Assessment criteria
303 Scientific principles	2. Properties of materials	2.7
	3. Relationship between energy, heat and power	3.1-3.6
	4. Principles of force and pressure and their application in the plumbing and domestic heating industry	4.1-4.7
	6. Principles of electricity in the plumbing and domestic heating systems industry	6.1-6.4
307 Plumbing and domestic central heating systems	1. Cold water system installation	1.1-1.10
	2. Hot water system installation	2.1-2.11
	3. Central heating system installation	3.1-3.12
	4. Sanitary appliances and pipework system installation	4.1-4.13
	5. Rainwater system installation	5.1-5.8
308 Decommission plumbing and domestic central heating systems	1. Decommissioning of plumbing and domestic central heating systems	1.1, 1.3, 1.4
309 Test plumbing and domestic central heating systems	1. Soundness test of cold water systems and components	1.1-1.4
	2. Soundness test of hot water systems and components	2.1-2.4
	4. Soundness test of sanitary appliances, pipework systems and components	4.1-4.2
	5. Soundness test of rainwater systems	5.1-5.3

Phase 3

Unit	Learning outcome	Assessment criteria
307 Plumbing and domestic central heating systems	3. Central heating system installation	3.13
308 Decommission plumbing and domestic central heating systems	1. Decommissioning of plumbing and domestic central heating systems	1.2
309 Test plumbing and domestic central heating systems	3. Soundness test of central heating systems and components	3.1-3.4
310 Commission and handover plumbing and domestic central heating systems	1. Commission and handover of cold water systems and components	1.1-1.4
	2. Commission and handover of hot water systems and components	2.1-2.4
	3. Commission and handover of central heating systems and components	3.1-3.4
	4. Commission and handover of sanitary appliances, pipework systems and components	4.1-4.3
	5. Commission and handover of rainwater systems	5.1-5.3
311 Fault diagnosis and rectification on plumbing and domestic central heating systems	1. Fault diagnosis and rectification on cold water systems and components	1.1-1.3
	2. Fault diagnosis and rectification on hot water systems and components	2.1-2.3
	3. Fault diagnosis and rectification on central heating systems and components	3.1-3.3
	4. Fault diagnosis and rectification on sanitary appliances and pipework	4.1-4.3
	5. Fault diagnosis and rectification on rainwater systems and components	5.1-5.3
312 Service and maintenance on plumbing and domestic central heating systems	1. Service and maintenance on cold water systems	1.1-1.5
	2. Service and maintenance on hot water systems	2.1-2.5
	3. Service and maintenance on central heating systems	3.1-3.4

Unit	Learning outcome	Assessment criteria
	4. Service and maintenance on sanitary appliances and pipework systems	4.1-4.4
313 Size and select plumbing and domestic central heating systems	1. Sizing and selection of cold water systems and components for dwellings	1.1-1.7
	2. Sizing and selection of rainwater harvesting and greywater reuse systems and components for dwellings	2.1-2.6
	3. Sizing and selection of hot water systems and components for dwellings	3.1-3.7
	4 Sizing and selection of central heating systems and components for dwellings	4.1-4.7
	5. Sizing and selection of sanitary appliances pipework systems and components for dwellings	5.1-5.6
	6. Sizing and selection of rainwater systems components for dwellings	6.1-6.6
314 Environmental technology systems	1. Sources of renewable and non-renewable energy	1.1-1.3
	2. Operating principles of micro-renewable energy technologies	2.1-2.2
	3. Requirements to install micro-renewable energy systems to existing systems	3.1-3.5
	4. Current energy efficiency advice and guidance	4.1-4.3
315 Domestic fuel systems	1. Factors affecting fuel selection	1.1-1.5
	2. Combustion processes of fuel supplied systems	2.1-2.9
	3. Principles of chimney/flue systems	3.1-3.7
316 Electrical work and the control of plumbing and domestic central heating systems	1. Pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems	1.1-1.8
	2. Industry standard safe isolation procedures	2.1-2.2

Unit	Learning outcome	Assessment criteria
	3. Safe installation, testing and decommission of electrical systems	3.1-3.4
	4. Identification of faults and safe repair of electrical work	4.1

Phase 1-3 Work log

Unit	Learning outcome	Assessment criteria
317 Install, commission, service and maintain plumbing and domestic central heating systems (On site portfolio evidence)	1. Application of health and safety and welfare in the workplace	1.1-1.13
	2. Preparing for the installation of plumbing and domestic heating systems and components	2.1-2.5
	3. Installing plumbing and domestic heating systems and components in the workplace	3.1-3.7
	4. Performing fault diagnosis and rectification procedures	4.1-4.5
	5. Commissioning plumbing and domestic heating systems in the workplace	5.1-5.8

Phase 4 – Gas specialist pathway

Unit	Learning outcome	Assessment criteria
304 Planning and supervision	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry	5.1-5.4
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry	6.1-6.5
318 Combustion and properties of gas	1. Natural gas supply network	1.1-1.2
	2. Operation of pressure regulators	2.1-2.3
	3. Factors that affect pressure loss and the equipment used to measure gas pressure	3.1-3.3
	4. Combustion of gases, and potential risks	4.1-4.12
	5. Gas burner operation, design, features and types	5.1-5.4
	6. Properties and characteristics of Natural Gas (NG) and Liquefied Petroleum Gas (LPG)	6.1-6.3
319 Buildings, services and structures	1. Installation requirements, methods, and materials for Natural Gas (NG) and Liquefied Petroleum Gas (LPG) pipework	1.1-1.10
	2. Ventilation requirements, types and methods	2.1-2.13
	3. Types and operation of suitable chimney systems for gas appliances	3.1-3.8
	4. Methods for checking and testing chimney performance	4.1-4.9
320 Gas safety	1. Safety, legislation and standards within the gas industry	1.1-1.7
	2. Gas emergency actions and procedures	2.1-2.2
	3. Unsafe situations, emergency notices and warning labels	3.1-3.6
	4. Operation and positioning of emergency controls and valves	4.1-4.4

Unit	Learning outcome	Assessment criteria
	5. Low pressure domestic gas meters, regulators and housings	5.1-5.11
	6. Methods and requirements to tightness test and purge small gas installations	6.1-6.10
	7. How to check and set gas installation operating pressures at gas meters and LPG regulators	7.1-7.5
	8. How to safely assess the potential risks, tightness test and re-light temporarily isolated appliances	8.1-8.3
	9. Requirements to check and set appliance burner pressures and compare measured gas rates with published figures	9.1-9.4
	10. Principles of operation and methods of testing gas appliance safety controls	10.1-10.5
321 Specific core gas safety	1. Gas safety controls are operating correctly, and actions required when unsafe or ineffective operation is found	1.1-1.2
	2. Construction and operation of chimneys used for domestic gas appliances	2.1-2.2
	3. How to carry out chimney performance checks	3.1-3.7
	4. Completion of the correct notices, forms and labels used in domestic gas utilisation	4.1-4.2
	5. Correct use of combustion and atmosphere sampling analysers	5.1-5.9
	6. Installation and commission of a small domestic gas installation	6.1-6.12
	7. Calculation of the requirements for permanent ventilation in domestic gas utilisation environments	7.1-7.6

Unit	Learning outcome	Assessment criteria
	8. How to work correctly and safely with electrical systems and components used in domestic gas utilisation	8.1-8.8
322 Install, service, repair and remove gas water heating and wet central heating	1. Uses of gas water heating and wet central heating appliances in dwellings	1.1-1.4
	2. Types of gas water heating and wet central heating appliances and their layout requirements	2.1-2.5
	3. Site preparation techniques for gas water heating and wet central heating appliances	3.1-3.9
	4. Installation and commission of gas water heating and wet central heating appliances	4.1-4.7
	5. Service and maintenance of gas water heating and wet central heating appliances	5.1-5.4
	6. Decommission of gas water heating and wet central heating appliances	6.1-6.6
323 Install and maintain gas water heating and wet central heating appliances (On-site portfolio evidence)	1. Install, service and fault find gas water heating and wet central heating appliances	n/a
	2. Installation of gas pipework (≤ 35 mm)	
	3. Gas tightness testing, direct purging (IGEM/UP/1B) and relighting appliances	
	4. Opportunity for identification of unsafe situations	

Phase 4 – Environmental Technologies specialist pathway

Unit	Learning outcome	Assessment criteria
304 Planning and supervision	4. Responsibilities of relevant people in the building services industry	4.3
	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry	5.1-5.4
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry	6.1-6.5
324 Air source heat pump systems	1. Health and safety risks and legislation associated with air source heat pump systems	1.1-1.3
	2. Types of air source heat pump systems	2.1-2.6
	3. How to design air source heat pump systems	3.1-3.17
	4. Air source heat pump installation	4.1-4.5
	5. Service and maintenance of air source heat pump systems	5.1-5.4
	6. Fault diagnosis and rectification of defects and malfunctions on air source heat pump systems	6.1-6.6
	7. Testing, commissioning and handover of air source heat pump systems	7.1-7.8
325 Solar thermal hot water systems	1. Health and safety and relevant legislation, regulations and standards	1.1-1.3
	2. Fundamental design principles for solar thermal hot water systems	2.1-2.10
	3. Solar thermal hot water systems installation	3.1-3.6
	4. Testing, commissioning and handover of solar thermal hot water systems	4.1-4.3
	5. Service, maintenance, diagnosis and rectification of faults of a solar thermal hot water installation	5.1-5.3

Unit	Learning outcome	Assessment criteria
326 Install and maintain air source heat pump and solar thermal hot water systems (On site portfolio of evidence)	1. Install, commission, service and fault find air source heat pump and solar thermal hot water systems	n/a

Phase 4 – Non-domestic Plumbing specialist pathway

Unit	Learning outcome	Assessment criteria
304 Planning and supervision	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry	5.1-5.4
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry	6.1-6.5
327 Common processes and techniques in non-domestic plumbing systems	1. Health and safety risks and legislation associated with work on non-domestic plumbing systems	1.1-1.3
	2. Safe use of hand and power tools in non-domestic plumbing systems work	2.1-2.2
	3. Pipework and jointing methods used in non-domestic plumbing systems	3.1-3.4
	4. Site preparation techniques for work on non-domestic plumbing systems	4.1-4.4
	5. Use of clips and brackets to support non-domestic plumbing pipework and components	5.1-5.5
	6. Non-domestic plumbing pipework installation	6.1-6.6
328 Cold water supply to non-domestic premises	1. Cold water supply to non-domestic premises	1.1-1.4
329 Installation of non-domestic plumbing systems	1. Layouts of non-domestic plumbing systems	1.1-1.4
	2. Cold water systems installation in non-domestic premises	2.1-2.8
	3. Hot water systems installation in non-domestic premises	3.1-3.8
	4. Sanitary appliances and pipework systems installation in non-domestic premises	4.1-4.10
	5. Rainwater systems installation in non-domestic premises	5.1-5.5
330 Decommission non-domestic plumbing systems	1. Decommissioning of non-domestic plumbing systems	1.1-1.4

Unit	Learning outcome	Assessment criteria
331 Test and commission non-domestic plumbing systems	1. Soundness test and commission cold water appliances, systems and components in non-domestic premises	1.1-1.6
	2. Soundness test and commission hot water appliances, systems and components in non-domestic premises	2.1-2.6
	3. Soundness test and commission sanitary appliances, pipework systems and components in non-domestic premises	3.1-3.5
	4. Soundness test and commission rainwater systems in non-domestic premises	4.1-4.4
332 Fault diagnosis and rectification on non-domestic plumbing systems	1. Fault diagnosis and rectification procedures on cold water systems and components in non-domestic premises	1.1-1.2
	2. Fault diagnosis and rectification procedures on hot water systems and components in non-domestic premises	2.1-2.2
	3. Fault diagnosis and rectification procedures on sanitary pipework systems in non-domestic premises	3.1-3.2
	4. Fault diagnosis and rectification procedures on rainwater systems in non-domestic premises	4.1-4.2
333 Service and maintenance of non-domestic plumbing systems	1. Service and maintenance on cold water systems in non-domestic premises	1.1-1.4
	2. Service and maintenance on hot water systems in non-domestic premises	2.1-2.4
	3. Service and maintenance on sanitary pipework systems in non-domestic premises	3.1-3.3
334 Install, commission, service and maintain non-domestic plumbing systems	1. Non-domestic plumbing systems and components installation in the workplace	1.1-1.5
	2. Commissioning of non-domestic plumbing systems in the workplace	2.1-2.5

Unit	Learning outcome	Assessment criteria
	3. Fault diagnosis and rectification procedures on non-domestic plumbing systems	3.1-3.5

Delivery Resources

Core units

- Health and Safety at work act 1974
- Relevant health and safety regulations such as working at height, COSHH, PUWER, Asbestos regulations
- Current Water Regulations book (3rd edition)
- British Standards BS EN 806
- BS EN 12056
- BS 6465
- BS 8000
- BS EN 12828
- BS7671
- Domestic Heating Design Guide
- Directory of fittings (WRAS approved)
- 18th Edition on site guide
- Building regulations document L
- Building regulations document H
- Building regulations document G
- BS 12056 S EN 12056

Gas pathway

- Domestic Gas onsite guide part 1 and part 2
- IGEM/G/11 Edition 2 - Gas industry unsafe situations procedure
- IGEM/UP SERIES
- Gas Safety (Installation and Use) Regulations 1998 (GSIUR)
- HSE RIDDOR Procedure
- 18th Edition on site guide
- BS 5440-02
- BS 6891

Environmental Technologies pathway

- MCS Best practice heat pump guide
- Air source on site guide
- Solar thermal onsite guide
- Domestic Heating Design Guide
- Building regulations document L
- Building regulations document G

Non-domestic Plumbing pathway

- Current Water Regulations book (3rd edition)
- Directory of fittings (WRAS approved)

Physical resources

Centres will require the use of specifically designated areas, such as fully equipped workshops to fulfil assessment requirements. The equipment must meet industry standards and the workshops reflect a realistic working environment.

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

Gas specialist pathway

Mandatory requirement to meet IGEM audit requirements.

Source: IGEM/IG/1 Edition 2 Supplement 2

Safety, legislation and Standards:

- A selection of power tools and electrical equipment.

Products and characteristics of combustion:

- A selection of gas appliances with a variety of burners, at least one to be showing signs of incomplete combustion.
- An electronic flue gas performance analyser with MIs and a selection of probes were installed, including an open-flued, room-sealed, and flueless appliance with manufacturers' instructions.

Ventilation for domestic gas burning appliances:

- A selection of air grilles and air bricks (including terracotta).
- Air vent probe.
- A selection of installed ventilation air grilles and bricks with appliances installed (for candidates to calculate ventilation requirements).

Installation of pipework and fittings:

- A selection of copper fittings
- Copper pipe
- Bending machine (for copper)
- Mild steel pipework and taper threaded fittings
- CSST fittings and pipework
- Mechanical fittings including, compression, threaded, washer and union types
- Flexible connectors including meter connections and cooking appliances
- Temporary continuity bond
- A live metered gas installation including equipotential bonding.

Tightness testing and purging:

- A domestic LP gas installation and appliance for tightness testing and purging
- An MP-fed gas supply (test rig) with a meter inlet valve
- An installation with a gas escape for the candidate to trace and repair.

Checking and/or setting meter regulators:

- A live installation, including a gas meter and pipework connected to at least two appliances.

Unsafe situations, emergency notices and warning labels:

- A selection of ID appliances and installations including:
    - Signs of spillage / leaking products of combustion
    - Gas escape.
- A selection of AR appliances and installations including:
    - Chimney defects.
- A selection of warning labels and notices.

Checking and setting appliance operating pressures and heat inputs:

- A live installation including a gas meter and pipework connected to at least two appliances.

Operation and checking of appliance gas safety devices and controls:

- A range of gas safety devices and controls to include:
    - Simple gas tap
    - Cooker safety shut-off valves (fold down cooker lid)
    - Thermoelectric flame supervision device (FSD)
    - Vapour pressure FSD
    - Electronic FSD
    - Solenoid
    - Liquid expansion thermostat
    - Electrically operated thermostat
    - Regulator
    - Multifunctional control
    - Air/gas ratio valve
    - Interruptible thermo-electric valve
    - Vitiation device
    - Overheat device
    - Pressure switches.

Note: These devices may be contained within an appliance.

Chimney inspection and testing:

- Two different open flued chimney systems, one to be precast
- A room sealed appliance
- A fan assisted appliance with an extended chimney that requires supporting
- A concealed fan assisted chimney installation requiring an inspection hatch
- A room sealed fan assisted positive pressure appliance (can be simulated)
- An open chimney appliance including cement based and metallic chimney pipe, joints and adaptors
- A room scenario including a circulating or ceiling fan (can be simulated).

Re-establish existing gas supply and re-light appliances:

- A selection of bays with a live installation, including a gas meter and pipework connected to at least two appliances with manufacturers' instructions. Appliances to include:
    - Cooking appliance
    - Open flued boiler
    - Room Sealed boiler
    - Warm air unit (where this appliance competency is delivered by the training centre)
    - Open-flued gas fire
    - Flueless fire.

Basic Electrical Safety:

- Appliance connected via a connector unit
- Extraneous metalwork

- Two pole voltage detector
- Non-contact voltage detector
- Proving unit or known source.

Appliance options
Central heating boilers, systems & controls:

- A selection of installed boilers including:
  - Room sealed natural draught
  - Fan-assisted chimney open flue
  - Boiler with an air/gas ratio valve.
- A boiler installation connected to an electrical supply (or wiring board) comprising of the following components:
  - Motorised valve(s)
  - Room thermostat
  - Time and temperature controls
  - Pump over-run
  - Cylinder thermostat.

Ducted air heaters:

- A functioning installed warm air unit complete with plenum and return air duct.

Fires and Wall Heaters:

- A selection of gas fires including:
  - Outset gas fire
  - Inset live fuel effect type
  - Flueless gas fire.

Cookers:

- Free standing cooker fitted with cooker hose Cooker with fold down lid Built in hob fitted with flexible connection.
- Selection of stability devices.

Domestic Gas Meters and Regulators:

- A selection of domestic gas meters, regulators, interconnecting pipework & fittings, semi rigid connections, meter unions, meter washers, meter brackets and meter boxes.
- A low-pressure gas supply with main equipotential bonding fitted.

Water Heaters:

- An instantaneous water heater (not a combination boiler).

Support materials

The following resources are available for these qualifications:

Description	How to access
Sample exam questions	www.cityandguilds.com
Practical assignment packs	
Work logs	
SmartScreen (Phases 1-3 only)	www.smartscreen.co.uk

4 Assessment

Assessment of the qualification

The following must be applied to the assessment of this qualification:

- candidates must not take any assessment before they are registered for this qualification
- candidates must pass all the assessments for each phase before being entered for the assessments for the next phase
- centres should ensure all relevant content has been delivered before candidates attempt the assessments (*see* 'Phased delivery' below).

Assessment strategy

City & Guilds has written the following assessments use with this qualification:

- Live assessments that can be downloaded from the City & Guilds website.
- Sample assessments (MCQ) that can be downloaded from the City & Guilds website.
- Work logs for portfolio of evidence. All evidence in the portfolio for the skills learning outcomes must be generated in the workplace or a realistic working environment.

Portfolio of evidence

Candidate and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence candidates' progress towards achieving qualifications. Further details are available at **www.cityandguilds.com/eportfolios**.

City & Guilds has developed a set of **recording forms** including examples of completed forms for new and existing centres to use as appropriate. Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external quality assurers, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

Evidence sources

A portfolio of evidence will typically include several pieces of evidence – it must contain sufficient evidence to demonstrate the knowledge and skills required for each appropriate unit.

Evidence sources may include:

- training logbooks
- centre-produced worksheets and activities
- annotated photographs

- video clips (maximum duration in total = 10 minutes)
- workplace documentation/records, for example job cards/job sheets, equipment check/maintenance/service records, parts order records.

This is not a definitive list; other evidence sources are permitted.

The evidence provided must be valid and attributable to the candidate; the portfolio of evidence must contain a statement from the centre confirming this.

Evidence **must not** include:

- any methods of self-assessment

any employer contributions should focus on direct observation of evidence (for example witness statements) of competence rather than opinions.

Phased assessments

The assessments for this qualification are divided into four phases. Phases 1–3 cover core content and Phase 4 covers the specialist pathway content. Candidates must successfully complete all of the assessments for each Phase.

The four phases approximately equate to the four years of the Apprenticeship. Phase 1 assessments being delivered at the end of Year 1, Phase 2 assessments being delivered at the end of Year 2, etc. Candidates will complete a Work log (portfolio of evidence) as they progress through the core units (Phases 1–3) and another Work log for their specialist pathway in Phase 4.

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Gas (9289-01/91), learners must achieve:

Phase	Assessment component	Assessment method	Where to obtain assessment materials
Core			
1	001 Health and safety systems	e-assessment (multiple choice questions)	e-volve
	011 Phase 1 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	012 Phase 1 Practical assignment	Practical assignment	www.cityandguilds.com
2	021 Phase 2 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	022 Phase 2 Practical assignment	Practical assignment	www.cityandguilds.com
3	031 Phase 3 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	032 Phase 3 Practical assignment	Practical assignment	www.cityandguilds.com
	002 Work log	Portfolio of evidence	www.cityandguilds.com
Specialist pathway			

Phase	Assessment component	Assessment method	Where to obtain assessment materials
4	041 Phase 4 Multiple choice exam (Gas)	e-assessment (multiple choice questions)	e-volve
	042 Phase 4 Practical assignment (Gas)	Practical assignment	www.cityandguilds.com
	043 Phase 4 Work log (Gas)	Portfolio of evidence	www.cityandguilds.com

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Environmental Technologies (9289-02/92), learners must achieve:

Phase	Assessment component	Assessment method	Where to obtain assessment materials
Core			
1	001 Health and safety systems	e-assessment (multiple choice questions)	e-volve
	011 Phase 1 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	012 Phase 1 Practical assignment	Practical assignment	www.cityandguilds.com
2	021 Phase 2 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	022 Phase 2 Practical assignment	Practical assignment	www.cityandguilds.com
3	031 Phase 3 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	032 Phase 3 Practical assignment	Practical assignment	www.cityandguilds.com
	002 Work log	Portfolio of evidence	www.cityandguilds.com
Specialist pathway			
4	044 Phase 4 Multiple choice exam (Environmental Technologies)	e-assessment (multiple choice questions)	e-volve
	045 Phase 4 Practical assignment (Environmental Technologies)	Practical assignment	www.cityandguilds.com
	046 Phase 4 Work log (Environmental Technologies)	Portfolio of evidence	www.cityandguilds.com

To achieve the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating – Non-domestic Plumbing (9289-03/93), learners must achieve:

Phase	Assessment component	Assessment method	Where to obtain assessment materials
Core			
1	001 Health and safety systems	e-assessment (multiple choice questions)	e-volve
	011 Phase 1 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	012 Phase 1 Practical assignment	Practical assignment	www.cityandguilds.com
2	021 Phase 2 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	022 Phase 2 Practical assignment	Practical assignment	www.cityandguilds.com
3	031 Phase 3 Multiple choice exam	e-assessment (multiple choice questions)	e-volve
	032 Phase 3 Practical assignment	Practical assignment	www.cityandguilds.com
	002 Work log	Portfolio of evidence	www.cityandguilds.com
Specialist pathway			
4	047 Phase 4 Multiple choice exam (Non-domestic Plumbing)	e-assessment (multiple choice questions)	e-volve
	048 Phase 4 Practical assignment (Non-domestic Plumbing)	Practical assignment	www.cityandguilds.com
	049 Phase 4 Work log (Non-domestic Plumbing)	Portfolio of evidence	www.cityandguilds.com

Resits and retakes

Learners who fail to achieve a Pass in any externally set and marked examination will be permitted to re-take this assessment, as follows:

- First attempt post assessment feedback, resit within 14 days.
- Second attempt post assessment feedback and after any appropriate training has taken place, retake after 60 days.
- Third attempt post assessment feedback, resit within 14 days.
- Fourth attempt post assessment feedback and after any appropriate training has taken place, retake after 60 days.

If the fourth attempt results in a fail, learners must repeat the training for that phase before retaking the knowledge and/or practical assessment – depending on which assessment element(s) they failed.

Time constraints

The following must be applied to the assessment of this qualification:

Candidates must finish their assessment within 48 months.

Recognition of prior achievement (RPA)

Recognition of prior achievement means using a person's previous qualifications which have already been achieved to contribute to a new qualification. Refer to the *Exemption Guidance* for further details.

Assessment specifications

The way the knowledge and skills are covered by each assessment is laid out in the tables below:

9289-001 Health and Safety multiple choice questions

Duration: 30 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
301	1. Health and safety legislation that applies to the building services industry	2	10
	2. Hazardous situations working in the building services industry	4	20
	3. Personal protection measures	2	10
	4. How to respond to accidents	2	10
	5. Procedures for electrical safety	2	10
	6. How to work safely with heat producing equipment	4	20
	7. Safely use of access equipment	2	10
	8. Working safely in excavations and confined spaces	2	10
	Total	**20**	**100%**

9289-011 Phase 1 multiple choice questions

Duration: 1 hour

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
302	1. Use of hand and power tools in plumbing and domestic heating work	2	5
	2. Types of plumbing and domestic heating pipework, requirements and their jointing principles	5	12.5
	3. Site preparation techniques for plumbing and domestic heating work	3	7.5
	4. Use of clips and brackets to support plumbing and domestic heating pipework and components	3	7.5
303	1. Units of measurement used in the plumbing and heating industry	3	7.5
	2. Properties of materials	4	10
	5. Mechanical principles in the plumbing and heating systems industry	2	5
304	1. Role of the construction team within the plumbing and heating systems industry	1	2.5
	2. Information sources in the building services industry	1	2.5
	3. How to communicate with others	1	2.5
	4. Responsibilities of relevant people in the building services industry	1	2.5
305	1. Cold water supply route to dwellings	2	5
306	1. Recognition of the layouts plumbing and domestic heating systems	12	30
	Total	**40**	**100%**

9289-012 Phase 1 Practical assignment

Duration: 10-12 hours

Graded: Pass/Fail

Unit	Outcome
301	3. Personal protection measures
	5. Procedures for electrical safety
	7. Safe use of access equipment
302	1. Use of hand and power tools in plumbing and domestic heating work
	4. Use of clips and brackets to support plumbing and domestic heating pipework and components
	5. Plumbing and domestic heating system pipework installations

9289-021 Phase 2 multiple choice questions

Duration: 75 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
303	2. Properties of materials	1	2
	3. Relationship between energy, heat and power	2	4
	4. Principles of force and pressure and their application in the plumbing and domestic heating industry	2	4
	6. Principles of electricity in the plumbing and domestic heating systems industry	2	4
307	1. Cold water system installation	10	20
	2. Hot water system installation	10	20
	3. Central heating system installation	13	26
	4. Sanitary appliances and pipework system installation	5	10
	5. Rainwater system installation	5	10
	Total	**50**	**100%**

9289-022 Phase 2 Practical assignment

Duration: 14-19 hours

Graded: Pass/Fail

Unit	Outcome
307	1. Cold water system installation
	2. Hot water system installation
	4. Sanitary appliances and pipework system installation
	5. Rainwater system installation
308	1. Decommissioning of plumbing and domestic central heating systems
309	1. Soundness test of cold water systems and components
	2. Soundness test of hot water systems and components
	4. Soundness test of sanitary appliances, pipework systems and components
	5. Soundness test of rainwater systems

9289-031 Phase 3 multiple choice questions

Duration: 30 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
314	1. Sources of renewable and non-renewable energy	2	10
	2. Operating principles of micro-renewable energy technologies	2	10
	3. Requirements to install micro-renewable energy systems to existing systems	2	10
	4. Current energy efficiency advice and guidance	2	10
315	1. Factors affecting fuel selection	3	15
	2. Combustion processes of fuel supplied systems	3	15
	3. Principles of chimney/flue systems	3	15
316	1. Pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems	3	15
	Total	**20**	**100%**

9289-032 Phase 3 Practical assignment

Duration: 15 hours

Graded: Pass/Fail

Unit	Outcome
307	3. Central heating system installation
308	1. Decommissioning of plumbing and domestic central heating systems
309	3. Soundness test of central heating systems and components
310	1. Commission and handover of cold water systems and components
	2. Commission and handover of hot water systems and components
	3. Commission and handover of central heating systems and components
	4. Commission and handover of sanitary appliances, pipework systems and components
	5. Commission and handover of rainwater systems
311	1. Fault diagnosis and rectification on cold water systems and components
	2. Fault diagnosis and rectification on hot water systems and components
	3. Fault diagnosis and rectification on central heating systems and components
	4. Fault diagnosis and rectification on sanitary appliances and pipework
	5. Fault diagnosis and rectification on rainwater systems and components
312	1. Service and maintenance on cold water systems
	2. Service and maintenance on hot water systems
	3. Service and maintenance on central heating systems
	4. Service and maintenance on sanitary appliances and pipework systems
313	1. Sizing and selection of cold water systems and components for dwellings
	2. Sizing and selection of rainwater harvesting and greywater reuse systems and components for dwellings
	3. Sizing and selection of hot water systems and components for dwellings
	4 Sizing and selection of central heating systems and components for dwellings
	5. Sizing and selection of sanitary appliances pipework systems and components for dwellings
	6. Sizing and selection of rainwater systems components for dwellings
316	1. Pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems
	2. Industry standard safe isolation procedures
	3. Safe installation, testing and decommission of electrical systems

Unit	Outcome
	4. Identification of faults and safe repair of electrical work

9289-002 Phases 1-3 Work log (on site portfolio)

Graded: Pass/Fail

Unit	Outcome
317	1. Application of health and safety and welfare in the workplace
	2. Preparing for the installation of plumbing and domestic heating systems and components
	3. Installing plumbing and domestic heating systems and components in the workplace
	4. Performing fault diagnosis and rectification procedures
	5. Commissioning plumbing and domestic heating systems in the workplace

9289-041 Phase 4 Gas multiple choice questions

Duration: 90 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Approximate percentage %
318	1. Natural gas supply network	1	18
	2. Operation of pressure regulators	1	
	3. Factors that affect pressure loss and the equipment used to measure gas pressure	1	
	4. Combustion of gases, and potential risks	5	
	5. Gas burner operation, design, features and types	2	
	6. Properties and characteristics of Natural Gas (NG) and Liquefied Petroleum Gas (LPG)	1	
319	1. Installation requirements, methods, and materials for Natural Gas (NG) and Liquefied Petroleum Gas (LPG) pipework	4	28
	2. Ventilation requirements, types and methods	6	
	3. Types and operation of suitable chimney systems for gas appliances	3	
	4. Methods for checking and testing chimney performance	4	
320	1. Safety, legislation and standards within the gas industry	3	42
	2. Gas emergency actions and procedures	1	
	3. Unsafe situations, emergency notices and warning labels	3	
	4. Operation and positioning of emergency controls and valves	2	
	5. Low pressure domestic gas meters, regulators and housings	4	
	6. Methods and requirements to tightness test and purge small gas installations	5	
	7. How to check and set gas installation operating pressures at gas meters and LPG regulators	2	

Unit	Outcome	Number of questions	Approximate percentage %
	8. How to safely assess the potential risks, tightness test and re-light temporarily isolated appliances	1	
	9. Requirements to check and set appliance burner pressures and compare measured gas rates with published figures	2	
	10. Principles of operation and methods of testing gas appliance safety controls	2	
321	5. Correct use of combustion and atmosphere sampling analysers	2	5
	8. How to work correctly and safely with electrical systems and components used in domestic gas utilisation	1	
322	1. Uses of gas water heating and wet central heating appliances in dwellings	2	7
	2. Types of gas water heating and wet central heating appliances and their layout requirements	2	
	Total	**60**	**100%**

9289-042 Phase 4 Gas Practical assignment

Duration: 10-12 hours

Graded: Pass/Fail

Unit	Outcome
321	1. Gas safety controls are operating correctly, and actions required when unsafe or ineffective operation is found
	2. Construction and operation of chimneys used for domestic gas appliances
	3. How to carry out chimney performance checks
	4. Completion of the correct notices, forms and labels used in domestic gas utilisation
	5. Correct use of combustion and atmosphere sampling analysers
	6. Installation and commission of a small domestic gas installation
	7. Calculation of the requirements for permanent ventilation in domestic gas utilisation environments
	8. How to work correctly and safely with electrical systems and components used in domestic gas utilisation
322	3. Site preparation techniques for gas water heating and wet central heating appliances
	4. Installation and commission of gas water heating and wet central heating appliances
	5. Service and maintenance of gas water heating and wet central heating appliances
	6. Decommission of gas water heating and wet central heating appliances

9289-043 Phase 4 Gas Work log (on site portfolio)

Graded: Pass/Fail

Unit	Outcome
304	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry
323	1. Install, service and fault find gas water heating and wet central heating appliances
	2. Installation of gas pipework (≤ 35 mm)
	3. Gas tightness testing, direct purging (IGEM/UP/1B) and relighting appliances
	4. Opportunity for identification of unsafe situations

9289-044 Phase 4 Environmental Technologies multiple choice questions

Duration: 40 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
304	4. Responsibilities of relevant people in the building services industry	1	4
324	1. Health and safety risks and legislation associated with air source heat pump systems	4	16
	2. Types of air source heat pump systems	8	32
325	1. Health and safety and relevant legislation, regulations and standards	4	16
	3. Solar thermal hot water systems installation	8	32
	Total	**25**	**100%**

9289-045 Phase 4 Environmental Technologies Practical assignment

Duration: 14-18 hours

Graded: Pass/Fail

Unit	Outcome
324	3. How to design air source heat pump systems
	4. Air source heat pump installation
	5. Service and maintenance of air source heat pump systems
	6. Fault diagnosis and rectification of defects and malfunctions on air source heat pump systems
	7. Testing, commissioning and handover of air source heat pump systems
325	2. Fundamental design principles for solar thermal hot water systems
	3. Solar thermal hot water systems installation
	4. Testing, commissioning and handover of solar thermal hot water systems
	5. Service, maintenance, diagnosis and rectification of faults of a solar thermal hot water installation

9289-046 Phase 4 Environmental Technologies Work Log (on site portfolio)

Graded: Pass/Fail

Unit	Outcome
304	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry
326	1. Install, commission, service and fault find air source heat pump and solar thermal hot water systems

9289-047 Phase 4 Non-domestic Plumbing multiple choice questions

Duration: 40 minutes

Graded: Pass/Fail

Pass mark: the pass mark for this examination is set at approx. 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	Percentage %
327	1. Health and safety risks and legislation associated with work on non-domestic plumbing systems	4	16
	3. Pipework and jointing methods used in non-domestic plumbing systems		
	4. Site preparation techniques for work on non-domestic plumbing systems		
328	1. Cold water supply to non-domestic premises	2	8
329	1. Layouts of non-domestic plumbing systems	3	12
	2. Cold water systems installation in non-domestic premises	15	60
	3. Hot water systems installation in non-domestic premises		
	4. Sanitary appliances and pipework systems installation in non-domestic premises		
	5. Rainwater systems installation in non-domestic premises		
333	1. Service and maintenance on cold water systems in non-domestic premises	1	4
	2. Service and maintenance on hot water systems in non-domestic premises		
	Total	**25**	**100%**

9289-048 Phase 4 Non-domestic Plumbing Practical assignment

Duration: 25-34 hours

Graded: Pass/Fail

Unit	Outcome
327	2. Safe use of hand and power tools in non-domestic plumbing systems work
	3. Pipework and jointing methods used in non-domestic plumbing systems
	4. Site preparation techniques for work on non-domestic plumbing systems
	5. Use of clips and brackets to support non-domestic plumbing pipework and components
	6. Non-domestic plumbing pipework installation
329	2. Cold water systems installation in non-domestic premises
	3. Hot water systems installation in non-domestic premises
	4. Sanitary appliances and pipework systems installation in non-domestic premises
330	1. Decommissioning of non-domestic plumbing systems
331	1. Soundness test and commission cold water appliances, systems and components in non-domestic premises
	2. Soundness test and commission hot water appliances, systems and components in non-domestic premises
	3. Soundness test and commission sanitary appliances, pipework systems and components in non-domestic premises
	4. Soundness test and commission rainwater systems in non-domestic premises
332	1. Fault diagnosis and rectification procedures on cold water systems and components in non-domestic premises
	2. Fault diagnosis and rectification procedures on hot water systems and components in non-domestic premises
	3. Fault diagnosis and rectification procedures on sanitary pipework systems in non-domestic premises
	4. Fault diagnosis and rectification procedures on rainwater systems in non-domestic premises
333	1. Service and maintenance on cold water systems in non-domestic premises
	2. Service and maintenance on hot water systems in non-domestic premises
	3. Service and maintenance on sanitary pipework systems in non-domestic premises

9289-049 Phase 4 Non-domestic Plumbing Work log (on site portfolio)

Graded: Pass/Fail

Unit	Outcome
304	5. Producing risk assessments and method statements for the plumbing and domestic heating systems industry
	6. Producing a work programme for tasks in the plumbing and domestic heating systems industry
334	1. Non-domestic plumbing systems and components installation in the workplace
	2. Commissioning of non-domestic plumbing systems in the workplace
	3. Fault diagnosis and rectification procedures on non-domestic plumbing systems

Assessment objectives

The following assessment objectives are used within the **9289 multiple choice question exams.** The approximate weightings for how the assessment objectives are applied in the assessment are shown in the table below.

Assessment objective	Description	Approximate weighting in exams
AO1a Demonstrate knowledge of the content	The ability to demonstrate basic recall of relevant knowledge in response to straightforward questioning.	30%
AO1b Demonstrate understanding of the content	The ability to demonstrate understanding of principles and concepts beyond recall of definitions.	60%
AO2 Apply knowledge and understanding of the content to different situations and contexts	Applying knowledge and understanding taking the understanding of generalities and applying them to specific situations.	10%

5 Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- title
- level
- guided learning hours (GLH)
- unit aim
- assessment type
- learning outcomes, which are comprised of a number of assessment criteria
- range statements
- supporting information

Guidance for delivery of the units

This qualification comprises a number of **units**. A unit describes what is expected of a competent person in particular aspects of their job.

Each **unit** is divided into **learning outcomes** which describe in further detail the skills and knowledge that a candidate should possess.

Each **learning outcome** has a set of **assessment criteria** (performance and knowledge and understanding) which specify the desired criteria that must be satisfied before an individual can be said to have performed to the agreed standard.

Range statements define the breadth or scope of a learning outcome and its assessment criteria by setting out the various circumstances in which they are to be applied.

Supporting information provides guidance of the evidence requirement for the unit and specific guidance on delivery and range statements. Centres are advised to review this information carefully before delivering the unit.

Unit 301 Health and safety systems

Level:	3
GLH:	88
Assessment types:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit provides essential health and safety knowledge required to work safely in the plumbing and domestic heating industries.

Learning outcome

The learner will know and understand:

LO1 Health and safety legislation that applies to the building services industry

Assessment criteria

AC1.1 **Health and safety legislation** in protecting the workforce and members of the public
AC1.2 Responsibilities of members of the **construction team**
AC1.3 Legal status of **health and safety guidance** materials
AC1.4 Role of **enforcing authorities**
AC1.5 **Control measures of inspectors**

Range

AC1.1 **Health and safety legislation**

- The Health & Safety at Work etc. Act
- Construction (Design & Management) Regulations:
  - Client
  - Architect
  - Main contractor
- Confined Spaces Regulations
- Control of Asbestos Regulations
- Control of Noise at Work Regulations
- Control of Substances Hazardous to Health (COSHH) Regulations
- Electricity at Work Regulations
- Gas Safety (Installation & Use) Regulations
- Health & Safety (First Aid) Regulations
- Health & Safety (Signs & Signals) Regulations
- Lifting Operations & Lifting Equipment Regulations
- Manual Handling Operations Regulations
- Personal Protective Equipment at Work Regulations
- Provision & Use of Work Equipment Regulations (PUWER)
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)

- Work at Height Regulations

AC1.2 **Construction team**

- employers (including employer representatives)
- designers
- main contractors
- sub-contractors
- employees
- self-employed (labour only)
- clients (customers)

AC1.3 **Health and safety guidance**

- Approved Codes of Practice & Guidance
- HSE Guidance Notes
- Construction Skills Certification Scheme (CSCS)

AC1.4 **Enforcing authorities**

- Health & Safety Executive
- Local Authority

AC1.5 **Control measures of inspectors**

- improvement notice
- prohibition notice
- powers of prosecution
- role in providing advice and guidance

Learning outcome

The learner will know and understand:

LO2 Hazardous situations working in the building services industry

Assessment criteria

AC2.1 **Types of site hazards** that may be encountered while at **work** or by members of the public

AC2.2 **Strategies** used to prevent accidents during work activities

AC2.3 How the hazards of some substances and mixtures can be identified from the **labels** and packaging

AC2.4 How to deal with **hazardous substances** encountered during plumbing and heating activities including disposal where applicable

AC2.5 **Common building materials and services components that may contain asbestos**

AC2.6 Types of **asbestos** that may be encountered in the workplace

AC2.7 **Procedures** that must be used to safely work with asbestos cement-based materials

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Range

AC2.1 **Types of site hazards**

- trips
- slips
- falls

- burns
- cuts
- falling from height
- falling objects (tools)

AC2.1 **Work**

- construction sites (all property types)
- in industrial commercial premises (occupied and unoccupied refurbishment)
- in dwellings (occupied and unoccupied refurbishment)
- vehicle use (driving time limits, driving duress)

AC2.2 **Strategies**

- risk assessments
- method statements
- permit to work systems
- safety notices
- CSCS card

AC2.3 **Labels**

- Globally Harmonised System (GHS) on the classification and labelling of hazardous substances and mixtures
- categorisation and hazard classes:
    - physical hazards:
        - explosives
        - flammable gases
        - oxidising liquids
        - corrosive to metals
    - health hazards:
        - acute toxicity
        - skin corrosion/irritation
        - eye damage/irritation
        - respiratory/skin sensitisation
    - environmental hazards:
        - hazardous to the aquatic environment
- presentation of information:
    - GHS pictogram or signal word (Danger or Warning)
    - hazard statement (Causes serious eye damage, Toxic if swallowed, etc.)
    - precautionary statement (Wear eye protection, Do not eat, drink or smoke when using this product, etc.).

AC2.4 **Hazardous substances**

- lead – solid and fume
- solvents and lubricants
- fluxes
- jointing compounds
- sealants
- gases – LPG, oxy-acetylene, nitrogen and carbon dioxide
- petroleum
- diesel fuels
- cleaning agents
- corrosion inhibitors
- disinfectants

- anti-freeze, glycol mixtures
- solar fluid (flash to steam)
- biocides

AC2.5 **Common building materials and services components that may contain asbestos**

- flue, soil, rainwater pipes and gutters
- tanks and cisterns
- Artex
- small gaskets and seals
- bath panels/panelling
- floor tiles

AC2.6 **Types of asbestos**

- white (Chrysotile)
- brown or grey (Amosite)
- blue (Crocidolite)
- asbestos cement-based materials

AC2.7 **Procedures**

- work activities for licensed and unlicensed work
- licensing requirements for asbestos removal organisations
- safe disposal requirements
- protection of the workforce and members of the public

Learning outcome

The learner will know and demonstrate:

LO3 Personal protection measures

Assessment criteria

AC3.1 Purpose of **personal protective equipment (PPE)**
AC3.2 Use of **personal protective equipment (PPE)**
AC3.3 Manual handling **procedures**
AC3.4 **Mechanical lifting aids**

Range

AC3.1 and AC3.2 **Personal protective equipment (PPE)**

- clothing protection including high visibility
- eye protection
- hand protection
- head protection
- foot protection
- hearing protection
- respiratory protection (Including fit tests)
- vibration protection
- harnesses

AC3.3 **Procedures**

- assessment of a safe load
- safe kinetic lifting technique

AC3.4 **Mechanical lifting aids**

- sack trolley
- pallet truck
- hoists

Learning outcome

The learner will know and understand:

LO4 How to respond to accidents

Assessment criteria

AC4.1 Requirements for first aid provision in the **workplace**
AC4.2 Actions that should be taken when an accident or emergency is discovered
AC4.3 Procedures for dealing with **minor injuries**
AC4.4 Procedures for dealing with **major injuries**
AC4.5 **Recording procedures** for accidents and near misses at work

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Range

AC4.1 **Workplace**

- in small, occupied properties
- on construction sites (new-build and refurbishment)

AC4.3 **Minor injuries**

- cuts
- minor burns and scalds
- objects in the eye
- exposure to fumes

AC4.4 **Major injuries**

- bone fractures
- unresponsive (Unconscious) co-workers
- electric shock
- concussion

AC4.5 **Recording procedures**

- statutory requirements for the reporting of accidents/serious occurrences
- the use of company accident books
- the details to be recorded on a simple accident/incident report form

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Learning outcome

The learner will know and demonstrate:

LO5 Procedures for electrical safety

Assessment criteria

AC5.1 Common **electrical dangers** encountered on construction sites and in private dwellings
AC5.2 Methods of safe supply for **electrical tools** and equipment on site
AC5.3 **Procedure** that should be applied for tools and equipment that fail safety checks
AC5.4 Safe isolation procedure when replacing **attachments** to power tools
AC5.5 Conduct a **visual inspection** of a power tool for safe condition before use
AC5.6 Use of temporary continuity bonding when working on pipework components

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Range

AC5.1 **Electrical dangers**

- faulty electrical equipment
- signs of damaged or worn electrical cables – power tools and property hard wiring system
- trailing cables
- proximity of cables to services pipework
- buried/hidden cables
- inadequate over-current protection devices

AC5.2 **Electrical tools**

- battery powered supplies
- 110-volt supplies
- 230-volt supplies
- generators

AC5.3 **Procedure**

- don't use equipment
- report to supervisor
- take out of service

AC5.4 **Attachments**

- drill bits
- cutting blades

AC5.5 **Visual inspection**

- checking for a valid PAT test
- inspection for general condition

Learning outcome

The learner will know and understand:

LO6 How to work safely with heat producing equipment

Assessment criteria

AC6.1 **Types of gases** used in pipe jointing processes
AC6.2 How bottled **gases** and **equipment** should be safely transported and stored
AC6.3 Types of **heat producing equipment** and how to check them for safety
AC6.4 How gas heating equipment is **safely assembled** and used

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AC6.5 Three elements of the fire triangle and how combustion takes place

AC6.6 Dangers of working with **heat producing equipment** and how to prevent fires occurring

AC6.7 Method for **fighting small, localised fires** that can occur in the workplace in order to aid escape

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Range

AC6.1 and AC6.2 **Types of gases**

- Propane
- MAPP gas
- Butane
- Oxy/Acetylene
- Oxy-Propane

AC6.2 and AC6.3 **Heat producing equipment**

- hoses:
  - colours used
  - thread directions
  - dates
- flashback arrestors
- control valves
- gauges
- blowpipes

AC6.4 **Safely assembled**

- bottle location and position
- equipment assembly sequence
- leak detection procedures
- safe purging procedure
- safe lighting and extinguishing procedure
- actions in the event of leakage
- transportation

AC6.7 **Fighting small, localised fires**

- tackling fires to aid escape
- types of extinguishers
- selection of extinguisher by fire type
- method of use
- evacuation procedures

Learning outcome

The learner will know and demonstrate:

LO7 Safe use of access equipment

Assessment criteria

AC7.1 Situations where it may be necessary to work at height

AC7.2 How to select appropriate **access equipment** to permit work at heights

AC7.3 **Safety checks** to be carried out on **access equipment**

AC7.4 Use of **access equipment**

Range

AC7.2 and AC7.3 **Access equipment**

- step ladders
- ladders
- harnesses
- roof ladders and crawling boards
- mobile tower scaffolds
- fixed scaffolds and edge protection
- motorised mobile elevated work platforms (MEWP)

AC 7.3 **Safety checks**

- no signs of damage
- level work area/surface
- appropriate certification
- adequate fall protection

AC7.4 **Access equipment**

- step ladders
- ladders
- podium/platform

Learning outcome

The learner will know and understand:

LO8 Working safely in excavations and confined spaces

Assessment criteria

AC8.1 Situations where it may be necessary to work in **excavations** and **confined spaces**
AC8.2 **Safe working** in excavations and confined spaces
AC8.3 **Dangers** associated with excavations and confined spaces
AC8.4 Safety **measures** when working in excavations and confined spaces

Range

AC8.1 **Excavations**

- drainage systems
- rainwater harvesting systems
- cold water mains

AC8.1 **Confined spaces**

- main service duct
- in tanks (including below ground)/large storage cisterns
- suspended timber floors
- roof spaces
- foundations

AC8.2 **Safe working**

- safe access and egress
- trench support systems

AC8.3 **Dangers**

- inadequate ventilation
- inadequate lighting
- flooding
- obstruction of an escape route
- explosion
- collapse

AC8.4 **Measures**

- warning signs
- safety barriers
- vehicle stops
- permit to work

Unit 302 Common installation processes and techniques

Level:	3
GLH:	88
Assessment types:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit includes an introduction to the processes and techniques used when installing plumbing and domestic heating systems.

Learning outcome

The learner will know and demonstrate:

LO1 Use of hand and power tools in plumbing and domestic heating work

Assessment criteria

AC1.1 Purpose of **hand tools** and **power tools**
AC1.2 Use and **maintenance** of **hand** and **power tools**

Range

AC1.1 and AC1.2 **Hand tools**

- screwdriver
- hammer
- chisel
- grip
- wrench
- spanner
- spirit level
- manual pipe threader
- measuring equipment
- pipe cutter
- hand saw
- plier
- bending tool
- blow torch

AC1.1 and AC1.2 **Power tools**

- power drill
- circular saw
- jig saw

- reciprocating saws
- portable pipe threading machine
- hydraulic machine bender
- hydraulic crimping kit
- portable pipe freezing kit
- 110 -230V generators

AC1.2 **Maintenance**

- visual inspection for damage
- clean
- sharpen
- oil
- fit for purpose

Learning outcome

The learner will know and understand:

LO2 Types of plumbing and domestic heating system pipework, requirements and their jointing principles

Assessment criteria

AC2.1 **Pipework materials and sizes** used in dwellings
AC2.2 Pipework installation **requirements**
AC2.3 Methods of jointing new hot and cold water pipes to existing lead pipework
AC2.4 Types of **fittings** used in dwellings
AC2.5 Methods of **jointing pipework**
AC2.6 Methods of **bending pipework**

Range

AC2.1 **Pipework materials and sizes** (≤ 28mm R1)

- copper (BS EN 1057):
  - R220 soft coils
  - R250 half hard lengths
  - R290 hard lengths
- carbon steel
- stainless steel
- corrugated stainless steel
- low carbon steel (LCS):
  - medium grade
- plastic pipework (hot, cold, heating):
  - polyethylene (MDPE & HDPE)
  - cross linked Polyethylene (PEX)
  - polybutylene (PB)
- plastic pipework (underfloor heating):
  - PE-RT (underfloor heating)
  - plastic - metal composite or multilayer pipe for underfloor heating (eg. PE-Al-PEX or Alu-PEX, PEX-Al-PEX etc.)
- plastic pipework (sanitary ≤ 110mm):
  - PVC-u
  - polypropylene

    - PVC-mu
    - ABS
- lead

AC2.2 **Requirements**

- prefabrication of pipework
- installing pipework in-situ
- use of sleeves
- fire stopping to pipework
- timber joist notching
- first and second fix
- pipework protection
- pipe insulation

AC2.4 **Fittings**

- couplers
- elbows and bends
- equal tees
- reducing tees
- reducers
- tap connectors
- flexible connectors
- manifolds
- tank connectors
- stop ends
- union

AC2.5 **Jointing pipework**

- copper pipe:
    - solder ring and end feed
    - compression (type A and B)
    - push-fit
    - press-fit
- carbon steel, stainless steel:
    - press-fit
    - compression
- corrugated stainless steel:
    - compression
- low carbon steel (LCS) pipe:
    - threaded
    - compression
- plastic/composite pressure pipe:
    - push fit
    - compression
    - proprietary - copper and MDPE
- plastic jointing (sanitary pipework):
    - ring seal
    - compression
    - solvent weld

AC2.6 **Bending pipework**

- copper/carbon steel/stainless steel machine bending:

    - 90º bends
    - sets and offset bends
    - passover bends
- copper spring bend:
    - 90º bends
    - sets and offset bends
- LCS hydraulic machine bending:
    - 90º bends
    - sets and offset bends
    - passover bends
- plastic/composite pressure pipe:
    - spring bend
    - cabling technique
    - cold forming bend
    - minimum bend radius

Learning outcome

The learner will know and understand:

LO3 Site preparation techniques for plumbing and domestic heating systems work

Assessment criteria

AC3.1 **Work methods** for preparing and protecting the building for installation work

AC3.2 Pre-existing damage checks to the building fabric or customer property before the work commences

AC3.3 Methods and locations for safe storage of tools and equipment

AC3.4 **Sources of information** for carrying out preparatory work

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Range

AC3.1 **Work methods**

- holes in masonry and building fabric surfaces
- making good to masonry and building fabric surfaces
- lifting and replacing timber flooring materials
- notching timber floor joists
- drilling holes – timber floor joists
- cutting chases – wall and floor surfaces
- walking boards
- dust sheets
- floor, carpet and décor protection
- removal of personal property

AC3.4 **Sources of information**

- statutory regulations
- industry standards
- manufacturer technical instructions
- building plans
- specifications

Learning outcome

The learner will know and demonstrate:

LO4 Use of clips and brackets to support plumbing and domestic heating pipework and components

Assessment criteria

AC4.1 How to measure and mark out for fixings to pipework and plumbing and heating components

AC4.2 Types of **fixing devices**

AC4.3 **Clip and bracket types**

AC4.4 Select, and fix clips and brackets appropriate to the pipework material and the industry recommended spacing

Range

AC4.2 **Fixing devices**

- nails:
  - for timber
  - for masonry
- screws:
  - slotted head
  - Phillips head
  - Pozidrive
  - torx
  - hex
- plastic plugs
- heavy duty fixings:
  - coach bolts
  - rawlbolts
- cavity fixings
- drive in fixings
- chemical fixing
- channel fixings
- concrete screws

AC4.3 **Clip and bracket types**

- munsen rings
- saddle clips
- stand-off clips
- school board clips

Learning outcome

The learner will know and demonstrate:

LO5 Plumbing and domestic heating system pipework installations

Assessment criteria

AC5.1 Select pipework materials and fittings from instructions

AC5.2 Measure, mark and cut **pipework materials**

AC5.3 Fabricate pipework **bends** to clear obstacles
AC5.4 Select, position and fix **pipework materials** to specifications
AC5.5 **Joint** pipework to specifications

Range

AC5.2 and AC5.4 **Pipework materials**

- copper pipework (hot, cold and central heating)
- plastic pipework (hot, cold, central heating (including underfloor), sanitary and rainwater)

AC5.3 **Bends**

- copper:
  - 90º bends
  - sets and offset bends
  - passover bends
- plastic/composite (hot, cold and heating):
  - cabling technique
  - minimum bend radius

AC5.5 **Joint**

- copper pipe:
  - solder ring and end feed
  - compression (type A)
  - push-fit
  - press-fit
- plastic/composite pipe (hot, cold and heating):
  - push fit
  - compression
  - proprietary - copper and MDPE
- plastic jointing (sanitary pipework):
  - ring seal
  - compression
  - solvent weld

Unit 303 Scientific principles

Level:	3
GLH:	70
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit includes scientific principles that underpin the installation, commissioning and maintenance of systems in the plumbing and domestic heating industries.

Learning outcome

The learner will know and understand:

LO1 Units of measurement used in the plumbing and domestic heating systems industry

Assessment criteria

AC1.1 Internationally recognised (SI) **units of measurement**
AC1.2 Application and use of **SI derived units**
AC1.3 Use of conversion tables for non-SI units

Range

AC1.1 **Units of measurement**

- metre (length) m
- kilogram (mass) kg
- second (time) s
- kelvin (temperature)
- pascals Pa
- bar

AC1.2 **SI derived units**

- millimetre (length) mm
- centremetre (length) cm
- area (m^2)
- volume (m^3)
- litres (L)
- density (kg/m^3)
- velocity (m/s)

Learning outcome

The learner will know and understand:

LO2 Properties of materials

Assessment criteria

AC2.1 **Relative densities** of common materials
AC2.2 Properties and applications of **solid materials**
AC2.3 Reasons why solid **materials break down**
AC2.4 **Methods** of preventing corrosion
AC2.5 Applications of **liquids** and **gases**
AC2.6 **Properties of water**
AC2.7 **Properties of gases**

Range

AC2.1 **Relative densities**

- relative density to air
- relative density to water

AC2.2 **Solid materials**

- pure metals
- ferrous metals
- alloys including solders
- thermo plastics
- thermo-setting plastics
- fireclays/ceramics

AC2.3 **Materials break down**

- atmospheric corrosion
- oxidisation of metals
- UV damage to plastics
- heat damage to plastics
- electrolytic corrosion
- electromotive series
- dissimilar metals in the presence of an electrolyte (water)
- erosion corrosion

AC2.4 **Methods**

- internal:
  - inhibitor
- external:
  - paint
  - tape
  - coating

AC2.5 **Liquids**

- water
- refrigerants

- anti-freeze/glycol mixes
- fuel oils
- lubricants/greases
- biocides

AC2.5 **Gases**

- air & steam
- LPG
- natural gas
- carbon dioxide
- refrigerant gases

AC2.6 **Properties of water**

- boiling/freezing point
- change of state and molecular changes
- volume and pressure increase
- density at differing temperatures
- to steam/super-heated steam
- capillarity
- acidity/alkalinity (pH value)
- water hardness:
    - soft
    - temporary hard
    - permanently hard

AC2.7 **Properties of gases**

- refrigerant gas, LPG and air:
    - pressure
    - volume
    - temperature of gases found within the industry.
    - Charles's law
    - Boyle's law

Learning outcome

The learner will know and understand:

LO3 Relationship between energy, heat and power

Assessment criteria

AC3.1 Relationship between the Celsius and Kelvin temperature scales
AC3.2 Principles associated with a **change of state**
AC3.3 Terms latent and sensible heat as they apply to liquids and gases
AC3.4 Methods of **heat transfer**
AC3.5 How **units of energy and heat** are related and derived
AC3.6 Carrying out heat, energy and power **calculations**

Range

AC3.2 **Change of state**

- melting

- freezing
- boiling
- evaporating
- condensing

AC3.4 **Heat transfer**

- conduction
- convection
- radiation

AC3.5 **Units of energy and heat**

- energy – Joules (J)
- specific heat capacity (kJ/kg/°C)
- power – Watts (W)
- maximum density
- coefficient of linear expansion

AC3.6 **Calculations**

- quantity of heat energy required to raise the temperature of a substance
- the amount of power required to heat a substance

Learning outcome

The learner will know and understand:

LO4 Principles of force and pressure and their application in the plumbing and domestic heating industry

Assessment criteria

AC4.1 How **units of force and pressure** are derived from SI units
AC4.2 **Pressure and flow** rate units of measurements
AC4.3 The application of pressure and flow rate measurement
AC4.4 Carrying out simple **force and pressure** calculations
AC4.5 Relationship between **velocity, pressure and flow rate** in systems
AC4.6 How **restrictions** in the pipework affects the flow of liquids and gases
AC4.7 Principles of a siphon

Range

AC4.1 **Units of force and pressure**

- acceleration (m/s^2)
- force due to gravity
- force - Newton (N)
- pressure (N/m^2)
- atmospheric pressure
- flow rate (m^3/s)

AC4.2 **Pressure and flow**

- pressure:
    - bar/millibar

    - kPa
    - Psi
    - metre head
- flow rate:
    - m^3/s
    - l/s
    - kg/s

AC4.4 **Force and pressure**

- force calculations:
    - pressure head
- pressure calculations:
    - static pressure
    - dynamic pressure
    - draught
    - forced draught

AC4.5 **Velocity, pressure and flow rate**

- effects of increasing/reducing pressure
- effects of increasing/reducing pipe size

AC4.6 **Restrictions**

- changes of direction, bends and tees
- pipe size
- pipe reductions
- roughness of material surface
- constrictions such as valves

Learning outcome

The learner will know and understand:

LO5 Mechanical principles in the plumbing and domestic heating systems industry

Assessment criteria

AC5.1 Principles of **machines**
AC5.2 Principles of **mechanics**

Range

AC5.1 **Machines**

- levers
- pulleys
- Archimedes screws

AC5.2 **Mechanics**

- theory of moments
- action and reaction
- centre of gravity
- equilibrium
- velocity and ratio

- mechanical advantage

Learning outcome

The learner will know and understand:

LO6 Principles of electricity in the plumbing and domestic heating systems industry

Assessment criteria

AC6.1 **Basic principles** of electron flow theory
AC6.2 Purpose and application of simple **units of electrical measurement**
AC6.3 Carrying out simple **electrical calculations**
AC6.4 Requirement to earth electrical circuits

Range

AC6.1 **Basic principles**

- measurements of electrical flow
- material conductivity and resistance
- direct and alternating current

AC6.2 **Units of electrical measurement**

- current (Amps)
- voltage (Volts)
- resistance (Ohms)
- power (Watts)

AC6.3 **Electrical calculations**

- Ohm's law
- Power consumption of electrical circuits
- over-current protection device size
- voltage, current and resistance in series and parallel circuits

Unit 304 Planning and supervision

Level:	3
GLH:	54
Assessment types:	e-assessment (multiple choice questions) Portfolio of evidence Practical assignment
Aim:	This unit includes the key knowledge and skills to develop and maintain effective relationships, and safely plan plumbing and heating activities.

Learning outcome

The learner will know and understand:

LO1 Role of the construction team within the plumbing and domestic heating systems industry

Assessment criteria

AC1.1 Roles of the **site management team**
AC1.2 Roles of the **site operatives**
AC1.3 **Site visitors**

Range

AC1.1 **Site management team**

- Architect
- Project manager
- Clerk of Works
- Structural engineer
- Surveyor
- Building services engineer
- Quantity surveyor
- Buyer
- Estimator
- Contracts manager
- Site manager
- Health and Safety Manager
- Client; as part of the CDM

AC1.2 **Site operatives**

- Sub-contractors
- Site supervisor

- Trade supervisor
- Bricklayer
- Joiner
- Kitchen fitter
- Plasterer
- Dry liner
- Tiler
- Electrician
- Roofer
- Heating and ventilating fitter
- Gas fitter
- Decorator
- Groundworkers
- Plumber
- Drillers
- Refrigeration engineer

AC1.3 **Site visitors**

- inspectors:
    - building control
    - water
    - HSE
    - electrical services
- members of the public
- delivery drivers

Learning outcome

The learner will know and understand:

LO2 Information sources in the building services industry

Assessment criteria

AC2.1 **Workplace information**
AC2.2 Importance of complying with **company policies and procedures**

Range

AC2.1 **Workplace information**

- statutory legislation
- building regulations
- job specifications
- plans/drawings:
    - Computer Aided Design (CAD) drawings
    - working drawings
    - 3D models
    - drawing revisions
    - approved, non-approved drawing control processes
- work programmes
- variation order
- delivery notes
- time sheets

- policy documentation:
    - health & safety
    - environmental
    - customer service
- manufacturer guidance
- installation instructions
- service & maintenance instructions
- user instructions
- customer information:
    - quotations
    - estimates
    - invoices/statements
    - statutory cancelation rights
    - handover information
    - manufactures' warranty
    - benchmark

AC2.2 **Company policies and procedures**

- company working policies/procedures:
    - behaviour
    - timekeeping
    - dress code
    - contract of employment
    - limits to personal authority
- organisation/reporting structures
- relevant qualifications and training

Learning outcome

The learner will know and understand:

LO3 How to communicate with others

Assessment criteria

AC3.1 Methods for effective communication with **individual's needs**
AC3.2 Suitable **communication methods**
AC3.3 **Appropriate actions** to deal with conflicting parties
AC3.4 Effects of poor communication

Range

AC3.1 **Individual's needs**

- disabilities
- learning difficulties
- language differences:
    - dialects
    - accents
    - English spoken as a second language

AC3.2 **Communication methods**

- oral communication:
    - in person

    - online
    - telephone
- written communication:
    - e-mail
    - fax
    - letter
    - text messaging
    - social media

AC3.3 **Appropriate actions**

- mediation
- negotiating
- compromising
- escalation

Learning outcome

The learner will know and understand:

LO4 Responsibilities of relevant people in the building services industry

Assessment criteria

AC4.1 Types of **clients**
AC4.2 What may be communicated to the client through the progress of a job
AC4.3 Duties and methods for **supervising staff**

Range

AC4.1 **Clients**

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

AC4.3 **Supervising staff**

- duties:
    - competence of operatives to undertake work
    - direct supervision or detailed direction is required
    - specific health and safety issues
    - responsibility for planning safe working for subordinates
    - how to adjust work schedules when health and safety problems delay work
- methods:
    - motivation
    - monitoring timesheets
    - direct supervision
    - monitoring outputs
    - work programmes

Learning outcome

The learner will know and demonstrate:

LO5 Producing risk assessments and method statements for the plumbing and domestic heating systems industry

Assessment criteria

AC5.1 Types of **hazards**
AC5.2 **Levels** of risk
AC5.3 Produce a **risk assessment** for a task
AC5.4 Produce a **method statement** for a task

Range

AC5.1 **Hazards**

- trips
- slips
- falls
- fire
- burns
- cuts
- chemicals
- fumes
- falling from height
- falling objects (tools)

AC5.2 **Levels of risk**

- low
- medium
- high

AC5.3 **Risk assessment**

- who is at risk
- hazard
- level of risk
- control measures:
    - PPE
    - tidy work area
    - ventilation
    - safe access and egress route
    - fit for purpose equipment
    - training (tools, equipment, chemicals)

AC5.4 **Method statement**

- detail of safe working method and sequence of operation:
    - specific hazards
    - safe sequence of operation
    - hazardous substances
    - PPE
    - emergency procedures

- summary of information about the task:
    - personnel involved
    - key tools and equipment
    - key materials

Learning outcome

The learner will know and demonstrate:

LO6 Producing a work programme for tasks in the plumbing and domestic heating systems industry

Assessment criteria

AC6.1 Types of **projects**
AC6.2 **Factors** to consider when planning activities to job specifications
AC6.3 **Impact** when materials are not delivered on time against the **work programme**
AC6.4 Factors which affect working **time allocation** to work activities
AC6.5 Produce **simple work programmes**

Range

AC6.1 **Projects**

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

AC6.2 **Factors**

- the scope, purpose and requirements of the work
- identification of work responsibilities
- external factors that affect timeframe

AC6.3 **Impact**

- alteration of work schedule
- possible delay for multiple trades
- possible extra work or additional cost

AC6.3 **Work programme**

- work in private properties
- work on new-build housing
- work on commercial contracts
- avoiding loss of materials on site (theft)

AC6.4 **Time allocation**

- labour resources
- planning work with other trades
- material deliveries

AC6.5 **Simple work programmes**

- written plan

- simple bar (progress) charts

Unit 305 Cold water treatment and routing

Level:	3
GLH:	61
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit includes the understanding of cold water supply to domestic dwellings. The scope of the system is from the boundary stop valve into the property feeding the water outlets.

Learning outcome

The learner will know and understand:

LO1 Cold water supply to dwellings

Assessment criteria

AC1.1 Stages in the rainwater cycle
AC1.2 **Sources of water** and the typical properties of water from those sources
AC1.3 Types of **water supply** to dwellings and how these are regulated
AC1.4 **Types of water** and uses of water in dwellings
AC1.5 Mains water treatment processes and typical mains water distribution system from treatment works to property
AC1.6 Private supply water treatment processes and typical pipework systems from source to properties
AC1.7 Water treatment processes and typical supply pipework and storage systems utilising harvested rainwater and recycled greywater
AC1.8 Water **service to the dwellings** and isolation points
AC1.9 Requirements to provide water whilst preventing waste, undue consumption, misuse or contamination

Range

AC1.2 **Sources of water**

- surface sources:
  - lakes
  - reservoirs
  - rivers
  - streams
- underground sources:
  - deep and shallow wells
  - artesian wells
  - boreholes
  - spring

- harvested rainwater and recycled greywater

AC1.3 **Water Supply**

- mains
- private

AC1.4 **Types of water**

- wholesome water
- softened wholesome water
- unwholesome water:
    - harvested rainwater
    - greywater

AC1.8 **Service to the dwelling**

- connection methods to the main
- communication pipe detail
- service pipe detail
- main external stop valve location
- meter housings
- pump installations
- installation requirements
- methods of entry of the service pipework to a property

Unit 306 Plumbing and domestic central heating system layouts

Level:	3
GLH:	81
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit covers the essential understanding of types and layouts of plumbing and domestic central heating systems.

Learning outcome

The learner will know and understand:

LO1 Recognition of the layouts of plumbing and domestic heating systems

Assessment criteria

AC1.1 Types and layout features of **cold water systems** in dwellings
AC1.2 Types and layout features of **hot water systems in** dwellings
AC1.3 Types and layout features of **domestic central heating systems**
AC1.4 Types and layout features of **sanitary pipework systems**
AC1.5 Types and layout features of **rainwater systems**

Range

AC1.1 **Cold water systems**

- wholesome water supply:
  - direct cold water system
  - indirect cold water system
  - borehole
  - boosted (single dwellings only including accumulators)
- unwholesome water supply:
  - harvested rainwater:
    - water collected in a storage tank and fed by gravity to the point(s) of use
    - water collected in a storage tank and pumped directly to the point(s) of use
    - water collected in a storage tank and pumped to an intermediate cistern and fed by gravity to the point(s) of use
  - greywater reuse:
    - direct reuse system
    - short retention system
    - basic physical/chemical system

AC1.2 **Hot water systems (vented and unvented)**

- direct:
    - boiler
    - immersion
    - point of use
- indirect:
    - single feed self-venting indirect
    - double feed indirect
- thermal store
- instantaneous:
    - single point (point of use)
    - multipoint
    - combination boiler

AC1.3 **Domestic central heating systems**

- layout:
    - one pipe
    - two pipe
    - manifold (micro and minibore)
    - underfloor heating
    - configuration:
        - pumped heating gravity hot water
        - fully pumped, 2 x two port valves (S plan)
        - fully pumped, 3 x two port valves (S plan+)
        - fully pumped, 3 port valve (mid position/diverting) (Y/W plans)
        - fully pumped with a low loss header
- types:
    - wet central heating:
        - open vented heating systems:
            - heat only boiler
    - sealed heating systems:
        - system boiler
        - combination boiler
    - warm air
    - storage heaters
    - heat networks (district heating):
        - heat interface unit

AC1.4 **Sanitary pipework systems**

- types:
    - primary ventilated stack system
    - secondary ventilated stack system
    - ventilated branch discharge system
    - stub stack system
- layout:
    - layout of ventilated and unventilated branch discharge pipework
    - waste appliance connections to gullies
    - waste appliance connections direct to drain
    - WC connection direct to drain

AC1.5 **Rainwater systems**

- pipe (RWP):
    - round section

    - square section
- gutter:
    - half round
    - square
    - ogee
    - high capacity

Unit 307 Plumbing and domestic central heating systems

Level:	3
GLH:	166
Assessment types:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit covers the installation of systems: cold water, hot water, central heating, sanitary, and rainwater. The unit enables learners to demonstrate understanding of the principles and installation requirements of the different systems.

Learning outcome

The learner will know and demonstrate:

LO1 Cold water system installation

Assessment criteria

AC1.1 **Fluid categories** of water and uses of water supplied to dwellings
AC1.2 Advantages and disadvantages of **cold water systems**
AC1.3 Types and typical pipe sizes used in **cold water systems** within dwellings
AC1.4 Working principles of **cold water systems**, positioning fixing, connection and operation of **components**
AC1.5 **Layout and installation requirements** for protected plastic storage cisterns
AC1.6 Insulation requirements, system frost protection and prevention of undue warming of cold water systems
AC1.7 Positioning and fixing of pipework within the **building**
AC1.8 **Sources of information** required when undertaking work on cold water systems
AC1.9 **Backflow** risk and required **methods** of prevention
AC1.10 Cold water systems **installations**

Range

AC1.1 **Fluid categories**

- 1 to 5

AC1.2 and AC1.3 and AC1.4 **Cold water systems**

- potable cold water supplies (wholesome):
  - direct cold water systems (mains and private supplies)
  - indirect cold water systems (mains and private supplies)

- non-potable cold water supplies (unwholesome):
    - rainwater harvesting and greywater reuse

AC1.4 **Components**

- appliances:
    - baths
    - WCs
    - over the rim bidets
    - wash hand basins
    - sinks
    - urinals
    - refrigerators
    - washing machines
    - dishwashers
- taps, outlets and valves:
    - mixer taps
    - outside taps
    - pillar taps
    - bib taps
    - bi-flow mixer taps
    - ceramic disc taps
    - infra-red operated taps
    - boiling water taps
    - flexible outlet taps
    - stop valves
    - servicing valves
    - full way gate valves
    - spherical plug valves
    - drain valves
    - float operated valves (part 1–4)
- water meters
- showers:
    - gravity
    - instantaneous electric
    - digital shower valves
    - bath shower mixer
    - pumped (single and twin impeller)
    - mixer valve
- water treatment:
    - water softeners
    - water filters
    - water conditioners
- cisterns:
    - cold water storage cisterns ((less than 1000l)
    - cold water feed cisterns
    - combined feed and expansion cisterns
    - WC/urinal flushing cisterns
    - break cisterns
- boosted system components:
    - float switch
    - pressure switch
    - accumulator/pressure vessel
    - booster pump sets
    - pressure relief valve

    - pressure gauge
- rainwater harvesting, greywater reuse:
    - anti-surcharge valve
    - calmed inlet
    - inlet filter
    - level sensor/float switch
    - module (including pump and air gap)
    - pump control unit
    - system control unit
    - expansion vessel (direct systems)
    - water level gauge
    - solenoid controlled type AA air gap back-up supply
    - floating extraction point
    - storage tanks

AC1.5 **Layout and installation requirements**

- typical cistern sizes for dwellings
- warning pipe (overflow) arrangements
- inlet/outlet position
- position of float operated valve
- position of cistern vent
- position of open vent pipe connection
- requirement for a rigid close fitting lid
- service valve requirements
- insect screens
- insulation
- support
- drilling requirement
- maintenance and access requirements
- prevention of stagnation
- linking multiple cisterns

AC1.7 **Building**

- suspended timber floors
- solid floors
- embedded in walls
- in areas of the building subject to frost
- weight distribution of cisterns and heavy components

AC1.8 **Sources of information**

- water regulations
- building regulations – to include water efficiency calculator
- industry standards
- manufacturers' technical instructions

AC1.9 **Backflow**

- back pressure
- back siphonage

AC1.9 **Methods**

- air gaps:
    - AA

    - AB
    - AD
    - AG
    - AUK1
    - AUK2
    - AUK3
    - DC
- mechanical:
    - BA
    - CA
    - DB
    - EA/EB
    - EC/ED
    - HA
    - HUK1
    - HC

AC1.10 **Installations**

- cistern
- bath
- WHB
- WC
- booster set
- shower
- pipework:
    - plastic
    - copper

Learning outcome

The learner will know and demonstrate:

LO2 Hot water system installation

Assessment criteria

AC2.1 Advantages and disadvantages of hot water systems
AC2.2 Types and typical pipe sizes used in hot water systems within dwellings
AC2.3 Working principles of hot water systems, positioning fixing, connection and operation of **components**
AC2.4 Insulation requirements and system frost protection
AC2.5 Positioning and fixing of pipework within the **building**
AC2.6 Expansion and contraction in hot water systems and negative effects
AC2.7 Location and function of **unvented system components**
AC2.8 Secondary circulation and how trace heating can be used
AC2.9 **Sources of information** required when undertaking work on hot water systems
AC2.10 **Backflow** risk and required **methods** of prevention
AC2.11 Hot water systems **installations**

Range

AC2.3 **Components**

- cylinders (vented and unvented):

    - various grades available
    - sizes available
    - direct
    - indirect:
        - single feed, self-venting
        - double feed
        - quick recovery
        - dual coil
        - combination
    - thermal store
- appliances:
    - baths
    - WCs
    - over the rim bidets
    - wash hand basins
    - sinks
    - washing machines
    - dishwashers
- taps, outlets and valves:
    - mixer taps
    - pillar taps
    - bib taps
    - bi-flow mixer taps
    - ceramic disc taps
    - infra-red operated taps
    - boiling water taps
    - flexible outlet taps
    - concussive taps
    - flow limiting taps and valves
    - stop valves
    - spray taps
    - servicing valves
    - full way gate valves
    - spherical plug valves
    - thermostatic mixing valve
    - drain valves
    - non-return valves
    - float operated valves (part 1–4)
- showers:
    - gravity
    - digital shower valves
    - bath shower mixer
    - pumped (single and twin impeller)
    - mixer valve
    - negative head
    - positive head
- secondary circulation pump
- cisterns

AC2.5 **Building**

- suspended timber floors
- solid floors
- embedded in walls
- in areas of the building subject to frost
- weight distribution of cisterns and heavy components

AC2.7 **Unvented system components**

- cylinder
- isolation valve
- strainer
- expansion vessel
- pressure reducing valve
- expansion (pressure) relief valve
- temperature relief valve
- balanced cold connection
- check valve
- D1, D2 discharge pipework requirements
- composite valve
- tundish
- operating thermostat
- overheat thermostat

AC2.9 **Sources of information**

- water regulations
- building regulations – to include water efficiency calculator
- industry standards
- manufacturers' technical instructions

AC2.10 **Backflow**

- back pressure
- back siphonage

AC2.10 **Methods**

- air gaps:
    - AA
    - AB
    - AD
    - AUK2
    - AUK3
    - DC
- mechanical:
    - BA
    - CA
    - DB
    - EA/EB
    - EC/ED
    - HA
    - HC

AC2.11 **Installations**

- cylinder (open vented)
- cylinder (unvented)
- bath
- WHB
- shower
- pipework:
    - plastic

- copper

Learning outcome

The learner will know and demonstrate:

LO3 Central heating system installation

Assessment criteria

AC3.1 Advantages and disadvantages of **types** and **layout** features of heating systems
AC3.2 Typical pipe sizes used in central heating system **types** and **layouts** within dwellings
AC3.3 Working principles of **types** of central heating systems, positioning, fixing, connection and operation of **components**
AC3.4 Importance of pump positioning in **domestic central heating systems**
AC3.5 **Operating principles** for system control
AC3.6 Zoning and control requirements of central heating systems in accordance with statutory legislation, including Building Regulations
AC3.7 Insulation requirements and system frost protection
AC3.8 Positioning and fixing of pipework within the **building**
AC3.9 Expansion and contraction in central heating systems and negative effects
AC3.10 **Sources of information** required when undertaking work on central heating systems
AC3.11 Procedures for filling and venting **system types**
AC3.12 Operating principles of **heat-producing appliances**
AC3.13 Central heating systems **installations**

Range

AC3.1, AC3.2, AC3.4 and AC3.11 **Domestic central heating systems**

- types:
  - pumped heating gravity hot water
  - fully pumped, 2 x two port valves (S plan)
  - fully pumped, 3 x two port valves (S plan+)
  - fully pumped, 3 port valve (mid position/diverting) (Y/W plans)
  - fully pumped with a low loss header
  - low temperature hot water and lower temperature hot water central heating systems
- layout:
  - one pipe
  - two pipe
  - manifold (micro and minibore)
  - underfloor heating:
    - series and spiral
    - timber floor
    - solid floor

AC3.3 **Heating Systems**

- wet central heating:
  - sealed systems:
    - system boiler
    - combination boiler
    - heat only boiler (with external expansion vessel)
  - open vented systems:

        - heat only boiler
- warm air
- storage heaters
- heat networks (district heating):
    - heat interface unit

AC3.3 **Components**

- sealed systems:
    - expansion vessel
    - pressure gauge
    - filling loop
    - pressure relief valve
- open vented systems:
    - feed and expansion cisterns
    - air separators
    - open vent and feed pipe
    - automatic air vents
- generic:
    - radiator valves – thermostatic and manual/lockshield valves
    - circulating pumps
    - pump valves
    - thermo-mechanical cylinder control valves
    - anti-gravity valves
    - drain valves
    - additives:
        - inhibitor
        - de-scaler
        - de-sludger
    - primary and secondary heating circuits:
        - low loss headers
        - low loss headers for multiple boiler installations
        - multiple heat producing appliance installation
        - buffer tanks
    - expansion joints
    - corrosion filters
    - controls:
        - zone valves (2 port, 3 port, mid position and diverter)
        - programmer
        - timer
        - thermostats:
            - programmable room stat
            - cylinder stat
            - frost stat
        - optimizer
        - weather compensator
        - wiring centre
    - automatic by-pass
    - heat emitters:
        - bespoke heat emitters
        - panel radiators
        - column radiators
        - low surface temperature radiators
        - fan convectors
        - plinth heaters
        - towel warmers

    - underfloor heating components:
        - manifolds
        - pump control unit
        - insulation
        - pipework
        - manifold isolation ball valves
        - supports
    - underfloor heating pipework:
        - clip rails and staple clips
        - screed system plates
        - pocketed polystyrene products
        - heat emission/transfer plates
        - floating floor panels
        - reflective foil insulation
        - bend supports

AC3.5 **Operating principles**

- time
- temperature
- weather compensation:
    - delayed start
    - optimum start/stop
- smart control systems and associated equipment correct connection to home Wi-Fi networks
- multiple boiler controls
- zoning requirements
- 'Boiler Plus' requirements
- pump overrun requirements

AC3.8 **Building**

- suspended timber floors
- solid floors
- embedded in walls
- areas subject to frost
- weight distribution of boilers

AC3.10 **Sources of information**

- water regulations
- building regulations – to include water efficiency calculator
- industry standards
- manufacturers' technical instructions

AC3.13 **Heat producing appliances**

- boilers, wall and floor mounted, condensing and non-condensing:
    - heat only
    - system
    - combination
    - multiple and bivalent
- heat interface units
- heat pumps

AC3.13 **Installations**

- boiler/jig
- pump
- motorised valve
- expansion vessel
- radiator
- radiator valves
- underfloor heating
- controls
- valves
- pipework:
    - plastic
    - copper

Learning outcome

The learner will know and demonstrate:

LO4 Sanitary appliances and pipework system installation

Assessment criteria

AC4.1 Advantages and disadvantages of sanitary appliances pipework **systems**

AC4.2 Typical pipe sizes and maximum distances permitted in sanitary appliances pipework systems within dwellings

AC4.3 Working principles of sanitary appliances pipework **systems** and **layouts** and the positioning, fixing, connection and operation of **components**

AC4.4 Positioning and fixing of pipework within the **building**

AC4.5 Expansion and contraction in sanitary appliances pipework systems and negative effects

AC4.6 **Sources of information** required when undertaking work on sanitary appliances pipework systems

AC4.7 Types of **sanitary appliances** and components used in dwellings

AC4.8 Factors that lead to trap seal loss in sanitary pipework systems

AC4.9 Suitability of **below ground drainage systems** to receive **waste water**

AC4.10 Requirements of sanitary facilities and equipment in dwellings for the disabled, including wet rooms

AC4.11 **Jointing methods** used in sanitary appliances pipework systems

AC4.12 Working principles of greywater recycling systems

AC4.13 Sanitary appliances, pipework systems and components **installation**

Range

AC4.1 and AC4.3 **Systems**

- primary ventilated stack system
- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system

AC4.3 **Layouts**

- discharge stacks:
    - soil stack sizes based on WC outlet size
    - waste stack sizes serving waste appliances only

    - use and types of bends
    - proximity of low level connections
- branch discharge:
    - layout of unventilated and ventilated branch discharge pipework
    - maximum pipework lengths and gradients
    - sizes of branch discharge pipework for soil and waste appliances
    - use of traps and self-sealing valves
    - methods of ventilating branch discharge pipework
    - methods of connecting multiple waste appliances to branch discharge pipework
    - methods of connecting branch discharge pipework into the main stack
- stack ventilation:
    - proximity of vent outlet to openable windows
    - use of air admittance valves
- systems and appliances:
    - waste appliance connections to gullies
    - waste appliance connections direct to drain
    - WC connection direct to drain

AC4.3 **Components**

- bend:
    - male & female
    - 92½º
    - 135º
    - access bend
    - offset bend
- branch tee
- socket
- strap boss
- socket boss
- vent terminal
- waste manifold
- pan connectors
- traps
- waterless trap
- air admittance valve
- clips/brackets
- socket plug
- socket rodding access
- floor gullies

AC4.4 **Building**

- suspended timber floors
- solid floors
- embedded in walls
- in areas of the building subject to frost
- underground

AC4.6 **Sources of information**

- statutory legislation
- industry standards
- manufacturers' technical instructions

AC4.7 **Sanitary appliances**

- conventional WC
- flushing cisterns (automatic and manual)
- waste disposal units
- baths
- bidets
- wash hand basins
- shower tray
- bath/shower screens and cubicles
- sinks
- WC macerators
- waste water lifters/pumps used in domestic dwellings

AC4.9 **Below ground drainage systems**

- combined drainage systems
- separate drainage systems
- partially separate drainage systems
- soakaway
- cesspit
- septic tanks

AC4.9 **Waste water**

- foul
- waste
- condensate

AC4.11 **Jointing methods**

- ring seal (push fit)
- solvent weld
- mechanical
- fusion weld

AC4.13 **Installations**

- bath
- WHB
- WC
- primary ventilated stack
- stub stack

Learning outcome

The learner will know and demonstrate:

LO5 Rainwater system installation

Assessment criteria

AC5.1 Advantages and disadvantages of **rainwater systems**

AC5.2 Typical sizes and **materials** used in rainwater systems

AC5.3 Working principles of rainwater systems (positioning, fixing, connection and operation of **components**

AC5.4 Expansion and contraction in rainwater systems and negative effects

AC5.5 **Factors** affecting gutter bracket selection and fixing for buildings

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AC5.6 Sources of information required when undertaking work on rainwater systems
AC5.7 Working principles of rainwater recycling systems
AC5.8 Rainwater systems **installation**

Range

AC5.1 **Rainwater systems**

- pipe (RWP):
  - round section
  - square section
- gutter:
  - half round
  - square
  - ogee
  - high capacity

AC5.2 **Materials**

- PVC-u
- extruded aluminium
- cast iron
- specialist:
  - copper
  - lead
- brackets:
  - rise and fall
  - rafter
  - downpipe clips

AC5.3 **Components**

- pipe (RWP):
  - offsets
  - angles
  - branches
  - hopper heads
  - shoes
  - specialist connectors to the drainage system
- gutter:
  - running outlets
  - gutter angles
  - gutter unions
  - stop ends
  - specialist unions between different gutter materials
  - siphonic outlet

AC5.5 **Factors**

- fascia boards
- exposed rafters
- no fascia board or exposed rafters
- gutter and rainwater material selection

AC5.8 **Installation**

- pipe (RWP):

    - offsets
    - shoes
    - clips
- gutter system:
    - running outlets
    - gutter angles
    - gutter unions
    - stop ends
    - brackets

Unit 308 Decommission plumbing and domestic central heating systems

Level:	3
GLH:	26
Assessment type:	Practical assignment
Aim:	This unit covers the decommissioning procedures for systems: cold water, hot water, central heating, sanitary, and rainwater.

Learning outcome

The learner will know and demonstrate:

LO1 Decommissioning of plumbing and domestic central heating systems

Assessment criteria

AC1.1 **Decommissioning** of cold and hot water systems in accordance with appropriate **procedures**

AC1.2 **Decommissioning** of domestic central heating systems in accordance with appropriate **procedures**

AC1.3 **Decommissioning** of sanitary appliances and pipework systems in accordance with appropriate **procedures**

AC1.4 **Decommissioning** of rainwater systems in accordance with appropriate **procedures**

Range

AC1.1 – AC1.4 **Decommissioning**

- temporary
- permanent

Procedures

AC1.1 Cold and hot water systems:

- notify relevant person
- isolate the fuel/electricity supply to the system as appropriate
- isolate water supply
- apply warning notices and signs
- drain system to a suitable location
- appropriately dispose of contents and any additives
- continuity bonding as required
- temporary capping of pipework sections as required
- notify building users
- alternative supplies as required

AC1.2 Central heating systems:

- notify relevant person
- isolate fuel/electricity supply to the system as appropriate
- isolate water supply
- apply warning notices and signs
- drain system to a suitable location
- appropriately dispose of contents and any additives
- continuity bonding as required
- temporary capping of pipework sections as required
- notify building users
- alternative source of heat or supplies as required

AC1.3 Sanitary appliances and pipework:

- notify relevant person
- checks for hazardous materials
- appropriate access equipment
- isolate the electricity supply to the system as appropriate
- isolate water supply
- apply warning notices and signs
- drain system to a suitable location
- appropriately dispose of contents
- temporary capping of pipework sections as required
- notify building users
- alternative sources of facilities or supplies as required
- removal of components
- appropriately dispose of materials

AC1.4 Rainwater systems:

- notify relevant person
- checks for hazardous materials
- appropriate access equipment
- apply warning notices and signs
- removal of components
- appropriately dispose of materials.

Unit 309 Test plumbing and domestic central heating systems

Level:	3
GLH:	65
Assessment type:	Practical assignment
Aim:	This unit covers the soundness test and commissioning procedures for systems: cold water, hot water, central heating, sanitary, and rainwater.

Learning outcome

The learner will know and demonstrate:

LO1 Soundness test of cold water systems and components

Assessment criteria

AC1.1 **Information sources** required to complete testing and commissioning
AC1.2 How to fill and vent **cold water systems**
AC1.3 **Soundness test** to industry requirements on **cold water systems pipework** and components
AC1.4 **Flushing requirements** for new and existing cold water systems

Range

AC1.1 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions

AC1.2 and AC1.3 **Cold water systems**

- wholesome:
  - direct cold water systems (mains and private supplies)
  - indirect cold water systems (mains and private supplies)
- unwholesome:
  - rainwater harvesting and greywater reuse

AC1.3 **Soundness test** (as applicable to the **cold water system** type)

- visual inspection
- notify persons that testing is to commence
- initial fill

- stabilisation
- test to required pressure
- check for leaks
- check pressures after test period
- complete documentation and notify as required

AC1.3 **Pipework**

- metal pipework
- plastic pipework

AC1.4 **Flushing requirements**

- cold flush

Learning outcome

The learner will know and demonstrate:

LO2 Soundness test of hot water systems and components

Assessment criteria

AC2.1 **Information sources** required to complete testing and commissioning
AC2.2 How to fill and vent **hot water systems**
AC2.3 **Soundness test** to industry requirements on **hot water systems pipework** and components
AC2.4 **Flushing requirements** for new and existing **hot water systems**

Range

AC2.1 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions

AC2.2 and AC2.3 and AC2.4 **Hot water systems**

- vented
- unvented

AC2.3 **Soundness test**

- visual inspection
- notify persons that testing is to commence
- initial fill
- stabilisation
- test to required pressure
- check for leaks
- check pressures after test period
- complete documentation and notify as required

AC2.3 **Pipework**

- Metal pipework
- Plastic pipework

AC2.4 **Flushing requirements**

- cold flush
- hot flush

Learning outcome

The learner will know and demonstrate:

LO3 Soundness test of central heating systems and components

Assessment criteria

AC3.1 **Information sources** required to complete testing and commissioning

AC3.2 How to fill and vent central heating systems

AC3.3 **Soundness test** to industry requirements on central heating systems **pipework** and components

AC3.4 **Flushing requirements** including the use of **system additives** for new and existing central heating systems

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Range

AC3.1 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions

AC3.3 **Soundness test**

- visual inspection
- notify persons that testing is to commence
- initial fill
- stabilisation
- test to required pressure
- check for leaks
- check pressures after test period
- complete documentation and notify as required

AC3.3 **Pipework**

- metal pipework
- plastic pipework

AC3.4 **Flushing requirements**

- cold flush
- hot flush
- cleansing

AC3.4 **System additives**

- neutralisers
- cleanser
- descaler
- inhibitor

Learning outcome

The learner will know and demonstrate:

LO4 Soundness test of sanitary appliances, pipework systems and components

Assessment criteria

AC4.1 **Visual inspection** of sanitary appliances and pipework systems to confirm that they are ready to be soundness tested

AC4.2 **Soundness test** to industry requirements on sanitary appliances pipework systems and components

Range

AC4.1 **Visual inspection**

- checks
- leakage
- adequate support
- damage

AC4.2 **Soundness test**

- visual inspection
- notify persons that testing is to commence
- air test
- initial fill
- wet test
- check for leaks
- complete documentation and notify as required

Learning outcome

The learner will know and demonstrate:

LO5 Soundness test of rainwater systems

Assessment criteria

AC5.1 **Information sources** required to complete testing and commissioning

AC5.2 **Visual inspection** of a rainwater system to confirm that it is ready to be soundness tested

AC5.3 **Soundness test** to industry requirements on rainwater/gutter systems pipework and components

Range

AC5.1 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions

AC5.2 **Visual inspection**

- leakage
- adequate support
- damage
- gutters are clear of debris

AC5.3 **Soundness test**

- visual inspection
- notify persons that testing is to commence
- initial fill
- check for leaks
- complete documentation and notify as required

Unit 310 Commission and handover plumbing and domestic central heating systems

Level:	3
GLH:	86
Assessment type:	Practical assignment
Aim:	This unit covers the commissioning and handover of systems: cold water, hot water, central heating, sanitary, and rainwater.

Learning outcome

The learner will know and demonstrate:

LO1 Commission and handover of cold water systems and components

Assessment criteria

AC1.1 **Operational checks** required during commissioning **cold water systems**
AC1.2 Range of information that would be detailed on commissioning documentation
AC1.3 Procedure for handing over to the end user
AC1.4 **Commissioning procedure** for cold water systems

Range

AC1.1 **Cold water systems**

- wholesome:
  - direct cold water systems (mains and private supplies)
  - indirect cold water systems (mains and private supplies)
- unwholesome:
  - rainwater harvesting and greywater reuse

AC1.1 **Operational checks** (as applicable to the **cold water system** type)

- temperature
- flow rate
- pressures
- operation of components and controls
- setting/checking water levels

AC1.4 **Commissioning procedure** (as applicable to the **cold water system** type)

- visual inspection
- confirm the provision of appropriate marking and labelling to system pipework and components

- fill and vent
- soundness test
- flush
- operational checks
- water quality checks where required
- commissioning documentation
- handover procedure:
    - how to isolate
    - how to operate
    - handover manufacturers' instructions
    - service period

Learning outcome

The learner will know and demonstrate:

LO2 Commission and handover of hot water systems and components

Assessment criteria

AC2.1 **Operational checks** required during commissioning
AC2.2 Range of information that would be detailed on commissioning documentation
AC2.3 Procedure for handing over to the end user
AC2.4 **Commissioning procedure** for **hot water systems**

Range

AC2.1 **Operational checks**

- temperature
- flow rate
- pressures
- operation of components and controls
- setting/checking water levels

AC2.4 **Commissioning procedure**

- visual inspection
- fill and vent
- soundness test
- flush
- operational checks
- commissioning documentation
- handover procedure:
    - how to isolate
    - how to operate
    - handover manufacturers' instructions
    - service period

AC2.4 **Hot water systems**

- vented
- unvented

Learning outcome

The learner will know and demonstrate:

LO3 Commission and handover of central heating systems and components

Assessment criteria

AC3.1 **Operational checks** required during commissioning
AC3.2 Range of information that would be detailed on commissioning documentation
AC3.3 Procedure for handing over to the end user
AC3.4 **Commissioning procedure** for central heating systems

Range

AC3.1 **Operational checks**

- temperature
- flow rate
- pressures
- operation of components and controls
- hydronic balancing of a central heating system

AC3.4 **Commissioning procedure**

- visual inspection
- fill and vent
- soundness test
- flush
- operational checks
- commissioning documentation – including benchmark
- handover procedure:
    - how to isolate
    - how to operate
    - handover manufacturers' instructions
    - service period

Learning outcome

The learner will know and demonstrate:

LO4 Commission and handover of sanitary appliances, pipework systems and components

Assessment criteria

AC4.1 **Operational checks** required during commissioning
AC4.2 Procedure for handing over to the end user
AC4.3 **Commissioning procedure** for sanitary appliances, pipework systems and components

Range

AC4.1 **Operational checks**

- correct fall
- no trap seal loss

- no leaks
- adequate support
- waste removed satisfactory

AC4.3 **Commissioning procedure**

- visual inspection
- soundness test
- operational checks
- commissioning documentation
- handover procedure:
    - how to isolate
    - how to operate
    - handover manufacturers' instructions
    - service period

Learning outcome

The learner will know and demonstrate:

LO5 Commission and handover of rainwater systems

Assessment criteria

AC5.1 **Operational checks** required during commissioning
AC5.2 Procedure for handing over to the end user
AC5.3 **Commissioning procedure** for rainwater systems

Range

AC5.1 **Operational checks**

- correct fall
- spill over
- leaks

AC5.3 **Commissioning procedure**

- visual inspection
- soundness test
- operational checks
- commissioning documentation
- handover procedure:
    - how to isolate
    - how to operate
    - handover manufacturers' instructions
    - service period

Unit 311 Fault diagnosis and rectification on plumbing and domestic central heating systems

Level:	3
GLH:	38
Assessment type:	Practical assignment
Aim:	This unit covers the diagnosis and rectification of faults in systems: cold water, hot water, central heating, sanitary, and rainwater.

Learning outcome

The learner will know and demonstrate:

LO1 Fault diagnosis and rectification on cold water systems and components

Assessment criteria

AC1.1 Methods of **diagnosing system faults**
AC1.2 Diagnostic checks for a range of **faults**
AC1.3 Repair and rectification **procedures** to deal with a range of faults

Range

AC1.1 **Diagnosing**

- end user
- manufacturer instruction
- fault diagnosis flow chart
- service history

AC1.1 **System**

- direct cold water systems (mains and private supplies)
- indirect cold water systems (mains and private supplies)
- rainwater harvesting and greywater reuse

AC1.1 and AC1.2 **Faults**

- incorrect pressures
- accumulator/expansion vessel failure
- blockages
- system debris
- pump failure
- control failure

- pressure relief valve failure
- incorrect support to system pipework and storage cisterns
- excessive noise in pipework systems
- cistern failure
- leakage from below ground cold water service pipework
- leakage or ineffective operation of:
    - terminal fittings
    - float operated valves
    - stop and service valves

AC1.3 **Procedures**

- diagnose
- notify client
- safely isolate
- decommission
- rectify
- re-commission
- handover

Learning outcome

The learner will know and demonstrate:

LO2 Fault diagnosis and rectification on hot water systems and components

Assessment criteria

AC2.1 Methods of **diagnosing faults**
AC2.2 Diagnostic checks for a range of **faults**
AC2.3 Repair and rectification **procedures** to deal with a range of faults

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Range

AC2.1 **Diagnosing**

- end user
- manufacturer instruction
- fault diagnosis flow chart
- service history

AC2.1 and AC2.2 **Faults**

- incorrect pressures
- blockages
- system debris
- stratification of cylinders
- incorrect support to hot water system pipework and storage cisterns
- excessive noise in pipework systems
- hot water storage cylinder/ heater failure
- leakage or ineffective operation of:
    - terminal fittings
    - float operated valves
    - stop and service valves
    - mixer showers
    - thermostatic mixing valves

- component failure:
    - motorised valves not operating
    - heat exchanger
    - thermostat
    - programmer
    - expansion valve
    - pressure relief valve
    - cistern
    - pump

AC2.3 **Procedures**

- diagnose
- notify client
- safely isolate
- decommission
- rectify
- re-commission
- handover

Learning outcome

The learner will know and demonstrate:

LO3 Fault diagnosis and rectification on central heating systems and components

Assessment criteria

AC3.1 Methods of **diagnosing faults**
AC3.2 Diagnostic checks for a range of **faults**
AC3.3 Repair and rectification **procedures** to deal with a range of faults

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Range

AC3.1 **Diagnosing**

- end user
- manufacturer instruction
- fault diagnosis flow chart
- service history

AC3.1 and AC3.2 **Faults**

- pumping over
- persistent venting
- emitter cold spots
- incorrect pressures
- blockages
- incorrect support to system pipework and components
- excessive noise in pipework systems
- leakage or ineffective operation of:
    - terminal fittings
    - stop and service valves
    - pipework
- component failure:
    - stuck TRVs

    - motorised valves not operating
    - heat exchanger
    - thermostat
    - programmer
    - pressure relief valve
    - underfloor manifold and pump station
    - feed and expansion cistern
    - expansion vessel
    - pump

AC3.3 **Procedures**

- diagnose
- notify client
- safely isolate
- decommission
- rectify
- re-commission
- handover

Learning outcome

The learner will know and demonstrate:

LO4 Fault diagnosis and rectification on sanitary appliances and pipework

Assessment criteria

AC4.1 Methods of **diagnosing faults**
AC4.2 Diagnostic checks for a range of **faults**
AC4.3 Repair and rectification **procedures** to deal with a range of faults

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Range

AC4.1 **Diagnosing**

- end user
- manufacturer instruction
- fault diagnosis flow chart
- service history
- visual inspection

AC4.1 and AC4.2 **Faults**

- leaks
- blockages
- inadequate or broken support
- trap seal loss
- debris
- lack of provision for expansion and contraction
- component failure:
    - cistern/tank faults
    - appliance faults
    - WC macerators
    - waste water lifters/pumps
    - sink waste disposal units

- air admittance valves
- pipework
- condensing boiler condensate

AC4.3 **Procedures**

- diagnose
- notify client
- safely isolate
- decommission
- rectify
- re-commission
- handover

Learning outcome

The learner will know and demonstrate:

LO5 Fault diagnosis and rectification on rainwater systems and components

Assessment criteria

AC5.1 Methods of **diagnosing faults**
AC5.2 Diagnostic checks for a range of **faults**
AC5.3 Repair and rectification **procedures** to deal with a range of faults

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Range

AC5.1 **Diagnosing**

- end user
- manufacturer instruction
- visual inspection

AC5.1 and AC5.2 **Faults**

- leaks
- blockages/debris
- inadequate or broken support
- broken gutter/pipe (RWP)
- incomplete systems
- incorrect fall
- lack of provision for expansion and contraction

AC5.3 **Procedures**

- diagnose
- notify client
- safely isolate
- decommission
- rectify
- re-commission
- handover

Unit 312 Service and maintenance on plumbing and domestic central heating systems

Level:	3
GLH:	32
Assessment type:	Practical assignment
Aim:	This unit covers the planned preventative maintenance of systems: cold water, hot water, central heating, and sanitary. The unit includes using information to establish the maintenance requirements, and the routine checks required as part of the service and maintenance procedure.

Learning outcome

The learner will know and demonstrate:

LO1 Service and maintenance on cold water systems

Assessment criteria

AC1.1 How to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components

AC1.2 **Routine checks** required on **cold water system** components and pipework as part of a periodic maintenance programme

AC1.3 Types of **information** to be provided on a maintenance record for cold water systems

AC1.4 Requirements for legionella and bacterial growth control measures

AC1.5 **Service and maintain cold water systems**

Range

AC1.2 **Cold water systems**

- wholesome:
  - direct cold water systems (mains and private supplies)
  - indirect cold water systems (mains and private supplies)
- unwholesome:
  - rainwater harvesting
  - greywater reuse

AC 1.2 **Routine checks**

- visual inspection of pipework for correct labelling, leakage and adequate support
- effective operation of terminal fittings
- effective operation of float operated valves

- effective operation of valves
- condition of cold water storage cistern
- condition of storage tanks
- condition of accumulator
- strainer/filter inspection and cleaning
- pump operation
- float and pressure switch operation
- pressure relief valves
- water quality checks where required
- effective backflow protection

AC1.3 **Information**

- specific to system and manufacturers' instructions:
    - components checked
    - status
    - actions
    - repairs

AC1.5 **Service and Maintain**

- wholesome:
    - direct cold water systems (mains and private supplies)
- unwholesome:
    - rainwater harvesting
    - greywater reuse

Learning outcome

The learner will know and demonstrate:

LO2 Service and maintenance on hot water systems

Assessment criteria

AC2.1 How to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components

AC2.2 **Routine checks** required on hot water system components and pipework a part of a periodic maintenance programme

AC2.3 Types of **information** to be provided on a maintenance record for hot water systems

AC2.4 Requirements for legionella and bacterial growth control measures

AC2.5 **Service and maintain** hot water systems

Range

AC2.2 **Routine checks**

- visual inspection of pipework for correct labelling, leakage and adequate support
- effective operation of terminal fittings
- effective operation of float operated valves
- effective operation of service valves
- condition of hot water cylinder
- condition of storage cisterns
- unvented cylinder and controls
- effective operation of thermostatic control devices

- temperature and pressure relief valve
- expansion vessel
- composite valve
- pumps

AC2.3 **Information**

- specific to system and manufacturers' instructions:
    - components checked
    - status
    - actions
    - repairs

AC2.5 **Service and maintenance**

- unvented cylinder
- controls

Learning outcome

The learner will know and demonstrate:

LO3 Service and maintenance on central heating systems

Assessment criteria

AC3.1 How to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components

AC3.2 **Routine checks** required on central heating system components and pipework as part of a periodic maintenance programme

AC3.3 Types of **information** to be provided on a maintenance record for central heating systems

AC3.4 Service and maintain central heating systems and controls

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Range

AC3.2 **Routine checks**

- visual inspection of pipework for leakage, adequate support and insulation
- effective operation of terminal fittings
- effective operation of float operated valves
- effective operation of valves
- condition of cisterns
- effective operation of thermostatic control devices
- temperature and pressure relief valve
- expansion vessel
- pumps
- heat emitter
- performance checks

AC3.3 **Information**

- Specific to system and manufacturers' instructions:
    - components checked
    - status
    - actions

- repairs

Learning outcome

The learner will know and demonstrate:

LO4 Service and maintenance on sanitary appliances and pipework systems

Assessment criteria

AC4.1 How to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components

AC4.2 **Routine checks** required on sanitary appliances and pipework systems as part of a periodic maintenance programme

AC4.3 Types of **information** to be provided on a maintenance record for sanitary appliances and pipework systems

AC4.4 **Routine checks** of sanitary appliances and pipework systems

Range

AC4.2 and AC4.4 **Routine checks**

- visual inspection of pipework for leakage, adequate support
- effective operation of terminal fittings
- effective operation of float operated valves
- effective operation of valves
- condition of cisterns
- operation of flushing cisterns/mechanisms
- fitting of effective waste outlet plugs
- effective operation of appliance traps/self-sealing valves
- pumps
- performance checks
- appliance support

AC4.3 **Information**

- specific to system and manufacturers' instructions:
  - components checked
  - status
  - actions
  - repairs

Unit 313 Size and select plumbing and domestic central heating systems

Level:	3
GLH:	70
Assessment type:	Practical assignment
Aim:	This unit covers the sizing and selection of systems and components: cold water, rainwater harvesting and greywater reuse, hot water, sanitary, and rainwater.

Learning outcome

The learner will know and demonstrate:

LO1 Sizing and selection of cold water systems and components for dwellings

Assessment criteria

AC1.1 **Factors** that affect the selection of cold water systems for dwellings
AC1.2 I**nformation sources** required to size and select cold water systems and components
AC1.3 Recommend **design temperatures** within cold water systems
AC1.4 Calculate cold water **system requirements** used in dwellings
AC1.5 Select cold water **components** in accordance with calculations from predetermined data
AC1.6 Information required to complete a detailed **materials list**
AC1.7 Present calculations and information in a suitable format for quotation and tender

Range

AC1.1 **Factors**

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

AC1.2 **Information sources**

- statutory regulations
- industry standards

- manufacturers' technical instructions
- verbal and written feedback from the customer
- plans and drawings
- specifications
- pre-determined data

AC1.3 **Design temperatures**

- condensation consideration
- storage (frost protection and undue warming)
- appliance outlet

AC1.4 **System requirements**

- storage requirements
- pipe size
- outlet size and type

AC1.5 **Components**

- storage requirements
- pipe size
- accumulator
- safety device
- booster pump

AC1.6 **Material list**

- quantities and grades:
    - pipework
    - consumables
    - fittings
    - components
    - appliances

Learning outcome

The learner will know and demonstrate:

LO2 Sizing and selection of rainwater harvesting and greywater reuse systems and components for dwellings

Assessment criteria

AC2.1 **Factors** that affect the selection of rainwater harvesting systems and greywater reuse systems for dwellings

AC2.2 **Information sources** required to size and select **rainwater harvesting and greywater reuse systems** and components

AC2.3 Calculate rainwater harvesting, and greywater reuse **system requirements** used in dwellings

AC2.4 Select rainwater harvesting and greywater reuse **components** in accordance with calculations from predetermined data

AC2.5 Information required to complete a detailed **materials list**

AC2.6 Present calculations and information in a suitable format for quotation and tender

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Range

AC2.1 **Factors**

- rainwater harvesting:
  - building occupancy
  - demand/usage
  - roof plan area (tiled pitched roofs)
  - average annual rainfall depth for the location
  - design requirements for rainwater harvesting storage tank/cistern
  - prevention of stagnation
  - water treatment
  - filtration
  - yield
  - usage
- greywater reuse:
  - building occupancy
  - demand/usage
  - storage capacity (litres) of a greywater reuse system within premises using the simplified approach
  - design requirements for greywater reuse storage tank/cistern
  - water treatment
  - filtration
  - yield
  - usage

AC2.2 **Information requirements**

- water quality and efficiency
- roof drainage system installation
- rainwater and greywater storage tank installation
- connection arrangement where rainwater and greywater overflow and drainage pipework connect to the underground drainage system

AC2.3 **System requirements**

- storage requirements
- pipe size

AC2.4 **Components**

- greywater reuse storage tank/cistern
- rainwater harvesting storage tank/cistern
- pump
- pipe
- safety controls

AC2.5 **Materials list**

- quantities and grades:
  - pipework
  - consumables
  - fittings
  - components
  - appliances

Learning outcome

The learner will know and demonstrate:

LO3 Sizing and selection of hot water systems and components for dwellings

Assessment criteria

AC3.1 **Factors** that affect the selection of hot water systems for dwellings
AC3.2 **Information sources** required to size and select hot water systems and components
AC3.3 Recommended **design temperatures** within hot water systems
AC3.4 Calculate hot water **system requirements** used in dwellings
AC3.5 Select hot water **components** in accordance with calculations from predetermined data
AC3.6 Information required to complete a detailed **materials list**
AC3.7 Present calculations and information in a suitable format for quotation and tender

Range

AC3.1 **Factors**

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

AC3.2 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions
- verbal and written feedback from the customer
- plans and drawings
- specifications
- pre-determined data

AC3.3 **Design temperatures**

- pipework
- secondary circulation
- storage
- appliance outlet

AC3.4 **System requirements**

- storage requirements
- pipe size

AC3.5 **Components**

- storage vessel
- pipe

- pump
- expansion vessel
- safety device

AC3.6 **Materials list**

- quantities and grades:
    - pipework
    - consumables
    - fittings
    - components
    - appliances

Learning outcome

The learner will know and demonstrate:

LO4 Sizing and selection of central heating systems and components for dwellings

Assessment criteria

AC4.1 **Factors** that affect the selection of central heating systems for dwellings
AC4.2 **Information sources** required to size and select hot central heating systems and components
AC4.3 Principles of **heat loss and heat gain** and how this affects heating requirements
AC4.4 Calculate central heating **system requirements** used in dwellings
AC4.5 Select central heating system **components** in accordance with calculations from predetermined data
AC4.6 Information required to complete a detailed **materials list**
AC4.7 Present calculations and information in a suitable format for quotation and tender

---

Range

AC4.1 **Factors**

- customer needs
- building layout and features
- energy efficiency
- heat source and circulating water temperature
- environmental impact
- occupancy and purpose
- appliance location
- cost
- storage type/location
- legislation

AC4.2 **Information sources**

- statutory regulations
- industry standards
- manufacturers' technical instructions
- verbal and written feedback from the customer
- plans and drawings
- specifications
- pre-determined data

AC4.3 **Heat loss and heat gain**

- electrical equipment
- occupancy
- solar
- building fabric
- ventilation
- internal and external design temperatures
- pipework

AC4.4 **System requirements**

- water flow temperature:
  - low temperature hot water heating (55°C and below)
  - traditional hot water heating (55°C and above)
- total heat load
- emitter load
- hot water allowance
- pipe size
- pump size
- emitter size
- expansion
- system control requirements

AC4.5 **Components**

- emitter
- heat source
- pipe
- pump
- expansion vessel

AC4.6 **Materials list**

- quantities and grades:
  - pipework
  - consumables
  - fittings
  - components
  - appliances

Learning outcome

The learner will know and demonstrate:

LO5 Sizing and selection of sanitary appliances pipework systems and components for dwellings

Assessment criteria

AC5.1 **Factors** that affect the selection of sanitary appliances pipework systems for dwellings

AC5.2 **Information sources** required to size and select sanitary appliances pipework systems

AC5.3 **Calculate** sanitary appliance pipework system requirements used in dwellings

AC5.4 Select sanitary system **components** in accordance with calculations from predetermined data

AC5.5 Information required to complete a detailed **materials list**

AC5.6 Present calculations and information in a suitable format for quotation and tender

Range

AC5.1 **Factors**

- customer needs
- building layout and features
- energy efficiency
- environmental impact
- appliance type and location
- cost
- legislation
- drainage system type
- pipework routes
- access requirements

AC5.2 **Information sources**

- statutory regulations
- industry standards
- manufacturer technical instructions
- verbal and written feedback from the customer
- plans
- drawings and specifications
- pre-determined data

AC5.3 **Calculation**

- gradient
- diameter
- length
- material
- system type

AC5.4 **Components**

- conventional WC
- flushing cisterns (automatic and manual)
- baths
- wash hand basins
- shower tray
- sinks
- WC macerators
- waste water lifters/pumps used in domestic dwellings

AC5.5 **Materials list**

- quantities and grades:
    - pipework
    - consumables
    - fittings
    - components
    - appliances

Learning outcome

The learner will know and demonstrate:

LO6 Sizing and selection of rainwater systems components for dwellings

Assessment criteria

AC6.1 **Factors** that affect the selection of rainwater systems for dwellings
AC6.2 **Information sources** required to size and select rainwater systems components
AC6.3 Calculate rainwater systems requirements used in dwellings
AC6.4 Select rainwater system **components** in accordance with calculations from predetermined data
AC6.5 Information required to complete a detailed **materials list**
AC6.6 Present calculations and information in a suitable format for quotation and tender

Range

AC6.1 **Factors**

- customer needs
- building layout and features
- energy efficiency
- environmental impact
- cost
- legislation
- rainfall intensity
- roof area
- roof pitch
- outlet position
- gutter fall
- changes of direction in the gutter run

AC6.2 **Information sources**

- statutory regulations
- industry standards
- manufacturer technical instructions
- verbal and written feedback from the customer
- plans
- drawings and specifications
- pre-determined data

AC6.4 **Components**

- pipe (RWP)
- gutter

AC6.5 **Material list**

- quantities and grades:
    - pipe (RWP)
    - consumables
    - fittings
    - components
    - appliances

- gutter

Unit 314 Environmental technology systems

Level:	3
GLH:	15
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit provides an introduction to renewable energy.

Learning outcome

The learner will know and understand:

LO1 Sources of renewable and non-renewable energy

Assessment criteria

AC1.1 Renewable and non-renewable energy
AC1.2 **Types of non-renewable energy**
AC1.3 **Types of renewable energy**

Range

AC1.1 and AC1.2 **Types of non-renewable energy**

- gas
- oil
- solid fuel (mineral)
- electricity generated by non-renewable energy sources

AC1.1 and AC1.3 **Types of renewable energy**

- electricity generated by renewable energy sources:
  - solar
  - wind
  - hydro
  - geothermal
- solid fuel (biomass)
- hydrogen

Learning outcome

The learner will know and understand:

LO2 Operating principles of micro-renewable energy technologies

Assessment criteria

AC2.1 Operating principles of heat producing **micro-renewable energy** technologies

AC2.2 Operating principles of heat-led micro-combined heat and power

Range

AC2.1 **Micro-renewable energy**

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

Learning outcome

The learner will know and understand:

LO3 Requirements to install micro-renewable energy systems to existing systems

Assessment criteria

AC3.1 Suitability of **building location and features** when installing micro-renewable energy systems

AC3.2 **Statutory regulations** affecting installation of micro-renewable energy systems

AC3.3 What would be typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of technologies

AC3.4 Which parts of the regulations apply in relation to the installation of **environmental technologies**

AC3.5 Typical advantages and disadvantages associated with environmental technologies

Range

AC3.1 **Building location and features**

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

AC3.2 and AC3.3 **Statutory regulations**

- Building regulations:
  - Part A
  - Part E
  - Part G
  - Part H
  - Part F
- Town and country planning regulations

AC3.4 **Environmental technologies**

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

- biomass
- micro-combined heat and power (heat-led)

Learning outcome

The learner will know and understand:

LO4 Current energy efficiency advice and guidance

Assessment criteria

AC4.1 **Effects** of using renewable and non-renewable energy sources
AC4.2 Benefits of **energy efficient products**, services and equipment
AC4.3 Factors of the **Building Regulations and Guidance** that apply to energy efficiency

Range

AC4.1 **Effects**

- on the environment
- climate change

AC4.2 **Energy efficient products**

- Ecodesign and energy related products (ErP)

AC4.3 **Building Regulations and Guidance**

- Approved Documents
- Document L Volume 1 Dwellings
- Document L Volume 2 Buildings other than Dwellings
- Domestic Building Services Compliance Guide
- Non-domestic Building Services Compliance Guide
- PAS 2035

Unit 315 Domestic fuel systems

Level:	3
GLH:	30
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit includes factors affecting fuel selection, the combustion processes of fuel supply systems and the operating principles of chimney/flue systems.

Learning outcome

The learner will know and understand:

LO1 Factors affecting fuel selection

Assessment criteria

AC1.1 Types of **fuels** used in appliances
AC1.2 **Factors** which affect the selection of fuels
AC1.3 **Sources of information** for fuel supply installation
AC1.4 **Regulatory type bodies** which govern the installation of different fuel types
AC1.5 **Factors** which could affect storage requirements for fuels

Range

AC1.1 **Fuels**

- natural gas
- LPG
- oil
- solid fuel
- hydrogen
- biomass

AC1.2 **Factors (selection)**

- client preference
- availability
- appliance type
- fuel storage requirements
- environmental considerations
- smoke control legislation
- cost

AC1.3 **Sources of information**

- industry standards

- statutory regulations
- manufacturers' instructions
- guidance notes

AC1.4 **Regulatory type bodies**

- Gas Safe
- OFTEC
- HETAS
- MCS

AC1.5 **Factors (storage)**

- space
- delivery requirements
- safety
- weather conditions
- distribution
- proximity to dwelling

Learning outcome

The learner will know and understand:

LO2 Combustion processes of fuel supplied systems

Assessment criteria

AC2.1 Combustion process
AC2.2 Main constituents of complete and incomplete combustion
AC2.3 **Causes** of incomplete combustion
AC2.4 **Signs** of incomplete combustion
AC2.5 Symptoms of CO poisoning
AC2.6 Purpose of CO detectors
AC2.7 **Requirements** for ventilation
AC2.8 **Types** of ventilation
AC2.9 **Installation practices** for ventilation

Range

AC2.3 **Causes**

- insufficient air
- too much fuel
- vitiated air
- flame impingement

AC2.4 **Signs**

- poor flame picture
- soot deposits
- staining

AC2.7 **Requirements**

- combustion air

- cooling air

AC2.8 **Types**
- natural
- mechanical

AC2.9 **Installation practices**
- adequately sized
- continuous free area
- sleeved
- permanently open
- fly screen removed
- correctly positioned

Learning outcome

The learner will know and understand:

LO3 Principles of chimney/flue systems

Assessment criteria

AC3.1 **Operating principles** of chimney/flue systems
AC3.2 **Types** of chimney/flue systems
AC3.3 **Components** within chimney/flue systems
AC3.4 **Effects** of layout on chimney/flue systems
AC3.5 Layout and features of **chimney and flue construction**
AC3.6 Reference termination requirements for chimney/flue systems from relevant **documents**
AC3.7 **Inspection and testing** procedures for chimney/flue systems

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Range

AC3.1 **Operating principles**
- remove combustion products
- draw in combustion air

AC3.2 **Types**
- open flued:
  - natural draught
  - forced draught
- room sealed:
  - natural draught
  - forced draught

AC3.3 **Components**
- primary flue
- draught diverter/stabiliser
- secondary flue
- terminal

AC3.4 **Effects**

- equivalent height
- internal temperature
- external temperature
- air quality
- humidity
- route
- bends
- termination

AC3.5 **Chimney and flue construction**

- rigid chimney types:
    - brick/masonry
    - pre-cast flue blocks
- metallic (single and double wall flues)
- flexible metallic liner installation (types and suitability)

AC3.6 **Documents**

- industry standards
- approved documents
- manufacturers' instructions

AC3.7 **Inspection and testing**

- visual inspection
- flue flow
- spillage
- flue gas analysis

Unit 316 Electrical work and the control of plumbing and domestic central heating systems

Level:	3
GLH:	70
Assessment types:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit includes the knowledge and skills to safely carry out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems.

Learning outcome

The learner will know and demonstrate:

LO1 Pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems

Assessment criteria

AC1.1 **Limitations** of your responsibility when carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems

AC1.2 Applications, advantages and limitations of **electrical supplies**

AC1.3 Applications, advantages and limitations of different **electrical equipment**, **cables/wiring** and **components** in relation to the **working environment**

AC1.4 Appropriate industry standards and regulations relevant to carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems

AC1.5 How to verify that job information and documentation is current and relevant and that the **plant**, instruments, access equipment and tools are fit for purpose

AC1.6 **Status** of the electrical supplies

AC1.7 Confirm, as necessary, that the electrical supply is suitable for the plumbing and domestic heating systems

AC1.8 Select, as required, electrical equipment, cables/wiring and components and confirm that they are:

a) of the right type and size

b) fit for purpose in accordance with the plumbing and domestic heating system's design

Range

AC1.1 **Limitations**

- multiphase supply (out of scope identification only)

- extra low voltage (in scope)
- low voltage single (in scope)

AC1.2 **Electrical supplies**

- extra low voltage and/or low voltage single:
    - control
    - communication
    - heating
    - lighting
    - power

AC1.3 **Electrical equipment**

- isolators
- circuit breakers
- fuses
- switches
- socket-outlets/fused-spurs
- earthing protection
- motor control equipment
- control panels – environmental control
- control devices – electrical, electronic, electro-mechanical

AC1.3 **Cables/wiring**

- PVC flat profile (twin and earth)
- flex including heat resistant (butyl) rubber etc

AC1.3 **Components**

- boiler
- central heating controls:
    - zone valves (2 port, 3 port, mid position and diverter)
    - programmer
    - timer
    - thermostats
    - programmable room stat
    - optimizer
    - weather compensators
    - frost stat
    - wiring centre
    - cylinder stat
    - wi-fi routers
    - wi-fi range extenders
- wiring centres
- immersion heater
- instantaneous shower
- shower pump
- hot tub
- macerator WC
- waste water pumps
- rainwater harvesting/greywater pumps
- heat producing or cooling appliances
- pumps
- fans

AC1.3 **Working environment**

- commercial
- domestic

AC1.5 **Plant**

- generators
- transformers for low voltage hand-tools
- lifting equipment
- access equipment

AC1.6 **Status**

- live
- dead

Learning outcome

The learner will know and demonstrate:

LO2 Industry standard safe isolation procedures

Assessment criteria

AC2.1 Correct means of electrical isolation prior to commencing **work**

AC2.2 Safely isolate **electrical equipment** and **components** associated with the **electrical supply** of the plumbing and domestic heating system

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Range

AC2.1 **Work**

- disconnection
- installation
- connection

AC2.2 **Electrical equipment**

- isolators
- circuit breakers
- fuses
- switches
- socket-outlets/fused-spurs
- earthing protection
- motor control equipment
- control panels – environmental control
- control devices – electrical, electronic, electro-mechanical

AC2.2 **Components**

- boiler
- central heating controls:
    - zone valves (2 port, 3 port, mid position and diverter)
    - programmer
    - timer
    - thermostats

    - programmable room stat
    - optimizer
    - weather compensators
    - frost stat
    - wiring centre
    - cylinder stat
    - wi-fi routers
    - wi-fi range extenders
- wiring centres
- immersion heater
- instantaneous shower
- shower pump
- hot tub
- macerator WC
- waste water pumps
- rainwater harvesting/greywater pumps
- heat producing or cooling appliances
- pumps
- fans

AC2.2 **Electrical supply**

- extra low voltage and/or low voltage single:
    - control
    - communication
    - heating
    - lighting
    - power

Learning outcome

The learner will know and demonstrate:

LO3 Safe installation, testing and decommission of electrical systems

Assessment criteria

AC3.1 Carry out **work** on **electrical equipment**, **cables/wiring** and **components** associated with the **electrical supply** and control of the plumbing and domestic heating system in accordance with the requirements of:

a) industry recognised methods and procedures
b) manufacturers' instructions

AC3.2 Identify that the electrical equipment, cables/wiring and components are in accordance with the requirements of the plumbing and domestic heating system

AC3.3 Check that the electrical equipment, cables/wiring and components are of proper **construction** in accordance with the requirements of the plumbing and domestic heating system

AC3.4 Functional test the electrical equipment and components associated with the electrical supply and control of the plumbing and domestic heating system in accordance with:

a) industry recognised methods and procedures
b) manufacturers' instructions

Range

AC3.1 **Work**

- disconnection
- installation
- connection

AC3.1 **Electrical equipment (fused spur outlet to appliances only)**

- isolators
- circuit breakers
- fuses
- switches
- socket-outlets/fused-spurs
- earthing protection
- motor control equipment
- control panels – environmental control
- control devices – electrical, electronic, electro-mechanical

AC3.1 **Cables/wiring**

- PVC flat profile (twin and earth)
- flex including heat resistant (butyl) rubber etc

AC3.1 **Components**

- boiler
- central heating controls:
    - zone valves (2 port, 3 port, mid position and diverter)
    - programmer
    - timer
    - thermostats
    - programmable room stat
    - optimiser
    - weather compensators
    - frost stat
    - wiring centre
    - cylinder stat
    - wi-fi routers
    - wi-fi range extenders
- wiring centres
- immersion heater
- instantaneous shower
- shower pump
- hot tub
- macerator WC
- waste water pumps
- rainwater harvesting/greywater pumps
- heat producing or cooling appliances
- pumps
- fans

AC3.1 **Electrical supply**

- extra low voltage and/or low voltage single:

- control
- communication
- heating
- lighting
- power

AC3.3 **Construction**

- insulation
- mechanical strength
- protection

Learning outcome

The learner will know and demonstrate:

LO4 Identification of faults and safe repair of electrical work

Assessment criteria

AC4.1 Identify and rectify of electrical **faults and deficiencies** on plumbing and domestic heating systems in accordance with:

a) industry recognised methods and procedures
b) manufacturers' instructions

Range

AC4.1 **Faults and deficiencies**

- appliance components:
  - micro switches
  - relays
  - pressure switches
  - printed circuit boards
  - pumps
  - fans
- control components:
  - thermostats
  - programmers/timers
  - electrically operated control valves
  - wiring centres
- deficiencies:
  - inadequate earthing provision
  - defective cable routing
  - defective termination
  - incorrect polarity
  - provision of inadequate circuit protection device

Unit 316 Electrical work and the control of plumbing and domestic central heating systems

Supporting information

Unit guidance

This unit is for plumbing and domestic heating technicians who, as part of their normal activities, carry out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems which:

- do not require the addition of a circuit to the fixed electrical installation.
- will only be associated with the disconnection, installation and/or connection of electrical equipment and components associated with the supply and/or control of plumbing and domestic heating systems.

The person performing this work must be able to comply with the correct procedures and practices for disconnecting, installing and/or connecting electrical equipment and components that supply and/or control plumbing and domestic heating systems.

This work must be in accordance with the current versions of the appropriate industry standards and regulations, the specification, industry recognised working practices, the working and natural environment. It will **not** involve the testing or commissioning of the fixed electrical installation and its constituent parts.

Operatives must know and understand the types, applications and limitations of electrical supplies, isolation and control equipment, earthing and overcurrent protection, cables and wiring associated with plumbing and domestic heating system work.

Unit 317 Install, commission, service and maintain plumbing and domestic central heating systems (On site portfolio of evidence)

Level:	3
GLH:	60
Assessment type:	Work log (Portfolio of evidence)
Aim:	This performance unit covers the requirements for learners to demonstrate their skills in the workplace. It includes safe installation, commissioning, and fault diagnosis across a range of components and systems.

Learning outcome

The learner will know and demonstrate:

LO1 Application of health and safety and welfare in the workplace

Assessment criteria

AC1.1 Select and use personal protective equipment
AC1.2 Ensure appropriate provision for **first aid** and **fire safety** is in place
AC1.3 Comply with information, warning, mandatory instruction and prohibition notices
AC1.4 Perform manual handling techniques
AC1.5 Ensure appropriate facilities are in place for welfare and personal hygiene
AC1.6 Transport and store tools and equipment
AC1.7 Verify **appropriate access and exit routes** to and from the work location
AC1.8 Demonstrate appropriate procedures are in place for reporting hazards
AC1.9 Carry out procedures for reporting hazards
AC1.10 Carry out procedures for the disposal of waste materials and products
AC1.11 Demonstrate safe working practices when joining pipework
AC1.12 Produce a risk assessment and method statement in accordance with organisational procedures
AC1.13 **Use access equipment** in the workplace

Range

AC1.2 **First aid**

- first aid kit
- accident book
- nominated person

AC1.2 **Fire safety**

- fire extinguisher
- evacuation procedure
- muster points

AC1.7 **Appropriate access and exit routes**

Candidates must be assessed on **three** of the following:

- adequate lighting
- routes free from obstruction
- follow safety signs and notices
- emergency exit routes in place
- appropriate barrier

AC1.13 **Using access equipment**

Candidates must be assessed on **two** of the following:

- step ladders
- ladders
- podium/platform

Learning outcome

The learner will know and demonstrate:

LO2 Preparing for the installation of plumbing and domestic heating systems and components

Assessment criteria

AC2.1 Check that all necessary job information is available

AC2.2 Liaise with other persons to confirm the detail of the installation work to be carried out

AC2.3 Comply with **health and safety requirements**

AC2.4 Carry out **preparatory work**

AC2.5 Comply with organisational procedures for **documentation** that is required during work operations

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Range

AC2.3 **Health and safety requirements**

Candidates must be assessed on **two** of the following:

- risk assessment
- method statements
- work permits

AC2.4 **Preparatory work**

Candidates must be assessed on **all** of the following:

- safe and unobstructed access to work areas
- safe storage of materials tools and equipment
- reporting pre-existing damage
- protecting the building fabric

Candidates must be assessed on:

- drilling walls or floors
- cutting holes and notches in timber floor joists
- cutting chases in wall or floor surfaces

AC2.5 **Documentation**
Candidates must be assessed on **three** of the following:

- variation order
- timesheets
- work programme
- requisitions
- delivery note

Learning outcome

The learner will know and demonstrate:

LO3 Installing plumbing and domestic heating systems and components in the workplace

Assessment criteria

AC3.1 Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed
AC3.2 Plan the installation and pipework routes using relevant job information
AC3.3 Complete installation work on a range of plumbing and domestic heating **systems**
AC3.4 Position and fix **pipework** and **components**
AC3.5 Connect pipework to system controls and main components
AC3.6 Complete a range of **jointing methods** during pipework installation
AC3.7 Carry out a **soundness test** to industry requirements on systems pipework and components

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Range

AC3.3 **Systems**
Candidates must be assessed on **cold and hot water systems** and **one** from the following:

- central heating systems
- sanitation systems
- gravity rainwater systems

AC3.4 **Pipework**
Candidates must be assessed on **three** of the following:

- copper
- plastic pressure pipe
- steel (screwed or pressed)
- stainless steel
- plastic (sanitary)
- rainwater

AC3.4 **Components**
Candidates must be assessed on **six** components from **Group A** with at least **three** on more than one occasion and **two** unique components from **Group B**:

- group A:
    - bath

    - WC
    - wash hand basin
    - sink
    - shower and tray
    - cylinder
    - boiler (connections)
    - soil stack system
    - rain water/guttering system
    - F&E/CWSC cistern
    - pump
    - motorised valves
    - radiator
    - water conditioners/filters
- group B:
    - booster pump/shower pump
    - accumulators/expansion vessels
    - fan convector
    - low loss header
    - macerator or waste water lifter/pump
    - greywater/rainwater station
    - water softener/filter
    - washing machine/dishwasher
    - underfloor heating circuit and underfloor manifold
    - outside tap installation
    - backflow protection components (e.g. EA, EB, EC or ED)
    - instantaneous water heater
    - boiling tap

AC3.6 **Jointing methods**

Candidates must be assessed on **four** of the following:

- compression
- push fit plastic pressure
- push fit waste
- threaded/screwed
- soft soldered
- crimped
- glued/adhesives
- fusion welded

AC3.7 **Soundness test**

- visual inspection
- notify
- initial fill
- stabilisation
- test to required pressure
- check for leaks
- check pressures after test period
- complete documentation and notify as required

Learning outcome

The learner will know and demonstrate:

LO4 Performing fault diagnosis and rectification procedures

Assessment criteria

AC4.1 Obtain **information** on system faults
AC4.2 Carry out diagnostic checks for a range of **faults**
AC4.3 Carry out **decommission procedures**
AC4.4 Carry out fault repair or replace system component
AC4.5 Re-commission and handover to the client

Range

AC4.1 **Information**

- end user
- manufacturer instruction
- fault diagnosis flow chart
- service history

AC4.2 **Faults**

Candidates must be assessed on **three** from **Group A** (common faults) and **three** from **Group B** (system faults):

- group A:
  - system debris
  - pump failure
  - leakage
  - trap seal loss
  - expansion and contraction
  - cistern failure
  - pumping over/persistent venting
  - emitter cold spots
  - TRV/valve
  - tap/valve failure
- group B:
  - accumulator expansion vessel failure
  - motorised valves not operating
  - heat exchanger failure
  - expansion valve
  - WC macerators/waste water lifter
  - sink waste disposal units
  - control failure
  - pressure relief valve
  - thermostat
  - programmer
  - air admittance valves
  - condensing boiler condensate
  - component failure

AC4.3 **Decommission procedures**

- notify relevant person
- isolate the fuel/electricity supply to the system as appropriate
- isolate water supply
- apply warning notices and signs
- drain system to a suitable location
- appropriately dispose of contents and any additives
- continuity bonding as required

- temporary capping of pipework sections as required
- notify building users
- alternative supplies as required

Learning outcome

The learner will know and demonstrate:

LO5 Commissioning plumbing and domestic heating systems in the workplace

Assessment criteria

AC5.1 Carry out a visual inspection of the **systems**
AC5.2 Charge the system to normal operating pressure and checking for leakage
AC5.3 Perform a soundness test to industry requirements
AC5.4 Flush the system with cold water on completion of soundness testing
AC5.5 Operate the system and take performance readings in order to compare them to the design specifications
AC5.6 Adjust system controls to establish that the system operates to its design specifications
AC5.7 Prepare commissioning records for completed systems
AC5.8 Instruct the customer in the efficient and effective operation of the system

Range

AC5.1 **Systems**
Candidates must be assessed on **two** of the following systems on **two** occasions:

- hot and cold water systems (one system)
- central heating systems
- sanitation and drainage system

Unit 317 Install, commission, service and maintain plumbing and domestic central heating systems (On site portfolio of evidence)(On site portfolio of evidence)

Supporting information

Evidence requirements

Evidence must be gathered across a **minimum of four different jobs/site addresses**. It is an expectation that candidates will require more than the minimum four jobs to meet the full range required. **All range items must be assessed unless the number of range items required is identified.**

The information below identifies the minimum **direct observation** requirements of the performance evidence for this unit.

A requirement of this qualification is that candidates are directly observed on a **minimum** of **six separate occasions** in the workplace by a suitably qualified assessor.

- **Observation 1** First fix installation of a significant amount of pipework and associated fixings and fittings from the required range, picking up the requirements for health and safety holistically as part of the visit.
- **Observation 2** First fix installation of a significant amount of pipework and associated fixings and fittings from the required range, picking up the requirements for health and safety holistically as part of the visit.
- **Observation 3** Second fix complete installation of two major components from the required range in Group A and associated pipework fixings and fittings, picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required component installations.
- **Observation 4** Second fix complete installation of two major components from the required range in Group A and associated pipework fixings and fittings, picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required component installations.
- **Observation 5** Complete commissioning of two of the system types from the required range, picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required system types.
- **Observation 6** Complete commissioning of two of the system types from the required range, picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required system types.

Gas Pathway

Unit 318 Combustion and properties of gas

Level:	3
GLH:	57
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit covers understanding of gas relevant to working in the domestic gas industry, and commissioning gas appliances.

Learning outcome

The learner will know and understand:

LO1 Natural gas supply network

Assessment criteria

AC1.1 Features of a **natural gas network**
AC1.2 **Operating pressure ranges**

Range

AC1.1 **Natural gas network**

- gas terminals
- pipe materials and sizes
- compressors
- pressure regulation
- storage
- gas quality

AC1.2 **Operating pressure ranges**

- low pressure
- medium pressure
- intermediate pressure
- high pressure

Learning outcome

The learner will know and understand:

LO2 Operation of pressure regulators

Assessment criteria

AC2.1 Need for, purpose and application of **pressure regulators**
AC2.2 Types of **pressure regulators**
AC2.3 Construction and operating principles of a compensated constant pressure regulator

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Range

AC2.1 and AC2.2 **Pressure regulators**

- meter regulator
- appliance regulator

Learning outcome

The learner will know and understand:

LO3 Factors that affect pressure loss and the equipment used to measure gas pressure

Assessment criteria

AC3.1 **Factors** affecting pressure loss
AC3.2 Operation, **checks** and use of a manometer
AC3.3 **Operation** and uses of a digital pressure gauge

Range

AC3.1 **Factors**

- temperature changes
- leaks

AC3.2 **Checks**

- check water level prior to testing

AC3.4 **Operation**

- check calibration of the digital manometer motorised valves

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Learning outcome

The learner will know and understand

LO4 Combustion of gases, and potential risks

Assessment criteria

AC4.1 **Characteristics of complete and incomplete combustion** including air and fuel requirements
AC4.2 **Causes of incomplete combustion**
AC4.3 Main constituents of complete and **incomplete combustion**
AC4.4 Pre and post aerated flames
AC4.5 **Symptoms and effects** when humans are exposed to carbon monoxide
AC4.6 Other sources of carbon monoxide and carbon dioxide found in dwellings
AC4.7 Typical ambient levels of carbon dioxide and identification of critical levels and the potential effects on the gas combustion process

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AC4.8 **Measures** necessary to ensure that exposure to carbon monoxide does not take place/is minimised
AC4.9 **Warning signs** associated with incomplete combustion
AC4.10 Regional differences in Building Regulations regarding carbon monoxide detection when installing and maintaining new or replacement fixed combustion appliances
AC4.11 Carbon monoxide **detectors** and indicators
AC4.12 Carbon monoxide **detectors** and indicator installation and location requirements

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Range

AC4.1 **Characteristics of complete and incomplete combustion**

- the combustion equation
- air requirements for combustion
- flammability limits of gases
- calorific values of gases:
    - Gross
    - Net
    - British thermal units (BTUs)
    - Kilowatts (kW)
    - Use of conversion charts
- wobbe number of gases

AC4.2 **Causes of incomplete combustion**

- causes of appliance incomplete combustion at the:
    - burner
    - combustion space
    - heat exchanger
    - flue

AC4.3 **Incomplete combustion**

- carbon monoxide
- soot deposits

AC4.5 **Symptoms and Effects**

- effects of exposure to carbon monoxide on the human body
- symptoms of CO poisoning
- advice to give to a person who describes symptoms of being affected by products of combustion
- advice to be given when a CO detector has activated
- ambient levels of CO in atmosphere
- levels of CO within dwellings and effect on electronic detectors
- causes of activation of CO detectors and indicators
- movement of products of combustion within properties and its effect

AC4.8 **Measures**

- primary measures – correct appliance installation and maintenance
- secondary measures – use of carbon monoxide detectors:
    - types of CO detectors available and standards of manufacture
    - the positioning requirements for carbon monoxide detectors
    - the associated maintenance requirements of CO detectors
    - causes of activation of CO detectors & indicators

AC4.9 **Warning Signs**

- around appliance location
- in appliance

AC4.11 and AC4.12 **Detectors**
- audible
- readable
- visual

Learning outcome

The learner will know and understand:

LO5 Gas burner operation, design, features and types

Assessment criteria

AC5.1 Layout features and operating principles of gas appliance **burners**
AC5.2 **Terms** related to gas appliance burners
AC5.3 How to diagnose **faults** in gas appliance burners
AC5.4 **Reasons for burner faults** that result in incomplete combustion

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Range

AC5.1 **Burners**
- pre and post aerated burners
- premix burners
- forced draught burners
- radiant burners

AC5.2 **Terms**
- flame speed
- ignition temperature
- venturi
- burner head
- burner (flame) retention

AC5.3 **Faults**
- flame picture
- sooting
- discolouration
- flame Chilling
- linting
- condition of the burner
- air supply faults
- condition and size of injectors

AC5.4 **Reasons for burner faults**
- gas rate/pressure settings
- effects of excessive pressure at the appliance (flame lift)
- aeration
- vitiation
- light back
- flame chilling

Learning outcome

The learner will know and understand:

LO6 Properties and characteristics of Natural Gas (NG) and Liquefied Petroleum Gas (LPG)

Assessment criteria

AC6.1 First, second and third family **gases** and their chemical symbols
AC6.2 **Characteristics** of NG and LPG
AC6.3 Additional characteristics and properties of **LPG**

Range

AC6.1 **Gases**

- chemical symbols:
  - methane (CH4)
  - propane (C_3H_8)
  - butane (C_4H_{10})
- gas characteristics
- viscosity
- families of gas:
  - 1st, 2nd and 3rd families
- relative density of gases compared to air
- explosive mixtures

AC6.2 **Characteristics**

- relative density
- calorific value
- gross and net calorific value
- Wobbe numbers
- flammability limits
- flame speed
- ignition temperature
- viscosity

AC6.3 **LPG**

- storage of LPG
- boiling points of LPG
- types of gases
- vapour pressure curves
- vaporisation and offtakes
- viscosity
- auto-refrigeration and excessive offtakes
- origins of LPG

Unit 319 Buildings, services and structures

Level:	3
GLH:	86
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit covers understanding of gas installation methods, ventilation and chimneys, and testing their performance.

Learning outcome

The learner will know and understand:

LO1 Installation requirements, methods, and materials for Natural Gas (NG) and Liquefied Petroleum Gas (LPG) pipework

Assessment criteria

AC1.1 Types of **pipe materials and fittings** suitable for carrying natural gas and/or LPG
AC1.2 Acceptable **jointing methods** for pipework used for domestic gas supplies
AC1.3 Correct **positioning, support and fixing** requirements for gas supply **pipework**
AC1.4 **General requirements** for pipework runs
AC1.5 Provision of **safety and control measures** to gas supply pipework
AC1.6 **Positioning, protection** and **fixing** methods for gas pipework, valves, systems and components
AC1.7 Requirements for **pipework** to multi-occupancy dwellings
AC1.8 **Procedures** for the disconnection of pipes and fittings including the use of temporary continuity bonds
AC1.9 **Precautions** to be taken when using exposed flames for soldering joints on existing gas installations meters
AC1.10 **Process** of sizing the **gas pipe work** in an installation for NG and LPG

Range

AC1.1 **Pipe materials and fittings**

- legislation and standards applicable to this subject area
- copper
- steel
- corrugated stainless steel
- MDPE
- up to 35mm/1¼" diameter
- standards for pipework and fittings
- actions to take with existing lead pipe

AC1.2 **Jointing methods**

- cleansing agents
- jointing methods:
    - Copper to copper
    - Mild steel to mild steel
    - Copper to mild steel
    - Press end connections
    - Steel semi-rigid pipework and termination
- restrictions and application of unions and compression fittings
- movable appliance hoses
- hoses
- safety precautions to take when jointing materials and fittings, including COSHH:
    - effects of flux on pipework
    - hot working and when to use alternative methods

AC1.3 **Positioning, support and fixing**

- requirements for sleeving pipework:
    - through building features such as walls and into meter boxes
- external surface mounted installation pipework
- ventilation size requirements for pipework installed within ducts
- ventilation requirements for protected shafts and voids
- accommodation for thermal movement of pipework
- protected areas

AC1.3 **Pipework**

- copper pipework
- mild steel pipework
- steel semi-rigid pipework

AC1.4 **General requirements**

- route
- protection of buildings
- appearance
- positioning requirements for gas controls/isolation valves
- exterior pipework
- minimum depth of pipework buried below ground
- pipework installed under the base of a wall or foundations
- pipework installed between joists in suspended floors or roof spaces:
    - solid timber
    - metal web
    - timber engineered
    - installed across solid timber joists fitted with flooring
- installed in floors or walls:
    - sheathing requirements
    - buried in concrete floors/walls
    - installed behind dry lined walls
    - installed within stud partition walls
    - installed under the base of a wall or foundation
- pipework:
    - in voids
    - in ducts/shafts
    - in roof spaces
    - laid in joisted floors

    - notching and drilling solid timber floor joists
    - passing through cavity walls
    - within timber/light steel frame walls
- entry to dwellings from medium pressure meter installations
- pipework passing through a timber frame/masonry wall - accommodating movement
- pipework within timber constructed walls
- fixing installation pipework when connected to a meter not securely restrained

AC1.5 **Safety control measures**

- positioning requirements adjacent to other services
- corrosion protection
- gas pipe identification
- methods of accommodating movement of pipework in buildings
- main equipotential bonding (minimum cross sectional area)
- disconnection of pipes and fittings – use of temporary continuity bond

AC1.6 **Positioning**

- in:
    - floors
    - ducts
    - through walls
    - buried in walls
    - multi-occupancy buildings
    - shafts, stairs, lifts or other protected fire escape routes (protected areas)
- to comply with:
    - industry standards
    - Gas Safety (Installation & Use) Regulations
    - British Standards
    - Building Regulations

AC1.6 **Protection**

- sleeving
- purposed designed channels
- fire stops
- purposed designed shafts

AC1.6 **Fixing**

- masonry plastic plug and screw
- plaster board fixings
- timber screw
- anchor bolt

AC1.7 **Pipework**

- safety requirements for fire stopping in buildings containing flats or maisonettes
- safety requirements for pipework inside a protected shaft or other fire escape route (protected areas)

AC1.8 **Procedures**

- apply bonding clip to upstream section of pipework
- apply bonding clip to upstream and downstream sections of pipework
- ensure section of pipework removed is within the two applied bonding clips
- following the reinstatement of the pipework or meter remove the temporary bonding clips

AC1.9 **Precautions**

- remove meter and cover the inlet and outlets
- place meter a safe distance from the soldering
- ventilate area

AC1.10 **Process**

- calculate the pipe size
- factors of the calculation:
    - actual pipe length
    - allowances for elbows, tees and bends
    - total equivalent length
    - gas rate
    - pipe diameter

AC1.10 **Gas pipe work**

- copper
- steel
- supply from meter to appliance branches
- supply from main branch connection to appliance termination

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Learning outcome

The learner will know and understand:

LO2 Ventilation requirements, types and methods

Assessment criteria

AC2.1 General **requirements** and reasons for **ventilation** in regard to gas appliances and installations

AC2.2 **Ventilation** type

AC2.3 Term ‘restricted location’ and the associated requirements for ventilators/grilles

AC2.4 Terms ‘gross’ and ‘net CV’ and their effect on ventilation calculus

AC2.5 Methods of calculating the **ventilation requirements**

AC2.6 Ventilation requirements of open flued and flueless **decorative fuel effect space heaters**

AC2.7 Potential **adverse effects** on ventilation

AC2.8 **Criteria** for ventilation **openings and grilles**

AC2.9 Correct and incorrect **positioning, location and restrictions** of air vents

AC2.10 Requirements for the provision of ventilation **labels/notices**

AC2.11 Ventilation requirements/paths for vertex flues

AC2.12 Ventilation requirements for gas appliances installed in dwellings with passive stack ventilation systems

AC2.13 Minimum separation distances between ventilators and appliance flue terminals

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Range

AC2.1 and AC2.2 **Ventilation**

- legislation and standards applicable to this subject area
- permanent ventilation
- adventitious ventilation
- compartment ventilation
- air supply requirements for cooling and combustion

- purge ventilation

AC2.1 and AC2.5 **Ventilation requirements**

- open-chimney appliances
- flueless appliances
- appliances in compartments
- multiple appliance ventilation

AC2.6 **Decorative fuel effect space heaters**

- single appliances
- DFEs in adjoining rooms
- in rooms with multiple appliances
- oil and solid fuel appliances

AC2.7 **Adverse effects**

- oil or solid fuel appliances and flue systems
- extract fans
- cooker hoods
- tumble dryers
- solid fuel appliances
- double glazing
- cavity wall insulation
- general draft proofing

AC2.8 **Criteria**

- rigid
- not closable
- do not have a fly-screen
- do not have openings narrower than 5mm
- size of free area available

AC2.8 **Openings and grilles**

- intumescent air vents
- terracotta
- plastic with angled louvres

AC2.9 **Positioning, location and restrictions**

- recommended siting/location of Vents
- installation of vents through:
    - walls
    - windows
    - floors
    - ceilings
    - ducts
- ventilation paths via other rooms
- ventilation paths to compartments, including ducts
- mechanical ventilation and extraction

AC2.10 **Labels/notices**

- compartment
- balanced compartment
- SE duct

- CFS labelling

Learning outcome

The learner will know and understand:

LO3 Types and operation of suitable chimney systems for gas appliances

Assessment criteria

AC3.1 How gas appliances are classified according to the **type of chimney or flue** used
AC3.2 Types and general layout features of **chimney and flue construction**
AC3.3 **Working principles** of flue systems serving gas appliances
AC3.4 **Installation requirements** for new and existing chimney and flue
AC3.5 **Design requirements** of chimney and flue systems used with gas appliances
AC3.6 Requirements for installing **chimney fans** to open flues and chimney systems
AC3.7 Flueing requirements for **balanced compartments** used with open flued appliances
AC3.8 Requirements for the **termination** of flue systems serving gas appliances

Range

AC3.1 **Type of chimney or flue**

- legislation & standards applicable to this subject area
- flueless
- open flued:
  - natural draught
  - forced (fanned) draught
- room sealed:
  - natural draught
  - forced (fanned) draught
  - vertex type appliances

AC3.2 **Chimney and flue construction**

- rigid chimney types:
  - brick/masonry
  - pre-cast flue blocks
  - metallic (single and double wall flues)
- flexible metallic liner installation
- use of flue box systems
- shared (common) chimney systems:
  - SE and U Ducts
  - Communal Flue Systems (CFS)
- legislation that applies to chimneys and flues that serve gas appliances:
  - Gas safety legislation
  - exchange of information and planning requirements for chimneys
- plume management

AC3.3 **Working principles**

- open flued chimneys
- room sealed - natural draught
- room sealed – fanned draught
- vertex type flues

AC3.4 **Installation requirements**

- requirements of designer, builder, provider or installer when installing gas chimneys
- chimney certificates
- existing solid fuel chimneys:
    - suitability - checks required
    - minimum size of unlined chimney used for gas fire before terminal is required
    - minimum size of side openings for slabbed over chimneys
    - minimum cross sectional area of new chimney installations – gas fires
    - operation of dampers and restrictor plates
    - effects of other fuels on chimneys and need for cleaning
    - minimum void dimensions below appliance connections
    - catchment spaces and standard dimensions/volumes
    - types of flue liners – during construction (salt glazed clay etc.):
        - poured/pumped concrete flue liners
        - pre-cast flue blocks
        - flexible flue liners
    - restrictions on use of poured concrete liners
    - sealing and support for flexible flue liners in chimneys
    - inspection of chimneys through loft spaces
    - chimney height/appliance types where liners are required
    - sealing chimney voids
    - fitting bird guards to chimneys
    - suitable and unsuitable terminals for space heaters including radiant, inset and DFE
- pre-cast flue design:
    - flue design, standards, operation, routing, connection, termination
    - minimum cross-sectional area of new gas flue blocks
    - minimum requirement of vertical flue blocks before off sets
    - jointing material for pre-cast flue blocks
    - minimum flue size diameter for connecting pre-cast transfer blocks to termination point
    - effects of temperature on installation requirements for pre-cast flues
    - classification of gas appliances - flueless, open flue, room sealed
- chimneys for individual open flue natural draught appliances:
    - construction and operation of chimney
    - types of chimney material – cement based, and metallic
    - methods of jointing chimney components
    - termination positions for chimney outlets
    - ridge terminal positions
    - effects on terminal positions by:
        - adjacent structures
        - basement areas
        - light wells
        - retaining walls
    - dealing with downdraught on steeply pitched roofs
    - restrictions to siting and lengths of chimney run to avoid condensation
    - minimum up-stand for chimneys passing through tiled or slated roofs
    - clearances when passing through combustible material
    - chimneys passing adjacent to combustible material or through other dwellings
    - terminals and/or guards – protection against wildlife
    - prefabricated metal starter box for space heaters
    - passive stack ventilation systems in houses, where open flue natural draught appliances are fitted
    - types of chimney material – cement based, and metallic
- fan draught chimneys for open flue appliances:

    - requirements prior to installing fans in secondary flues
    - additional requirements when fans are installed in secondary flues
    - fan dilution and shared open flue, fanned draught systems in domestic dwellings
- shared open flue chimneys for natural draught appliances:
    - two or more appliances connected to same flue
    - appliances with a common flue in same room
    - labelling appliances on shared flues installed on different floors
    - maintenance of shared flue systems
- room sealed natural draught chimney configurations for appliances:
    - balanced flue construction
    - outlet position:
        - horizontal to an opening, relating to appliance net input
        - below an opening, relating to appliance net input
        - above an opening, relating to appliance net input
        - below gutters, soil pipes, drainpipes and eaves
        - in car ports
    - balanced flue terminal guards
- room sealed fanned draught chimney configurations for appliances:
    - restrictions on lengths, bends etc. for fanned draught room sealed appliances
    - restrictions for outlet positions including horizontal and vertical configurations
    - enclosing chimneys
    - proximity of flue duct outlets to boundaries
    - identify unsafe situation of room sealed fanned flue system enclosed without sufficient inspection facility
- balanced compartments for open flue appliances:
    - ducted air positioning
    - cross sectional areas of air inlet ducts
    - compartment construction
- room sealed appliances for shared chimneys (SE-ducts, U-ducts and CFS):
    - construction and operation of SE-ducts, U-ducts and CFS
    - categories of appliances suitable for installation
    - chimney outlet positions for roof terminals
    - labelling air inlet ducts
    - labelling replacement appliances
    - maintenance of shared flue systems
    - requirements for replacement appliances
    - NRV requirements for appliance/exhaust ducts for CFS
- condensing flues:
    - condensate disposal position termination for appliances of heat input ≤ 4 Kw
    - plume management kits
    - differing air inlet duct and terminal positions
    - terminal guards for plume kit air inlets
- chimneys for vertex appliances:
    - construction and operation of vertex chimney
    - minimum height of appliance draught break above roof insulation
- room sealed positive pressure combustion chamber appliances:
    - types
    - causes of leakage of products of combustion
    - checks prior to fitting case, to include:
        - back plate inspection
        - appliance case
        - screws
        - case seals
    - installation and spillage testing new or used appliances when MIs are not

available
    - alternative methods of compliance when inspection hatches are not available for flues in voids
    - actions required where fumes, smells or spillage have been reported/encountered
- open, balanced and fan assisted chimneys:
    - insulation for chimneys for open flue appliances
    - condensing appliance chimneys
    - chimney maintenance
    - guards for balanced flue terminals
    - effects and hazards of inadequately sealed flue liners
    - incorrect applications of flue liners
    - identify difference of vertex systems to vertical room sealed chimney configurations

AC3.5 **Design requirements**

- requirements of designer, builder, provider or installer when installing gas chimneys
- requirements for chimney/hearth certificates
- chimney system design:
    - distance requirements when passing through combustible material
    - special requirements for chimneys passing adjacent to combustible material or through other dwellings
- temperature effects and condensation problems caused by flue pipe runs
- requirements for the catchment space to open flued space heaters
- open flued chimney system:
    - parts of an open flue chimney system
- room-sealed chimney system:
    - parts of a room sealed flue chimney system
    - natural and fanned draught

AC3.6 **Chimney fans**

- requirements prior to installing fans in secondary flues
- additional safety requirements when fans are installed in secondary flues
- requirements for fan dilution and shared open flue, fanned draught systems in domestic dwellings

AC3.7 **Balanced compartments**

- compartment construction
- ducted air positioning
- cross sectional areas of air inlet ducts

AC3.8 **Termination**

- room sealed flue positions
- chimney outlets in relation to courtyard and lightwell terminations
- restrictions applicable to use of plumbing kits
- condensing appliances
- terminal guard requirements
- open flue terminal positions:
    - flue/ chimney outlet locations/terminal positions - before 2001
    - flue chimney outlet locations/terminal positions - after 2001
    - methods of dealing with down-draught on steeply pitched roof

Learning outcome

The learner will know and understand:

LO4 Methods for checking and testing chimney performance

Assessment criteria

AC4.1 Points to be checked in the **visual inspection** of a flue system prior to undertaking commissioning of the gas appliance and chimney/flue system
AC4.2 Factors that can affect **flue system performance**
AC4.3 **Causes** of leakage of combustion products from room sealed positive combustion chamber pressure appliances
AC4.4 **Installation and testing** appliances when manufacturers' instructions (MIs) are not available
AC4.5 **Actions** to take when inspection hatches are not available for flues in voids
AC4.6 Chimney information requirements
AC4.7 Chimneys/flues **testing, commissioning and maintenance**
AC4.8 Requirement to inspect chimneys throughout their length (including in lofts)
AC4.9 Responsibilities for checking shared flues

Range

AC4.1 **Visual inspection**

- legislation and standards applicable to this subject area
- open flue systems
- room sealed flue systems – natural draught and fan assisted
- vertex type appliances

AC4.2 **Flue system performance**

- downdraught conditions
- wind effects at the appliance termination
- passive stack ventilation
- extraction fans sited in the vicinity of open flued appliances

AC4.3 **Causes**

- broken seal
- damaged casing

AC4.4 **Installation and testing**

- annual service if you cannot locate a period from MIs
- refer to information on data badge for correct pressures

AC4.5 **Actions**

- risk assess installation
- classify installation in accordance with IGEM/G/11
- installation of a CO Monitoring Safety Shut Off System
- carry out regular servicing and maintenance

AC4.7 **Testing, commissioning and maintenance**

- visual inspection:
  - flue route is free from obstruction
  - free from material deterioration
  - correct materials/linings are used

    - sockets and fittings face the correct way
    - no signs of leakage
    - termination type and location
- smoke/flow test
- check for spillage
- check voids
- check for gas escapes
- correct termination of gases

Unit 320 Gas safety

Level:	3
GLH:	119
Assessment type:	e-assessment (multiple choice questions)
Aim:	This unit covers the core gas safety requirements that apply when working in the domestic gas industry.

Learning outcome

The learner will know and understand:

LO1 Safety, legislation and standards within the gas industry

Assessment criteria

AC1.1 Gas **industry legislation**
AC1.2 **Information available** to Gas Safe registered operatives
AC1.3 **Gas Safety** (Installation & Use) **Regulations**
AC1.4 Features of **gas legislation**
AC1.5 How and when to use the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) procedures
AC1.6 Registration and Competence process that applies to gas engineers
AC1.7 Safety, legislation and standards applicable to relevant associated services such as water and electricity

Range

AC1.1 **Industry legislation**

- application of Gas Safety (Installation & Use) Regulations to work activities
- application of Relevant Building Regulations & Standards:
  - in the devolved administrations
  - gas supplies and appliances in high risk buildings
  - notifications
- precautionary actions required to prevent use of unsafe installations
- UKLPG COPs
- Pressure Systems Safety Regulations

AC1.2 **Information available**

- Legislative Normative and Informative Document List
- industry standard updates
- safety alerts
- technical bulletins
- IGEM/G/11

AC1.3 **Gas Safety Regulations**

- Reg.2 General interpretation and application 2 (1), (2), (3), (4), (5) c (iii), (6), (7) & (8)
- Reg.3 Qualification and supervision 3 (1), (2), (3), (5), (6), (7) & (8)
- Reg.4 Duty on employer
- Reg.5 Materials and workmanship 5 (1) to (3)
- Reg.6 General safety precautions 6 (1) to (6)
- Reg.7 Protection against damage 7 (1) to (3)
- Reg.8 Existing gas fittings 8 (1) to (3)
- Reg.9 (1) to (4)
- Reg.10 Maintaining electrical continuity
- Reg.14 Regulators 14(1), (5), (6), (7)
- Reg.18 Safe use of pipes 18 (1) and (2)
- Reg.19 Enclosed pipes 19 (1) to (6)
- Reg.20 Protection of buildings
- Reg.22 Testing and purging of pipes 22 (1) to (3)
- Reg.23 Marking of pipes 23 (1) and (2)
- Reg.25 Interpretation of Part E
- Reg.26 Gas appliances – safety precautions 26 (1) to (10)
- Reg.27 Flues (1) to (4)
- Reg.30 Room-sealed appliances (1) to (3)
- Reg.32 Flue dampers (2) and (3)
- Reg.33 Testing of appliances 33(1) to (3)
- Reg.34 Use of appliances 34 (1) to (3)
- Reg.35 Duties of employers and self-employed persons
- Reg.36 Duties of landlords 36 (1) to (12)
- Reg.37 Escape of gas 37 (1) to (4)

AC1.4 **Gas legislation**

- The Gas Act
- Gas Safety (management) Regulations
- Gas Safety (rights of entry) Regulations
- Gas Safety Regulations affecting Northern Ireland and Isle of Man

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Learning outcome

The learner will know and understand:

LO2 Gas emergency actions and procedures

Assessment criteria

AC2.1 **Responsibilities and appropriate actions** to be taken in the event of a gas emergency

AC2.2 Gas Emergency **Priorities**

Range

AC2.1 **Responsibilities and appropriate actions**

- reporting gas escapes
- responsibilities of the gas user
- responsibilities of the gas operative to give gas users advice and safety information
- responsibilities of the gas engineer
- turning off at emergency controls

- elimination of ignition sources
- reduction of gas concentrations via ventilation
- action by the gas transporter
- action by the LPG Supplier
- action if gas continues to escape after turning off supply
- action to stop a gas escape downstream of ECV/AECV
- the role of the gas emergency service provider
- the advice to be given to customers/general public:
    - including where to find the emergency telephone number and how to isolate in the event of a gas escape

AC2.2 **Priorities**

- protect life
- protect property
- secure the escape
- leave the site safe

Learning outcome

The learner will know and understand:

LO3 Unsafe situations, emergency notices and warning labels

Assessment criteria

AC3.1 Purpose and scope of the Unsafe Situations Procedure
AC3.2 Criteria for dealing with each of the **unsafe situation's** categories
AC3.3 How the **unsafe situations procedure** is applied
AC3.4 **Unsafe situations** identification and classification
AC3.5 Purpose and use of the associated warning **notices** and labels
AC3.6 Selection and issue of appropriate warning/advisory **notices**

Range

AC3.2 and AC3.3 and AC3.4 **Unsafe situations**

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

AC3.3 **Procedure**

- immediate danger to life
- situation that may lead to an unsafe situation
- isolation if required
- apply suitable warning notice

AC3.5 and AC3.6 **Notices**

- MP gas supply
- warning notice forms
- advisory notices:
    - appliance use

    - appliance shut off
    - work in progress
    - electrical bonding
- landlord/Homeowner Gas Safety Record
- gas Safety Inspection Form
- Benchmark Maintenance Report
- Service/Maintenance Checklist(s)
- Chimney/Hearth Notice Plate
- issuing to appropriate persons
- Un-commissioned Appliance Label
- Balanced Compartment Label

Learning outcome

The learner will know and understand:

LO4 Operation and positioning of emergency controls and valves

Assessment criteria

AC4.1 Installation, operation and **positioning** requirements for **Emergency Control Valves** (ECV)

AC4.2 Installation, operation and positioning requirements for Appliance Isolation Valves (AIV)

AC4.3 Associated labels required for **Emergency Control Valves** (ECV)

AC4.4 **Process** to follow when identifying **incorrectly positioned or faulty** Emergency Control Valves (ECV), Additional Emergency Control Valves (AECV) and Meter Inlet Valves (MIV)

Range

AC4.1 and AC4.3 **Emergency control valves**

- natural gas/LPG meter installations
- remote meter installations
- multiple occupancy meter installations
- external risers
- internal risers
- services into buildings
- inside and outside meter positions
- Additional Emergency Control Valves (AECV)
- Meter Inlet Valves (MIV)

AC4.1 **Positioning**

- ECVs for bulk storage vessels
- the operation of the ECV and the correct positioning of them, where reasonably practicable
- remote meter installations and the use of additional emergency controls, and where these should be fitted
- meter inlet valves and where these should be located

AC4.4 **Process**

- identify unsafe situation
- remedy access
- tightness test

- notify gas supplier to move supply, or replace ECV

AC4.4 **Incorrectly positioned/faulty**
- ECV is inaccessible
- meter inlet valve not fitted on a medium pressure installation
- fault is diagnosed on an emergency control valve

Learning outcome

The learner will know and understand:

LO5 Low pressure domestic gas meters, regulators and housings

Assessment criteria

AC5.1 Installation methods and requirements for the installation of Natural Gas and LPG **meter installations**
AC5.2 Associated meter **labels** required for primary and secondary meters
AC5.3 Operation and accuracy of gas positive displacement meters
AC5.4 Medium pressure (MP) installations identification
AC5.5 Sealing meter regulators
AC5.6 **Legislation and Standards** applicable to domestic meters
AC5.7 **Factors** to consider when installing a domestic meter
AC5.8 **Types** of gas meter housings and compartments
AC5.9 Suitable locations and fixing requirements for gas meter housings and compartments
AC5.10 Differences between low pressure and medium pressure gas meter houses and compartments
AC5.11 Gas operatives' responsibilities and the associated labels for meter housings and compartments

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Range

AC5.1 **Meter**
- U6
- E6
- G4
- Inferential
- Positive displacement

AC5.1 **Installations**
- primary meters
- secondary meters
- prepayment meters
- locations

AC5.2 **Labels**
- gas emergency label
- isolation valve direction label

AC5.6 **Legislation and Standards**
- LPG
- Natural Gas
- terms and acronyms

AC5.7 **Factors**

- location
- load
- future demand
- incoming supply
- diversity factors

AC5.8 **Types**

- surface mounted
- semi-concealed
- built-in meter boxes
- medium pressure installations
- purpose built meter housings/enclosures

Learning outcome

The learner will know and understand:

LO6 Methods and requirements to tightness test and purge small gas installations

Assessment criteria

AC6.1 Points when **tightness testing of an installation** should be carried out
AC6.2 How differing **system types and configurations** impact on the tightness testing procedure
AC6.3 How to measure, calculate and record gas system installation volumes for tightness testing and direct purging activities
AC6.4 **Procedure, equipment, and legislative requirements** for applying **direct purging** of gas **systems**
AC6.5 Medium pressure regulator sets where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, whether a meter inlet valve (MIV) is fitted
AC6.6 **Tightness testing procedures** for gas supply systems
AC6.7 Routines and sequences for direct purging of gas systems, appliances and components
AC6.8 Actions to take to **investigate and repair** suspected leakage from gas supplies and components
AC6.9 Industry practices and procedures for tracing and repairing gas escapes
AC6.10 **Actions** to be taken when a smell of gas persists following a gas tightness test

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Range

AC6.1 **Tightness testing of an installation**

- before work commences on existing systems
- on completion of work on new and existing gas systems
- following the report of a gas escape

AC6.2 **System types and configurations**

- maximum installation volume for individual tightness tests (0.035m³):
  - calculating pipe volume; Fittings volume; Meter volume
- pipe diameter up to 35mm
- inlet pressure exceeds 75 mbar without meter inlet valve
- different meter types:
  - diaphragm U6/G4/U16/G10

    - ultrasonic E6
    - single dwellings
    - multiple dwellings with emergency control valves only
- Anti-tamper devices

AC6.4 **Procedure, equipment and legislative requirements (purging)**

- installations with an IV of 0.02 m3 or under may be purged to atmosphere
- any accumulation of gas within confined spaces needs to be avoided
- area in which the purge is taking place must not be left unattended
- installations with an IV over 0.02 m3 and not more than 0.035 m3, need to be purged through a cooking appliance burner or a temporary burner connected to the installation
- installation volumes estimated using the methods in IGEM/UP/1B latest Edition

AC6.6 **Tightness testing procedures**

- testing new installation pipework (no meter connected)
- testing new installations (meter connected) with or without appliances connected
- testing existing installations (meter connected) with or without appliances connected to ensure the installation doesn't exceed the maximum permissible pressure drop
- testing existing medium pressure fed installations where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, where a meter inlet valve (MIV) is fitted, or no meter inlet valve is fitted
- medium pressure system without a meter inlet valve (MIV)
- permissible pressure loss.
- issue gas testing and purging certificates

AC6.8 **Investigate and repair**

- visual inspection
- use of gas detection equipment
- use of leak detection fluid
- dealing with let-by

AC6.10 **Actions**

- when the emergency control valve/additional emergency control valve/meter inlet valve is turned off
- when a leaking installation cannot be repaired

Learning outcome

The learner will know and understand:

LO7 How to check and set gas installation operating pressures at gas meters and LPG regulators

Assessment criteria

AC7.1 **Factors** which can affect the pressure readings at meter regulators
AC7.2 **Process** for setting **regulators**
AC7.3 **Procedures** for checking the gas supply for installing appliances
AC7.4 Procedures to take when **incorrect pressure readings are encountered** in gas supply systems
AC7.5 **Emergency Service Provider (ESP)** response and joint investigation procedure

Range

AC7.1 **Factors**

- factors affecting pressure loss
- effects of low flow rates & high flow rates on regulator outlet pressures (18.5 – 23 mbar)
- effects of pressure absorption across the primary meter installation

AC7.2 **Process**

- remove seal and cap from regulator
- attach manometer to meter outlet
- turn adjustment clockwise or anti-clockwise to adjust pressure

AC7.2 **Regulators**

- low pressure
- medium pressure

AC7.3 **Procedures** (IGEM-G-13)

- pre installation
- commissioning:
    - maximum appliance load
- post commissioning

AC7.4 **Incorrect pressure readings are encountered** (IGEM-G-13)

- following reports of poor pressure/failure to achieve operating pressure and/or heat input
- reporting of low pressure process

AC7.5 **ESP** (IGEM-G-13)

- initial actions
- follow up actions
- checking for incident conditions
- actions to resolve service fault

Learning outcome

The learner will know and understand:

LO8 How to safely assess the potential risks, tightness test and re-light temporarily isolated appliances

Assessment criteria

AC8.1 **Process and safety factors** associated with relighting temporarily isolated appliances

AC8.2 Correct **actions** required when un-commissioned appliances and systems are identified

AC8.3 Correct **actions** required when pipework and appliance(s) are not tested (commissioned) when the gas supply is re-established

Range

AC8.1 **Process and safety factors**

- confirmation that the installation is gas tight
- system and appliances are purged of air
- appliance(s) are re-lit
- satisfactory operation of user controls is confirmed
- visual risk assessments are carried out for unsafe situations

AC8.2 and AC8.3 **Actions**

- commission using MI
- if cannot be commissioned, isolate and disconnect

Learning outcome

The learner will know and understand:

LO9 Requirements to check and set appliance burner pressures and compare measured gas rates with published figures

Assessment criteria

AC9.1 **Procedures** for taking **pressure readings** in domestic gas supply systems
AC9.2 Methods of determining and/or setting **gas appliance working pressures**
AC9.3 Methods of **determining gas rates at appliances**
AC9.4 **Reasons** for excessive pressure loss across the installation and at the appliances

Range

AC9.1 **Procedures**

- let-by test
- stabilisation
- 2 minute test
- document
- repeat if required

AC9.1 **Pressure readings**

- measurement of pressure
- types of pressure gauges
- use of pressure gauges
- static pressure at the meter
- working pressure at the meter
- working pressure at appliances

AC9.2 **Gas appliance working pressures**

- fixed rated appliances
- range rated appliances
- variable-rated appliances

AC9.3 **Determining gas rates at appliances**

- use of manufacturer data (appliance input)
- use of meter test dial/index for calculation of gas consumption rate
- taking gas rates on smart meters

AC9.4 **Reasons**

- undersized pipework
- blocked pipework
- blocked appliance filter

Learning outcome

The learner will know and understand:

LO10 Principles of operation and methods of testing gas appliance safety controls

Assessment criteria

AC10.1 Types of **gas control devices** used for gas appliances and their operating principles
AC10.2 Types and operating principles of **flame protection and other safety devices** used in gas appliances
AC10.3 Types and operating principles of **thermostats** used to control heat emitted from gas appliances
AC10.4 Sequence of operation of controls/devices
AC10.5 Information required for spare part identification

Range

AC10.1 **Gas control devices**

- pressure regulators
- low pressure cut-off valves
- thermal cut-off valves
- gas cocks/valves
- cooker hotplate lid control valves
- electric solenoid valves
- excess flow valves

AC10.2 **Flame protection and other safety devices**

- vapour pressure devices
- thermoelectric valves
- flame conduction & rectification systems
- interrupter devices
- atmosphere sensing devices
- spillage detection devices
- multifunctional control valves

AC10.3 **Thermostats**

- bimetallic
- liquid expansion
- vapour pressure
- electrical control
- electrical overheat/limit
- thermistors

Unit 321 Specific core gas safety

Level:	3
GLH:	109
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit covers the gas safety requirements that apply when working in the domestic gas industry.

Learning outcome

The learner will know and demonstrate:

LO1 Gas safety controls are operating correctly, and actions required when unsafe or ineffective operation is found

Assessment criteria

AC1.1 Safely diagnose correct, unsafe or ineffective operation of **gas control devices, flame protection and other safety devices** and **thermostats**

AC1.2 **Actions** to take when defective or unsafe control operation is identified

Range

AC1.1 **Gas control devices**

- pressure regulators
- low pressure cut-off valves
- thermal cut-off valves
- gas cocks/valves
- cooker hotplate lid control valves
- electric solenoid valves
- excess flow valves
- multifunctional control valves

AC1.1 **Flame protection and other safety devices**

- vapour pressure
- thermoelectric valve
- flame rectification
- flame conduction
- atmosphere Sensing Device
- spillage Detection Device
- interrupter Devices

AC1.1 **Thermostats**

- bimetallic
- liquid expansion

- vapour pressure
- electrical Thermostats
- thermistors

AC1.2 **Actions**
- isolate gas and electricity supplies, where necessary
- repair or replace faulty gas safety control/devices
- check work carried out is gas tight
- confirm correct operation of repaired/ replaced gas safety controls/devices to MIs
- explain safe operation of gas safety controls/devices

Learning outcome

The learner will know and demonstrate:

LO2 Construction and operation of chimneys used for domestic gas appliances

Assessment criteria

AC2.1 Gas appliances according to their **chimney types**
AC2.2 **Classifications** of appliances

Range

AC2.1 **Chimney types**
- natural draught open flued
- natural draught room sealed
- positive and negative procedure
- vertex flues
- SE-duct and U-Duct
- balanced compartment
- multifunctional control valves
- Communal Flue Systems (CFS)

AC2.2 **Classifications**
- flueless: appliance classification A
- open chimney: appliance classification B
- room sealed: appliance classification C

Learning outcome

The learner will know and demonstrate:

LO3 How to carry out chimney performance checks

Assessment criteria

AC3.1 **Checks** on **open chimney systems**
AC3.2 How to identify **correct and incorrect open chimney installations**
AC3.3 **Checks** on **room sealed chimney systems**
AC3.4 How to identify **correct and incorrect room sealed chimney installations**
AC3.5 Chimney operational **tests**
AC3.6 **Factors** that can affect flue system performance
AC3.7 Room sealed chimney **tests**

Range

AC 3.1 and AC 3.3 **Checks** (as appropriate to chimney system)

- visual checks throughout the length
- confirmation of correct type
- adequate cross-sectional area
- fitness for intended appliance
- serves only one room or appliance
- terminal position meets current legal requirements
- joint between terminal and chimney system is weather tight
- adequate support
- clearance from obstructions
- no corrosion or cracking
- use of bends meets current requirements
- appliance draught diverter correctly installed and in good condition
- secondary flue correctly positioned and in good condition
- starter block correctly sized and positioned
- catchment space correct and correct measurement and free from debris
- joints correctly made
- no visual signs of spillage of combustion products
- correct space between flue and combustible material
- flexible flue liner correctly sealed at base and terminal position
- connection into a pre-lined chimney (clay) is correct
- seals on balanced natural and fan flues in good condition and correctly installed
- balanced flue appliance seals in good condition and correctly installed
- inspect a concealed fan assisted chimney installation
- checking case seals/case integrity
- checking flue pipe/air inlet connections for leakage
- checking/testing of positive pressure case appliances
- pluming kits

AC3.1 **Open chimney systems**

- natural draught chimneys
- metallic flexible flue liners

AC3.2 **Correct and incorrect open chimney installations**

- cement based and metallic rigid:
    - jointing
    - adapters
    - bends
    - supports
    - spacing between chimney and combustible material
    - ridge terminals and ridge tile adaptor
    - flueing into a pre-lined chimney (clay lined)
- flexible flue liners:
    - joining at base and at chimney outlet using appropriate adaptors
    - clamping at chimney outlet position
    - sealing annular space between liner and chimney
    - sealing voids at chimney base – pipework etc

AC3.3 **Room sealed chimney systems**

- natural draught
- fan assisted

- vertex flue appliances
- balanced compartments for open flue appliances
- SE-ducts, U-ducts and CFS
- condensing flues

AC3.4 **Correct and incorrect room sealed chimney installations**
- natural draught:
    - flue duct cuts
    - assemble, adjust and seal to MIs
    - flue terminal guards against balanced flue terminal
- fan assisted:
    - number of bends within flue duct length is to MIs
- calculate the ventilation for a vertex system

AC3.5 **Tests**
- chimney/flue flow test
- chimney spillage test
- chimney/flue testing procedures with appliances sited in the vicinity of extraction fans
- testing fanned draught open-flue systems and associated safety controls

AC3.6 **Factors**
- downdraught conditions
- wind effects at the appliance termination
- passive stack ventilation
- extraction fans sited in the vicinity of open flued appliances

AC3.7 **Tests**
- check seals
- check flow, no signs of spillage
- flame picture

Learning outcome

The learner will know and demonstrate:

LO4 Completion of the correct notices, forms and labels used in domestic gas utilisation

Assessment criteria

AC4.1 Correctly complete and apply **records, forms and labels**
AC4.2 Select and attach appropriate **labels** applicable to domestic gas work

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Range

AC4.1 **Records, forms and labels**
- landlord/Homeowner Gas Safety Record
- Gas Safety Inspection Form
- Benchmark Maintenance Report
- Service/Maintenance Checklist(s)
- Chimney/Hearth Notice Plate

AC4.2 **Labels**
- Un-commissioned Appliance Label
- Balanced Compartment Label

Learning outcome

The learner will know and demonstrate:

LO5 Correct use of combustion and atmosphere sampling analysers

Assessment criteria

AC5.1 Correct use of combustion performance analysers and atmosphere sampling analysers and **interpreting readings**
AC5.2 **Test procedures** for gas appliances that require commissioning by analysis of the flue combustion products
AC5.3 Visually and by the use of combustion performance analysis, identify complete and incomplete combustion for Type A, B & C gas appliances
AC5.4 Action levels for gas appliances
AC5.5 **Actions** if CO/CO_2 ratio remains above suitable performance levels after adjustment.
AC5.6 Unsafe situation category for a flued/flueless appliance that fails test
AC5.7 Required **checks** using a combustion/atmosphere analyser in the event of carbon monoxide detector **activation**
AC5.8 Types of and placing of CO detectors
AC5.9 Conducting a sweep test of open flue and room sealed appliances

Range

AC5.1 **Interpreting readings**

- CO, CO_2, O_2 readings, CO/CO_2 Ratios in a flueway
- CO, CO_2, O_2 readings in the atmosphere

AC5.2 **Test procedures**

- flue gas samples to be taken during the commissioning process
- sources of information required to determine correct flue gas products and ratios
- test:
    - flueless
    - open flued
    - room sealed
    - gas appliance

AC5.5 **Actions**

- identify and rectify faults
- consult appliance manufacturer
- implement unsafe situations procedure

AC5.7 **Checks**

- safe to proceed
- visual examination
- sweep test
- combustion test
- safe operation
- room atmosphere

AC5.7 **Activation**

- action levels when discovering CO in a property in accordance with BS 7967
- the evacuation level and the engineer's responsibility when CO levels are:
    - 10 ppm

    - 10 ppm to 30 ppm
    - greater than 30 ppm.
- other sources of CO that could enter a property

Learning outcome

The learner will know and demonstrate:

LO6 Installation and commission of a small domestic gas installation

Assessment criteria

AC6.1 **Select, position** and **install** a domestic gas meter, **pipework,** fittings and domestic appliance
AC6.2 How to identify **pipework safety defects**
AC6.3 **Tightness testing, purging** and **commissioning** procedures
AC6.4 **Procedures** for taking pressure readings in domestic gas supply systems
AC6.5 **Procedure** for resetting and sealing a regulator
AC6.6 **Repair** gas leaks
AC6.7 **Calculate the gas consumption** rates for gas appliances and confirm they comply with manufacturers' instructions
AC6.8 Correct **method of removal** of domestic meters and regulators
AC6.9 **Procedures** for re-establishing gas supplies and relighting appliances
AC6.10 Correct and incorrect **methods of connecting the main equipotential bonding**
AC6.11 **Main equipotential bonding requirements** for both permanent and temporary meter removal
AC6.12 Identify and rectify **faults** discovered during testing

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Range

AC6.1 **Select**

- materials
- fittings
- clips/pipework support
- temporary continuity bonding
- sleeving
- meter location
- meter supports
- pipe size

AC6.1 **Position**

- design arrangements
- suitable fittings
- position of the regulator
- general location of the meter for access

AC6.1 **Install**

- demonstrate the correct method of jointing materials and fittings
- demonstrate the correct method of installing securing and supporting domestic meters and regulators
- demonstrate the correct method of installing a domestic appliance
- de-commission metered gas installations, tee into existing copper pipework and re-commission installation on completion

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AC6.1 **Pipework**

- copper
- mild steel
- CSST

AC6.2 **Pipework safety defects**

- sleeving
- valve positions
- clipping/support
- medium pressure meter installations - pipework in meter boxes/entering the building
- proximity to other services
- ducts
- inappropriate fittings

AC6.3 **Tightness testing, purging**

- testing new installation pipework (no meter connected)
- testing new installations (meter connected) with or without appliances connected
- testing existing installations (meter connected) with or without appliances connected to ensure the installation doesn't exceed the maximum permissible pressure drop
- testing existing medium pressure fed installations where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, where a meter inlet valve (MIV) is fitted or, no meter inlet valve is fitted.
- air test / fuel gas test
- calculating purge volumes and carryout purging procedures for the different purge volume ranges.
- application of permissible pressure loss

AC6.3 **Commissioning**

- visual inspection of the appliance combustion:
    - referring to manufacturers' information
    - identify correct flame pictures
    - identify signs of incomplete combustion within and in the locality of an appliance installation
    - establish a stable flame on each appliance
    - visually inspect each appliance and identify any unsafe situations
    - confirm satisfactory operation of user controls

AC6.4 **Procedures**

- pre installation
- commissioning:
    - maximum appliance load
- post commissioning
- incorrect pressure readings are encountered (BS 6400):
    - following reports of poor pressure/failure to achieve operating pressure and/or heat input
    - reporting of low pressure process

AC6.5 **Procedure**

- remove seal and cap from regulator
- attach manometer to meter outlet
- turn adjustment clockwise or anti-clockwise to adjust pressure

AC6.6 **Repair**

- the actions/procedures to be taken on a gas related emergency by the:
    - gas user:
        - open all doors and windows
        - don't switch anything electrical on or off
        - put out all naked flames
        - don't smoke/strike matches/ignite the gas
        - open doors manually
        - notify Gas Emergency Service
    - gas operative:
        - isolate supply
        - source leak using leak detection fluid
        - repair or notify gas supplier
        - ventilate

AC6.7 **Calculate the gas consumption**

- imperial rated meters
- metric rated meters
- smart meters
- convert and adjust:
    - gas pressures in mbar
    - the gas rate to kW
- compare the gas rate with the appliance data badge or manufacturers' instructions
- gas rate a gas appliance installed with both imperial meters and metric meters

AC6.8 **Method of removal**

- test
- isolate
- apply equipotential bonding
- ventilate
- remove
- place at safe distance
- cap meter

AC6.9 **Procedures**

- visual inspection of the gas installation, appliance(s) location, terminal, chimney/flue route/position and signs of incomplete combustion
- appliance burner pressure or gas rate, or both, where necessary
- combustion gas analysis where specified in the appliance manufacturers' servicing and maintenance instructions
- ventilation is clear and sufficiently sized
- flue flow and spillage testing, where appropriate for correct operation of flue
- all flame supervision devices and/or other safety controls for correct operation
- investigate any evidence of unsafe operation of appliances

AC6.10 **Methods of connecting the main equipotential bonding**

- position of main equipotential bonding should:
    - connect to the installation pipework
    - have a robust clip to the pipework
- need to inform the responsible person should the bonding not comply to current regulations
- requirements for:
    - competent persons for the installation of bonding
    - provision of written notification to the responsible person if you are not competent to carry out the work

AC6.11 **Main equipotential bonding requirements**

- method of bonding connection
- positioning of bond
- sizing of bond
- 600mm from meter outlet
- fitting before any branch or tee
- cable size selection procedure:
    - should have a CSA of 10mm^2
    - temporary bonding should be at least 1.2m of single core insulated cable and of at least 250v rating
    - fitted with a robust clip or clamp
    - be left in position when the meter is removed

AC6.12 **Faults**

- excessive pressure loss at the appliance
- incorrect gas consumption rates at appliances
- effects of meter pressure absorption under full load conditions

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Learning outcome

The learner will know and demonstrate:

LO7 Calculation of the requirements for permanent ventilation in domestic gas utilisation environments

Assessment criteria

AC7.1 Calculate the **ventilation requirements** for open flued and flueless gas appliances as per BS5400 Part 2
AC7.2 Calculate the **ventilation required** for appliances located in compartments
AC7.3 **Acceptable locations** for ventilation to appliances
AC7.4 Measure **existing vents** and grilles to ensure that they are the correct type and provide the correct supply of air
AC7.5 **Correct** and **incorrect types** of grilles and vents available for ventilation
AC7.6 **Requirements** of balanced compartments

Range

AC7.1 **Ventilation requirements**

- adventitious air supplies
- gross and net calorific values of appliances
- for multiple appliance installations in the same room/space:
    - multiple open flued and flueless appliances
    - open flued and flueless appliances

AC7.2 **Ventilation required**

- open flued appliances
- room sealed appliances

AC7.3 **Acceptable locations**

- restrictions to ventilator/grille locations
- installation of vents through walls (including cavity walls)
- ventilation paths via other rooms
- ventilation paths to compartments including ducts

- ventilation for internal kitchens
- siting of ventilation:
    - wall
    - window
    - floor/ceiling (ducted and un-ducted)

AC7.4 **Existing vents**
- terracotta
- plastic
- anti draught

AC7.5 **Correct types**
- plastic Louvered (external and internal)
- metallic Louvered (internal)
- plastic Circular (anti draught)
- intumescent

AC7.5 **Incorrect types**
- fly screens
- closeable
- insufficient openings
- covered

AC7.6 **Requirements**
- self-closing flush door with draught sealing strip
- a notice attached to the door stating it should be kept closed
- no other ventilation openings into the balanced compartment
- a switch to act as an electrical isolator, which shuts appliance down if the door is open

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Learning outcome

The learner will know and demonstrate:

LO8 How to work correctly and safely with electrical systems and components used in domestic gas utilisation

Assessment criteria

AC8.1 **Sources of information** required when carrying out work on electrical systems
AC8.2 Checks, tests and test equipment to **confirm correct operation** of appliances and systems
AC8.3 How to access and interpret wiring diagrams and fault-finding charts
AC8.4 Uses and operation of **electrical testing equipment**
AC8.5 Perform a range of **routine checks** and diagnostics on electrical system components as part of a fault finding process
AC8.6 Safe isolation **procedure**
AC8.7 **Tests**, and procedures for temporary and permanent de-commissioning of gas and electricity systems, components and appliances
AC8.8 **Risks** associated with dual supplies and pump overruns

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Range

AC8.1 **Sources of information**
- statutory regulations

- industry standards
- manufacturer technical instructions

AC8.2 **Confirm correct operation**

- situations in which dead testing of components can be carried out
- situations in which live testing of components may be necessary and the safety precautions required

AC8.4 **Electrical testing equipment**

- the safe to touch procedure and equipment used
- the equipment used for electrical testing of gas and electricity systems, components and appliances and its calibration requirements:
    - basic operating principles of different electrical testing devices, including voltage meters, ammeters, multifunction testing devices, and voltage-indicating devices.
- the electrical test equipment used to undertake fault diagnostics:
    - operating procedures of Multimeters and Multi-functional testers on different settings (resistance, polarity etc)
- the test equipment required to prove that circuits to be worked on are dead:
    - approved voltage indicating device
    - proving unit
- the methods of ensuring that circuits cannot be re-activated while work is taking place on them:
    - use of locking devices
    - device retention (fuse removal)

AC8.5 **Routine checks**

- from manufacturers' information, as applicable:
    - ensure power to the wiring centre
    - ensure wi-fi connection
    - ensure power to the room thermostat
    - ensure power to the cylinder thermostat
    - ensure motorised valve motors have power
    - ensure power to the heat source (boiler)

AC8.6 **Procedure**

- obtain the required permission to work on the installation
- identify the source(s) of supply
- test your voltage detector or test lamp to ensure correct operation
- isolate the supply, disconnecting the system from the mains
- secure or lock off the isolation using your safety padlock, preventing any tampering
- use your voltage detector or test lamp to determine that the system is dead
- prove that your voltage detector or test lamp is functioning correctly
- put up clearly visible warning signs to indicate that the installation has been isolated
- confirmed that the system is dead

AC8.7 **Tests**

- the electrical testing procedures for new and existing circuits:
    - polarity
    - earth continuity
    - insulation resistance
    - earth fault loop impedance
    - residual current device
- the procedures for the completion of the electrical tests detailed above, taking account of:

- the equipment to be used
- the correct sequence
- expected readings
- actions to take if expected readings are not achieved

AC8.8 **Risks**

- potential for remaining live after isolation

Unit 322 Install, service, repair and remove gas water heating and wet central heating

Level:	3
GLH:	67
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit covers the requirements to install and maintain gas water heating and wet central heating appliances when working in the domestic gas industry.

Learning outcome

The learner will know and understand:

LO1 Uses of gas water heating and wet central heating appliances in dwellings

Assessment criteria

AC1.1 Purpose of gas water heating and wet central heating appliances used in dwellings
AC1.2 **Types of wet central heating appliances** used in dwellings
AC1.3 **Types of gas water heating appliances** used in dwellings
AC1.4 Energy efficiency requirements relating to boiler installations

Range

AC1.2 **Types of wet central heating appliances**

- system boiler
- heat only boiler
- combi boiler

AC1.3 **Types of gas water heating appliances**

- multi point
- circulator
- single point

Learning outcome

The learner will know and understand:

LO2 Types of gas water heating and wet central heating appliances and their layout requirements

Assessment criteria

AC2.1 Working principles of **wet central heating appliances**
AC2.2 Working principles of **water heating appliances**
AC2.3 **Layout** requirements of wet central heating systems
AC2.4 General operating principles of **gas fired heat producing appliances** systems in dwellings
AC2.5 Operating principles of wet central heating and hot water appliance **control components**

Range

AC2.1 **Wet central heating appliances**

- system boiler
- heat only boiler
- combi boiler

AC2.2 **Water heating appliances**

- multi point
- circulator
- single point

AC2.3 **Layout**

- open vented:
    - pumped heating only
    - pumped with gravity hot water, including heat sink circuits
    - fully pumped with 2 x two port valves
    - fully pumped with a mid-position valve
- sealed system:
    - pumped heating only
    - fully pumped with 2 x two port valves
    - fully pumped with a mid-position valve
    - combination boiler with pumped heating
    - system boiler with pumped heating
- cylinder types:
    - direct
    - indirect
    - twin coil
    - thermal store and combination cylinder (Fortic)

AC2.4 **Gas fired heat producing appliances**

- open flued appliances
- room sealed appliances
- freestanding appliances
- wall mounted appliances
- fan assisted appliances.

AC2.5 **Control components**

- flueing systems:
    - air pressure switches
    - horizontal and vertical systems
    - extended flue runs
- fans:

    - combustion
    - flueing
- safety controls
- burners
- automatic air vents
- circulating pumps:
    - pump over-run requirements, including safety precautions
- automatic bypass valves
- diverter valves
- printed circuit boards (PCBs)
- condensate requirements
- internal/external user controls:
    - timing devices – clocks and programmers
    - room thermostats
    - hot water thermostats
    - smart controls:
        - Boiler Plus
- frost thermostats

Learning outcome

The learner will know and demonstrate:

LO3 Site preparation techniques for gas water heating and wet central heating appliances

Assessment criteria

AC3.1 **Sources of information** required when undertaking work on gas water heating and wet central heating appliances

AC3.2 Preparatory work required to be undertaken to the building fabric in order to install, decommission or maintain gas water heating and wet central heating appliances

AC3.3 **Safety of the work location** in order for the work to safely proceed

AC3.4 Personal Protective Equipment appropriate to the task being carried out

AC3.5 Protection measures to the building fabric or customer property, during and on completion of work on gas water heating and wet central heating appliances

AC3.6 Pipework materials and fittings required to complete work on gas water heating and wet central heating appliances, ensuring that they are not damaged

AC3.7 Hand and power tools required to complete work on gas water heating and wet central heating appliances

AC3.8 Preparatory work in order to install gas water heating and wet central heating appliance

AC3.9 **Information** included on the appliance data badge

Range

AC3.1 **Sources of information**

- statutory regulations
- industry standards
- manufacturers' technical instructions
- Building Regulations: Approved Documents F, J, L1a, L1b, P and equivalent in the devolved administrations

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AC3.3 **Safety of the work location**

- safe access and exit
- safety within immediate work location e.g. tripping hazards
- appropriate risk assessments/ method statements are available

AC3.9 **Information**

- serial number
- operating pressure
- gas type
- voltage
- flue type
- manufacturer

Learning outcome

The learner will know and demonstrate:

LO4 Installation and commission of gas water heating and wet central heating appliances

Assessment criteria

AC4.1 **Procedures** required to assemble and mount gas water heating and wet central heating appliances on the wall and floor surfaces

AC4.2 How to select clips and brackets appropriate to the gas water heating and wet central heating pipework and the **industry recommended spacings**

AC4.3 **Positioning and fixing requirements** of gas water heating and wet central heating appliances and components

AC4.4 Suitable methods for making new gas water heating and wet central heating appliance pipework **connections into existing systems**

AC4.5 **Install** gas water heating and wet central heating appliances

AC4.6 **Commission** gas water heating and wet central heating appliances

AC4.7 **Methods** to prevent the end user from bringing central heating components and pipework systems into operation before the work is fully complete

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Range

AC4.1 **Procedures**

- mark out wall/floor
- drill building material
- attach fixings/rig
- hang/attach main appliance

AC4.2 **Industry recommended spacings**

- horizontally mounted pipework
- vertically mounted pipework

AC4.3 **Positioning and fixing requirements**

- within the fabric of the building:
    - in suspended timber floors
    - in solid floors
    - embedded in walls
    - in areas of the building subject to frost

- installation pipework:
    - gas/water
- Flueing systems:
    - horizontal and vertical systems
    - extended flue runs
- clearances – proximity of combustible materials – fire proofing of compartments
- ventilation, cooling and combustion requirements for the appliance
- circulating pumps
- hot water cylinder
- automatic bypass valves
- zone/diverter valves
- condensate requirements
- pressure release valve pipework
- internal/external user controls:
    - timing devices – clocks and programmers
    - room thermostats
    - hot water thermostats
    - smart controls
- frost thermostat

AC4.4 **Connections into existing systems**

- within a one or two pipe copper system
- within a one or two pipe low carbon steel system
- to a microbore or minibore system
- to the existing gas pipework installation.

AC4.5 **Install**

- install the appliance to a prepared point and to the manufacturers' instructions
- new or replacement appliance - at least **two** different types of appliance must be covered from the following list:
    - traditional Boiler (heat only and room sealed)
    - system Boiler
    - combination Boiler
    - multi-point water heater
- associated pipework connections
- associated flueing
- condensate removal and disposal, including condense pump (where applicable)

AC4.6 **Commission**

- follow the manufacturers' instructions.
- visual inspection
- ensure the appliance is correctly located, level and stable
- confirm correct operation/ adjustment of:
    - control components
    - thermostats
    - safety controls
- check and adjust the hot water flow rate
- where applicable, check the air/gas ratio valve is set correctly at high and low limits in accordance with the manufacturers' instructions, and adjust if permitted.
- undertake combustion performance analysis (where applicable)
- hydronic Balancing
- handover and completion of relevant documentation:
    - benchmark

AC4.7 **Methods**

- isolate and temporarily cap off pipe work
- don't make final connections
- don't make live

Learning outcome

The learner will know and demonstrate:

LO5 Service and maintenance of gas water heating and wet central heating appliances

Assessment criteria

AC5.1 Manufacturers' instructions and job maintenance schedules to establish the periodic servicing requirements of gas water heating and wet central heating appliances

AC5.2 Carry out **routine checks** on gas water heating and wet central heating appliances as part of a periodic maintenance programme

AC5.3 Carry out **repairs to defects** in gas water heating and wet central heating appliances

AC5.4 Complete the required **details** contained in a simple maintenance record for gas water heating and wet central heating appliances

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Range

AC5.2 **Routine checks**

- visual inspection
- ensure appliance is correctly located, level and stable
- dismantle and clean appliance operational gas safety components:
    - burners
    - primary air ports
    - combustion chambers
    - flue ways
- operation of control components
- effective operation of thermostats
- effective operation of safety controls
- operation/ adjustment
- check and adjust the hot water flow rate
- check air gas ratio
- carry out a flue gas analysis
- use appropriate cleaning methods and agents
- follow manufacturers' instructions

AC5.3 **Repairs to defects**

- fault diagnosis to incorporate manufacturer fault- finding flowchart
- unsatisfactory ignition of burner(s)
- unstable flame picture
- signs of flue spillage
- inoperative thermostat/limit stat(s)
- inoperative pressure switch(s)
- defective flame supervision device(s)
- scaled heat exchanger (IWH)
- defective gas valve assembly

AC5.4 **Details**

- manufacturer
- date
- location
- appliance type
- appliance number
- gas rate
- burner pressure
- operating pressure
- appliance performance details
- defects
- engineer details
- related notes

Learning outcome

The learner will know and demonstrate:

LO6 Decommissioning of gas water heating and wet central heating appliances

Assessment criteria

AC6.1 Working methods that reduce the periods during which gas water heating and wet central heating appliances are not available to building users

AC6.2 Advise appropriate persons before gas water heating and wet central heating appliances are isolated in order to undertake work

AC6.3 How to **temporarily decommission** gas water heating and wet central heating appliances

AC6.4 The work sequences for **permanently decommissioning** gas water heating and wet central heating appliances

AC6.5 Carry out temporary decommissioning of gas water heating and wet central heating appliances components and connecting pipework systems

AC6.6 Check to ensure that the decommissioning procedures carried out **prevent the end-user from operating** the appliance or system

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Range

AC6.3 **Temporarily decommission**

- safely isolate the electric supply
- isolate the fuel supply
- isolate any wet supplies
- drain down
- temporary capping-off of pipework sections
- place warning notices and lock off supplies

AC6.4 **Permanently decommission**

- safely isolate the electric supply
- isolate the fuel supply
- isolate any wet supplies
- drain down
- permanently cap off pipework sections
- remove pipework sections where not required

- isolate and remove electrical supply to the fused spur

AC6.6 **Prevent the end- user from operating**

- placing warning notices
- lock off fuel supply
- lock off water supply
- lock off electrical supply

Unit 323 Install and maintain gas water heating and wet central heating appliances (On site portfolio evidence)

Level:	3
GLH:	12
Assessment type:	Work log (portfolio of evidence)
Aim:	This performance unit covers the requirements for learners to demonstrate their skills in the workplace.

This unit outlines the on-site requirements that are to be assessed through performance.

All range items must be assessed unless the number of range items required is identified.

Evidence is gathered through activities carried out by the candidate (under the observation of an assessor or a mentor/expert witness) for a customer at their premises.

Note the following requirements regarding an mentor/expert witness:

- A mentor/expert witness must be occupationally competent, suitably experienced, trained and registered with the centre
- Training must include the requirements of assessment and the completion of related direct observation documentation
- Training must be documented and recorded within quality assurance documentation and be subject to annual review by an IQA
- Expert witnesses will be subject to the same internal quality assurance process as assessors
- Mentors must demonstrate proof of Gas Safe registration

Assessment codes

Colour code	Description
Green	**Directly observed by assessor** Green forms/sections – assessor to complete
Orange	**Observation with a mentor/expert witness** Reflective account from site with supporting evidence. This is the preferred option for Managed Learning Programme portfolios Reflective account from simulated task at centre with supporting evidence. Orange forms/sections – candidate to complete

1. Install, service and fault find gas water heating and wet central heating appliances

Candidates must be observed on the minimum amount of occasions and range as identified below.
Notes:

- * An observation may only to be simulated where it has not been possible for the observation to be obtained on site. The practical assignment can be used as a simulated direct observation for the portfolio requirements.
- The candidate must have covered the necessary training/mentoring required before the observation takes place.

Observation Requirements

Total – 14 observations for installation, service and fault finding		**Install & Commission**	**Service**	**Fault finding**
Observation 1	**Directly Observed** All three may be in centre			
Observation 2	**Reflective Account** All 3 accounts are to come from site			
Observation 3	**Reflective Account** Minimum of 2 accounts are to come from site 1 account may be simulated*			
Observation 4	**Reflective Account** Minimum of 2 accounts are to come from site 1 account may be simulated*			
Observation 5	**Reflective Account** Minimum of 1 account is to come from site 1 account may be simulated*			n/a

Observations to include:

- new or replacement appliance
- associated pipework connections
- associated flueing
- commission, handover and completion of relevant documentation.

Range: The types of appliances below are to be covered:

- traditional Boiler (open flued and/or room sealed) **
- system Boiler
- combination Boiler

****Service and maintenance only

2. Installation of gas pipework (≤ 35 mm)

Candidates are to be observed on the minimum amount of occasions and range as identified below.
Note: The candidate must have covered the necessary training/mentoring required before the observation takes place.

Observation Requirements

Total - 5 observations for installation gas pipework; these may be related directly to the installation requirements of an appliance

Observation 1	**Reflective Account** From site
Observation 2	**Reflective Account** From site
Observation 3	**Reflective Account** From site
Observation 4	**Reflective Account** from site
Observation 5	**Reflective Account** from site

Installation to include:

- new or replacement pipework
- associated pipework fixings and joints.

Range:

- copper tube

Secondary Range – at least two of the following:

- capillary joints**
- compression joints
- fabricated bending using mechanical tools.

** mandatory

3. Gas tightness testing, direct purging (IGEM/UP/1B) and relighting appliances

Candidates are to be observed on the minimum amount of occasions and range as identified below.
Note: The candidate must have covered the necessary training/mentoring required before the observation takes place.

Observation Requirements	
Total - 5 observations for tightness testing, purging and relighting of gas installations and appliances	
Observation 1	**Reflective Account** From site
Observation 2	**Reflective Account** From site
Observation 3	**Reflective Account** From site
Observation 4	**Reflective Account** From site
Observation 5	**Reflective Account** From site

Observations to include:

- tightness test
- purge
- relight appliances.

4. Opportunity for identification of unsafe situations

Candidates are to be observed on the minimum amount of occasions and range as identified below.
Note: The candidate must have covered the necessary training/mentoring required before the observation takes place.

Observation requirements	
Observations – Unsafe situations	
Observation 1	**Reflective Account** From site
Observation 2	**Reflective Account** From site
Observation 3	**Reflective Account** From site
Observation 4	**Reflective Account** From site
Observation 5	**Reflective Account** From site

Observations may include:
Gas appliances/installations classified as either:

- Immediately Dangerous (ID), or
- At Risk (AR).

The on-site portfolio must also include evidence for the following areas of learning:

Unit 304 Planning and supervision

- LO5 Producing risk assessments and method statements for the plumbing and domestic heating systems industry
- LO6 Producing a work programme for tasks in the plumbing and domestic heating systems industry

Environmental Technologies pathway

Unit 324 Air source heat pump systems

Level:	3
GLH:	160
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit enables learners to demonstrate knowledge and occupational competence in how to plan, install, test, commission and handover air source heat pump systems.

Learning outcome

The learner will know and understand:

LO1 Health and safety risks and legislation associated with air source heat pump systems

Assessment criteria

AC1.1 Aspects of installation work that pose health and safety **risks**
AC1.2 Requirements for safe systems of work for installation work
AC1.3 **Legislation** relevant to installation, testing and commissioning

Range

AC1.1 **Risks**

- electrocution/electric shock
- burns
- toxic poisoning
- personal injury though component/equipment handling

AC1.3 **Legislation**

- building regulations:
  - installation requirements
  - energy conservation
  - testing and commissioning
  - compliance certification
- water regulations:
  - water conservation
  - safe operation
  - testing and commissioning

- F gas regulations:
  - refrigerant tested by the manufacturer
  - refrigerant assembled and tested on site
  - leak checking on refrigerant circuits
  - recovery of fluorinated greenhouse gases on the refrigerant circuits

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Learning outcome

The learner will know and understand:

LO2 Types of air source heat pump systems

Assessment criteria

AC2.1 The purpose and operation of air source heat pump system **components**
AC2.2 How the vapour compression refrigerant circuit within a heat pump unit operates
AC2.3 **Types** of air source heat pump system
AC2.4 The meaning of monovalent system, bivalent system and hybrid system
AC2.5 Identifying **monovalent hydraulic emitter circuits**
AC2.6 Identifying **parallel bivalent/hybrid hydraulic emitter circuits** incorporating secondary heat sources

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Range

AC2.1 **Components**

- evaporator
- low pressure switch
- compressor
- high pressure switch
- condenser
- dryer/receiver
- sight glass
- expansion valve
- expansion valve phial
- refrigerant four way valve
- emitter circuit electro-mechanical valves
- fan coil
- buffer tanks (integrated, series and parallel)

AC2.3 **Types**

- external air, packaged (indoor)
- external air, packaged (outdoor)
- external air, internal heat pump unit with circuit between fan coil unit and heat pump unit (split unit)

AC2.5 **Monovalent hydraulic emitter circuits**

- heating only
- heating with buffer tank
- heating with buffer tank and indirect stored domestic hot water
- heating with buffer tank and indirect stored domestic hot water with solar coil
- heating with thermal store

AC2.6 **Parallel bivalent/hybrid hydraulic emitter circuits**

- heating with buffer tank
- heating with buffer tank and indirect stored domestic hot water
- heating with buffer tank and indirect stored domestic hot water with solar coil
- heating with buffer tank and thermal store

Learning outcome

The learner will know and understand:

LO3 How to design air source heat pump systems

Assessment criteria

AC3.1 Meaning of the **coefficient of performance** (COP) and its relationship with input and emitter temperatures

AC3.2 Effect that ambient temperature can have on:

a) coefficient of performance
b) heat pump output

AC3.3 Meaning of the seasonal performance factor (SPF) and factors that affect it

AC3.4 Meaning of system efficiency and factors that affect it

AC3.5 Achieving minimum heat loss from the building, its importance when designing an air source heat pump system

AC3.6 Effects of over sizing and under sizing a heat pump

AC3.7 Heat pump hydraulic flow rate requirements

AC3.8 Using **manufacturers' data** to select heat pump units

AC3.9 How heat pump **output capacity** is affected

AC3.10 Suitability of types of **hydraulic heating system emitters** for use with air source heat pump systems and their typical mean water temperatures

AC3.11 How correction factors are used to determine emitter output requirements in relation to mean water temperature and room temperature difference

AC3.12 Advantages and disadvantages of including a buffer tank in the system design

AC3.13 Method of determining the size of a monovalent heat pump system

AC3.14 Typical **annual operating hours** for a heat pump that is being used for

a) heating only
b) heating and domestic hot water

AC3.15 Reasons why heat pump annual operating hours vary

AC3.16 Factors to be considered in selecting and positioning an air source heat pump in relation to its fan coil unit

AC3.17 Defrost cycle options (including sizing a buffer tank) for an air source heat pump

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Range

AC3.1 **Coefficient of performance**

- heat pump input temperature
- heat pump emitter temperature

AC3.8 **Manufacturers' data**

- output charts (including bivalent points)
- other data

AC3.9 **Output capacity**

- heat pump input/output temperature

AC3.10 **Hydraulic heating system emitters**

- underfloor heating
- fan assisted convector heaters
- panel radiators
- bivalent points/auxiliary heat requirements
- mean water temperatures

AC3.14 **Annual operating hours**

- heat only
- heating and DHW
- type of building
- geographic location

Learning outcome

The learner will know and demonstrate:

LO4 Air source heat pump installation

Assessment criteria

AC4.1 **Pre-installation checks** for air source heat pump systems connected to hydraulic emitter circuits

AC4.2 **Pre-installation checks** that are specific to the positioning of fan coil units

AC4.3 Requirements for moving and handling heat pump units to avoid damage to the unit

AC4.4 **Installation requirements** where heat transfer fluid circuit pipework passes through the external building fabric

AC4.5 Installation of heat pump to the hydraulic emitter circuit

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Range

AC4.1 and AC4.2 **Pre-installation checks**

- tools, materials and equipment are safe and suitable
- building structure
- authorisation
- access
- collation of relevant information
- location of fan coil unit, heat pump unit and internal system components
- confirm design-heat pump rating, emitter circuit, buffer tank, electrical input

AC4.4 **Installation requirements**

- heat transfer fluid circuit passes through external building fabric:
    - provision of movement
    - protect against freezing
    - water ingress
    - airtightness
    - thermal transmission
    - fire resistance

Learning outcome

The learner will know and demonstrate:

LO5 Service and maintenance of air source heat pump systems

Assessment criteria

AC5.1 Documentation to be used and made available to inspect, **service and maintain** air source heat pump systems

AC5.2 Industry requirements for recording the outcomes of inspection, service and maintenance of air source heat pump systems

AC5.3 Actions to be taken in the event of a failure or suspected failure of the refrigerant circuit and/or a suspected refrigerant circuit defect

AC5.4 Inspect, service and maintain air source heat pump systems

Range

AC5.1 **Service and maintain**

- visual inspection requirements:
  - leaks and dampness
  - position of components
  - quality, condition and positioning of pipework insulation
  - safety labels
  - security of fixing of system components
- setting electrical controls and temperature sensors
- cleaning of components
- checking of system water content/ fluid levels
- functional checks:
  - safe operation
  - efficient operation
  - function of system
  - noise vibration levels
- pressure levels
- protection of the system against freezing
- cleaning, adjustment and lubrication of system components and controls
- complete documentation and actions if required

Learning outcome

The learner will know and demonstrate:

LO6 Fault diagnosis and rectification of defects and malfunctions on air source heat pump systems

Assessment criteria

AC6.1 **Sequence of actions** to enable diagnosis and rectification of air source heat pump system defects and malfunctions

AC6.2 Obtain the **information** required to enable fault diagnosis and rectification to be undertaken

AC6.3 Cause of **faults** on air source heat pump systems and carry out remedial work

AC6.4 Advise the client of the cause of the malfunction and the actions required to rectify

AC6.5 Precautionary actions to prevent unauthorised use of the system and minimise risk of injury prior to or during fault rectification
AC6.6 Undertaking post-rectification functional tests in accordance with manufacturers' instructions

Range

AC6.1 **Sequence of actions**

- diagnose
- notify client
- safe isolation
- decommission
- rectify
- re-commission
- handover

AC6.2 **Information**

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

AC6.3 **Faults**

- heat pump high/low pressure trip/alarm activated by an emitter circuit malfunction
- insufficient heat output to emitter circuit
- domestic hot water heat up is satisfactory but space heating is not operating
- system noise and/or vibration

Learning outcome

The learner will know and demonstrate:

LO7 Testing, commissioning and handover of air source heat pump systems

Assessment criteria

AC7.1 **Prepare** for air source heat pump system testing and commissioning
AC7.2 Requirements for **charging, flushing** and treating hydraulic heat emitter circuits
AC7.3 **Commission** the system in accordance with manufacturers' instructions, design specification, clients' and statutory requirements and industry recognised procedures
AC7.4 Final **checks** to ensure that the system is ready for handover to client
AC7.5 Explain and demonstrate to the client the operation and use of the air source heat pump system using manufacturers'/users' instructions
AC7.6 Explain to the client any aspects of the system at variance with the agreed design specification
AC7.7 Confirmation of acceptance from the client of the handover of the air source heat pump system
AC7.8 **Handover** documentation completed and passed to the client in accordance with manufacturers' instructions

Range

AC7.1 **Prepare**

- system design and specification
- system/component manufacturer requirements
- suitability of the electrical supply circuit
- system is ready for flushing of installation debris
- system is ready for filling and venting the hydraulic circuits
- system is ready for adding protection against freezing
- client requirements are met
- system is compliant with statutory regulations and/or industry recognised procedures
- conditions required for dynamic commissioning

AC7.2 **Charging and flushing**

- equipment required
- purging air and debris

AC7.3 **Commission**

- visual check
- fill and vent
- test
- flush
- operational checks
- commissioning documentation
- handover procedure

AC7.4 **Checks**

- mechanical controls
- electrical controls/temperature sensors
- functional tests

AC7.8 **Handover**

- provision of written/diagrammatic/verbal information
- demonstration of system operation and use

Unit 325 Solar thermal hot water systems

Level:	3
GLH:	130
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Aim:	This unit enables learners to demonstrate knowledge and occupational competence in how to plan, install, test, commission and handover Solar thermal water systems.

Learning outcome

The learner will know and understand:

LO1 Health and safety and relevant legislation, regulations and standards

Assessment criteria

AC1.1 Industry recognised **legislation, regulations and standards** relevant to solar thermal hot water systems
AC1.2 Safe systems of work for dealing with **hazards**
AC1.3 **Risks** associated with solar thermal collectors

Range

AC1.1 **Legislation, regulation and standards**

- building regulations
- town and country planning
- water t
- industry standards

AC1.2 **Hazards**

- working at height
- electrocution/electric shock energy conservation
- burns
- toxic poisoning
- injury through flash to steam of system heat transfer fluid
- personal injury though component/equipment handling

AC1.3 **Risks**

- size
- weight
- fragility
- wind
- thermal properties and outputs

Learning outcome

The learner will know and understand:

LO2 Fundamental design principles for solar thermal hot water systems

Assessment criteria

AC2.1 System **information requirements** identification
AC2.2 How to determine typical domestic **hot water storage vessel requirements**
AC2.3 Hot water storage vessel requirements
AC2.4 **Collector area requirements**
AC2.5 System **annual irradiation yield requirements**
AC2.6 System **primary circuit pipe size requirements**
AC2.7 System **expansion vessel size requirements**
AC2.8 System **pump size requirements**
AC2.9 **Factors** affecting solar thermal collector installation
AC2.10 The considerations of solar fraction

Range

AC2.1 **Information requirements**

- building design
- building dimensions/angles
- building location and orientation
- building fabric/material details
- existing input services
- existing hot water/heating systems
- building occupancy
- required hot water usage pattern

AC2.2 **Hot water storage vessel requirements**

- daily demand (vd) (litres/day per person or litres/day/m2 of floor area)
- boiler volume (vb)
- dedicated solar volume (vs) (litres per m2 of collector area or as a % or vd)
- total cylinder volume (vt)
- solar heat exchange coil surface area (m2 of surface area in relation to collector flow rate and collector surface area)

AC2.4 **Collector area requirements**

- building occupancy
- proposed angle of collector
- installation
- proposed orientation of collector installation
- shading that may affect collector performance

AC2.5 **Annual irradiation yield requirements**

- collector orientation
- collector angle
- collector over shading
- circulation rates

AC2.6 **Primary circuit pipe size requirements**

- primary circuit circulation rates
- collector area
- primary circuit pipework length
- primary circuit water content volume

AC2.7 **Expansion vessel size requirements**

- primary circuit water content
- volume
- collector height above cylinder
- typical sizing requirements for drain back vessel:
    - net collector area
    - total volume of the system

AC2.8 **Pump size requirements**

- fully filled systems
- drain back systems

AC2.9 **Factors**

- a listed property - installations to listed buildings
- property in conservation area
- permitted development
- flat roof loading calculations/approval
- wind uplift
- roof types
- azimuth (direction)
- angle of inclination
- shading
- brackets, rails and fixings
- specialist tools
- components
- incentive schemes

Learning outcome

The learner will know and demonstrate:

LO3 Solar thermal hot water systems installation

Assessment criteria

AC3.1 System **components** and placement
AC3.2 Key operating principles of **collectors** and their efficiency
AC3.3 **System types** and efficiencies
AC3.4 **Weathering requirements**
AC3.5 Pre-installation **checks** and **documentation** for the installation of solar thermal hot water systems
AC3.6 Solar thermal hot water systems **installation**

Range

AC3.1 **Components**

- solar collector
- differential temperature controller
- cylinder sensor(s)+
- solar collector sensor
- drain back vessel
- flow meter
- flow regulator (mechanical)
- expansion vessel

AC3.2 **Collectors**

- unglazed collector
- flat plate glazed collector
- roof integrated glazed collector
- evacuated tube collector – direct flow
- evacuated tube collector – heat pipe

AC3.2 **System types**

- fully filled system, collector array connected in series
- fully filled system, collector array connected in parallel
- fully filled system, collector array connected with east/west split
- drain back system, single collector array
- fully filled (active)
- drain back (active)
- passive (thermosiphon)
- direct (fully filled) dhw storage cylinder only
- indirect, sealed collector circuit, dhw storage cylinder only (solar primary coil only)
- indirect, sealed collector circuit, DHW storage cylinder only (dual coil)
- indirect, sealed collector circuit, pre-heat cylinder and DHW storage cylinder
- indirect, sealed collector circuit, thermal store
- combination boilers connected to STHW systems

AC3.4 **Weathering requirements**

- flat plate, surface mounted, inclined roof with single lap roof covering
- flat plate, surface mounted, inclined roof with double lap roof covering
- flat plate, integrated, inclined single lap roof covering
- flat plate, integrated, inclined double lap roof covering
- evacuated tube, inclined single lap roof covering
- evacuated tube, inclined double lap roof covering
- frame mounted, inclined (roof, wall or ground)
- frame mounted, horizontal (roof or ground)

AC3.5 **Checks**

- authorisation for the work to proceed
- verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load
- availability of appropriate access to all required work areas
- inspection of existing domestic hot water/heating system installations
- availability of a suitable electrical input service

- proposed siting of key internal system components
- suitability of the building structure in relation to the proposed installation
- suitability of the proposed location and position of the solar collector panel(s) for optimum collection capacity
- suitability of the building fabric in relation to the installation of the solar collector panel(s)

AC3.5 **Documentation**

- drawings
- specifications
- schedules
- method statements
- risk assessments
- manufacturers' information
- regulations governing buildings

AC3.6 **Installation**

- fully-filled systems
- solar collector
- connections to existing systems
- expansion vessel
- solar circulating pump
- pipework
- insulation

Learning outcome

The learner will know and demonstrate:

LO4 Testing, commissioning and handover of solar thermal hot water systems

Assessment criteria

AC4.1 **Requirements** for testing and commissioning a system

AC4.2 **Requirements** for handover of a system

AC4.3 **Test, commission and handover** of a system

Range

AC4.1 **Requirements**

- compliance with the system design and specification
- compliance with system/component manufacturer requirements
- suitability of electrical supply circuit arrangements
- flushing the system of installation debris
- selection of suitable heat transfer fluid
- filling and venting the hydraulic circuits
- checking system water quality
- protection against freezing
- provision of system labelling

AC4.2 **Requirements**

- provision of written/diagrammatic/verbal information

- demonstration of system operation and use

AC4.3 **Test, commission and handover**

- hydraulic test
- setting of the expansion vessel
- charge pressure
- setting of the system fluid level
- setting of mechanical controls
- setting of electrical controls and temperature sensors
- system functional tests
- the system is ready for handover
- written/diagrammatic/verbal information supplied
- system operation and use demonstrated

Learning outcome

The learner will know and demonstrate:

LO5 Service, maintenance, diagnosis and rectification of faults of a solar thermal hot water system installation

Assessment criteria

AC5.1 **Requirements** for service and maintenance and the diagnosis of faults
AC5.2 **Service and maintain** a solar thermal hot water system
AC5.3 Diagnose and rectify **faults**

Range

AC5.1 **Requirements**

- visual Inspection
- safe isolation
- compliance with manufacturers' installation instructions
- compliance with statutory regulations
- condition of system components including cleanliness
- correct positioning of system components
- component functional checks
- security of fixing of system components
- complete documentation

AC5.2 **Service and maintain**

- checking the system water levels
- checking provision for the expansion of system water
- checking for protection of the system water against freezing
- cleaning of system components
- adjustment of system controls
- safe operation
- efficient operation
- correct functioning of system components/controls
- complete documentation

AC5.3 **Faults**

- loss of system pressure without evidence of discharge
- discharge from pressure relief valve on the solar primary circuit
- insulation melting on solar collector circuit pipework
- overheating of solar collector circuit
- lack of circulation within the solar collector circuit
- poor or no system performance
- system noise and/or vibration

Unit 326 Install and maintain air source heat pump and solar thermal hot water systems (On site portfolio of evidence)

Level:	3
GLH:	10
Assessment type:	Work log (portfolio of evidence)
Aim:	This performance unit covers the requirements for learners to demonstrate their skills in the workplace.

This pathway covers:

- air source heat pump systems
- solar thermal hot water systems.

As a minimum, learners must complete each assessment task with reference to one of the above systems. Where possible, both types of system should be evidenced in order to access the range of knowledge and skills.

Task	Direct observation requirements	Evidence	Mandatory minimum requirements
1. Install one of the following: • air source heat pump system • solar thermal hot water system	One installation directly observed (by a competent witness or assessor) in the workplace.	Satisfactory installation of the chosen system required across the documented ranges. At least **five** separate jobs must be included in the work log. At least **three** of the jobs must be evidenced from the workplace.	Minimum requirements of five separate jobs: Minimum of three jobs evidenced from workplace to include: **One DO (**direct observation) **Two** Reflective accounts/witness testimonies Minimum of **two** jobs evidenced from site or can be simulated in centre
2. Test, commission and handover **one** of the following: • air source heat pump system • solar thermal hot water system	**One** test and commission directly observed (by a competent witness or assessor) in the workplace.	Satisfactory testing and commissioning of the chosen system required across the documented ranges. At least **five** separate jobs must be included in the work log. At least **three** of the jobs must be evidenced from the workplace.	Minimum requirements of five separate jobs: Minimum of three jobs evidenced from workplace to include: **One DO (**direct observation) **Two** Reflective accounts/witness testimonies Minimum of **two** jobs evidenced from site or can be simulated in centre

Note: Observations for 1) installation and 2) commissioning are combined in the Work Log forms provided (making a total of 14 observation forms across the 4 tasks).

Task	Direct observation requirements	Evidence	Mandatory minimum requirements
3. Find and rectify faults on **one** of the following: • air source heat pump system • solar thermal hot water system	Due to the nature of this task, no direct workplace observation is required	Satisfactory fault finding and rectification on the chosen system required across the documented ranges. At least **four** separate jobs must be included in the work log. At least **two** of the jobs must be evidenced from the workplace.	Minimum requirements of four separate jobs: Minimum of three jobs evidenced from workplace to include: **One DO (**direct observation) **One** Reflective account/witness testimony Minimum of **two** jobs evidenced from site or can be simulated in centre
4. Service one of the following: • air source heat pump system • solar thermal hot water system	**One** service directly observed (by a competent witness or assessor) in the workplace	Satisfactory servicing of the chosen system required across the documented ranges. At least **five** separate jobs must be included in the work log. At least **three** of the jobs must be evidenced from the workplace.	Minimum requirements of five separate jobs: Minimum of three jobs evidenced from workplace to include: **One DO (**direct observation) **Two** Reflective account/witness testimonies Minimum of **two** jobs evidenced from site or can be simulated in centre

Please refer to the range items in the relevant units for further information.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log.
- On site direct observation can be carried out by an expert witness from the workplace or the assessor from the delivery centre.
- The role of the expert witness is to observe the candidate on site and validate evidence recorded in the work log.
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Assessment codes

Colour Code	Description
Green	**Directly observed by assessor** Green forms/sections – assessor to complete
Orange	**Observation with an expert witness** Reflective account from site with supporting evidence. Reflective account from simulated task at centre with supporting evidence. Orange forms/sections – candidate to complete

On site tracking grid

1. Install, commission, service and fault find air source heat pump and/or solar thermal hot water systems

Candidates must be observed on the minimum amount of occasions and range as identified below.
Notes:

- * An observation may only to be simulated where it has not been possible for the observation to be obtained on site.
- The candidate must have covered the necessary training/mentoring required before the observation takes place.

Observation requirements				
Total – 14 observations for installation, commission, service and fault finding		**Install and commission**	**Service**	**Fault Finding**
Observation 1	**Directly Observed** All three may be from site			
Observation 2	**Reflective Account** All accounts are to come from site			
Observation 3	**Reflective Account** Minimum of 2 accounts to come from site			n/a
Observation 4	**Reflective Account** Minimum of 3 accounts are to come from site or may be simulated*			
Observation 5	**Reflective Account** Minimum of 3 accounts are to come from site or may be simulated*			

The on-site portfolio must also include evidence for the following areas of learning:

Unit 304 Planning and supervision

- LO5 Producing risk assessments and method statements for the plumbing and domestic heating systems industry
- LO6 Producing a work programme for tasks in the plumbing and domestic heating systems industry

Unit 324 Air source heat pump systems

- LO4 Air source heat pump installation
- LO5 Service and maintenance of air source heat pump systems
- LO6 Fault diagnosis and rectification of defects and malfunctions on air source heat pump systems
- LO7 Testing, commissioning and handover of air source heat pump systems

Unit 325 Solar thermal hot water systems

- LO3 Solar thermal hot water systems installation
- LO4 Testing, commissioning and handover of solar thermal hot water systems
- LO5 Service, maintenance, diagnosis and rectification of faults of a solar thermal hot water installation

Non-domestic Plumbing Pathway

Unit 327 Common processes and techniques in non-domestic plumbing systems

Level:	3
GLH:	91
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Unit aim:	This unit includes knowledge and skills required to work safely in non-domestic premises, and an introduction to the processes and techniques used in non-domestic plumbing.

Learning outcome

The learner will know and understand:

LO1 Health and safety risks and legislation associated with work on non-domestic plumbing systems

Assessment criteria

AC1.1 **Aspects of work** that pose **health and safety risks**
AC1.2 Requirements for **safe systems of work** and permit procedures
AC1.3 **Legislation** relevant to non-domestic plumbing work

Range

AC1.1 **Aspects of work**

- fabrication
- installation
- testing
- commissioning
- decommissioning

AC1.1 **Health and safety risks**

- burns
- electrocution/electric shock
- high-risk buildings
- personal injury through component/equipment handling
- toxic poisoning
- working at height
- working in confined spaces

AC1.2 **Safe systems of work**

- safe electrical isolation
- hot working procedures
- lone working procedures
- working at heights
- working in confined spaces

AC1.3 **Legislation**

- building regulations:
  - fire safety
  - toxic substances
  - ventilation
  - protection from falling, collision and impact
  - access and use of buildings
- The Construction (Design and Management) Regulations

Learning outcome

The learner will know and demonstrate:

LO2 Safe use of hand and power tools in non-domestic plumbing systems work

Assessment criteria

AC2.1 Purpose of **hand tools** and **power tools** used in non-domestic plumbing systems work

AC2.2 **Use of hand and power tools** in non-domestic plumbing systems work

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Range

AC2.1 **Hand tools**

- hand threading tools
- pipe cutters
- reamers
- pipe wrenches
- chain wrenches
- Joint forming tools (mechanical groove)
- hand bending machines

AC2.1 **Power tools**

- power threading machines
- powered crimping tools
- grinders
- core drills
- power pipe bending machines
- laser levels
- plastic pipe fusion welding equipment
- hydraulic bending machines

AC2.2 **Use of hand and power tools**

- visual inspection
- calibration
- safe operation

- safe storage
- maintenance requirements

Learning Outcome

The learner will know and understand:

LO3 Pipework and jointing methods used in non-domestic plumbing systems

Assessment Criteria

AC3.1 **Pipework materials** and diameters used in non-domestic plumbing systems
AC3.2 **Types of fittings** used in non-domestic plumbing systems
AC3.3 **Methods of jointing pipework** used in non-domestic plumbing systems
AC3.4 **Methods of bending pipework** used in non-domestic plumbing systems

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Range

AC3.1 **Pipework materials**

- copper (BS EN 1057):
  - R220 (Plastic coated)
  - R250 half hard lengths
  - 290 hard lengths
- stainless steel
- galvanised low carbon steel
- low carbon steel (LCS):
  - medium grade
  - heavy grade
- plastic (hot and cold water supply):
  - cross linked polyethylene (PE-x)
  - polybutylene (PB)
  - polyethylene (medium density (MDPE) & high density (HDPE) (cold water only)
  - chlorinated poly vinyl chloride (CPVC) (cold water only)
- Plastic (sanitary and rainwater):
  - polyvinyl chloride – unplasticized (PVC-u)
  - acrylonitrile butedyne styrene (ABS)
  - polypropylene
  - modified unplasticized poly vinyl chloride (MUPVC)
  - high density polyethylene (HDPE)
- cast iron (sanitary)

AC3.2 **Types of fittings**

- couplers
- elbows and bends
- equal tees
- reducing tees
- reducers
- flexible connectors
- tank connectors
- stop ends
- expansion joints
- swept tees
- swept branches

AC3.3 **Methods of jointing pipework**

- copper:
  - solder ring and end feed
  - brazed
  - compression (type A and B)
  - push-fit
  - press-fit
  - grooved
  - flanged
- stainless steel:
  - press-fit
  - compression
- low carbon steel (LCS)/galvanised low carbon steel pipe:
  - threaded
  - compression
  - flanged
- plastic/composite pressure pipe:
  - push fit
  - compression
  - proprietary - copper and MDPE
- plastic jointing (sanitary pipework):
  - ring seal
  - compression
  - solvent weld
  - fusion
  - mechanical grooved
- cast iron (mechanical)

AC3.4 **Methods of bending pipework**

- copper/carbon steel/stainless steel machine bending:
  - 90° bends
  - sets and offset bends
  - passover bends
  - partial passover
- low carbon steel hydraulic machine bending:
  - 90° bends
  - sets and offset bends
  - passover bends
  - partial passover
- plastic/composite pressure pipe:
  - cabling technique
  - cold forming bend
  - minimum bend radius

Learning Outcome

The learner will know and understand:

LO4 Site preparation techniques for work on non-domestic plumbing systems

Assessment Criteria

AC4.1 **Work methods** for preparing and protecting the building for installation work

AC4.2 Importance of identifying pre-existing damage to the building fabric or non-domestic property before the work commences

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AC4.3 **Methods of safe storage** of tools and equipment
AC4.4 **Sources of information** for carrying out non-domestic plumbing work

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Range

AC4.1 **Work methods**

- drilling holes in masonry and building fabric surfaces
- making good to masonry and building fabric surfaces, ensuring the maintenance of the structural integrity of the building in terms of:
    - imposed loads
    - fire resistance (Including requirements for high rise buildings and service ducts)
    - water tightness, including damp ingress
    - airtightness
    - thermal transmission
- cutting chases – wall and floor surfaces
- walking boards
- floor covering and décor protection

AC4.3 **Methods of safe storage**

- tool vault
- site storage container

AC4.4 **Sources of information**

- statutory regulations
- industry standards
- manufacturers' technical instructions
- building plans
- specifications

Learning Outcome

The learner will know and demonstrate:

LO5 Use of clips and brackets to support non-domestic plumbing pipework and components

Assessment Criteria

AC5.1 Pipework **locations** for non-domestic pipework and components
AC5.2 How to measure and mark out fixings for non-domestic pipework and components
AC5.3 **Types of fixing devices** for non-domestic pipework and components
AC5.4 **Types of clips and brackets** for non-domestic pipework and components
AC5.5 **Select and fix clips and brackets** appropriate to non-domestic pipework and components

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Range

AC5.1 **Locations**

- plant rooms
- tank rooms
- pipework riser shafts and ducts
- service cupboards and ducts
- meter and valve housings/cupboards

- concealed voids (panel accessible washrooms)
- cleaners' cupboards
- high level pipework:
    - exposed suspended
    - suspended within false ceiling tiles/grid
    - surface fixed (Internal and external)
- low level pipework:
    - within accessible suspended floors
    - surface fixed (internal and external)

AC5.3 **Types of fixing devices**

- light duty:
    - screws
    - plastic nylon plugs
    - drive in nylon fixings
    - cavity/hollow wall fixings
- heavy duty:
    - drop-in/drive-in anchors
    - sleeved anchors and rawl bolts
    - resin anchors
    - coach bolt screws
- channel strut and associated fixings
- threaded rod
- wedge nuts and lindapters

AC5.4 **Types of clips and brackets**

- two-piece/rubber lined ring clip
- Munson rings
- saddle clips
- stand-off clips
- school board clips
- expansion fixed points
- channel strut and associated fixings

AC5.5 **Select and fix clips and brackets**

- follow recommended spacing requirements

Learning Outcome

The learner will know and demonstrate:

LO6 Non-domestic plumbing pipework installation

Assessment Criteria

AC6.1 Non-domestic pipework installation **requirements**
AC6.2 Select non-domestic **pipework materials** and fittings to specifications
AC6.3 Measure, mark and cut pipework materials for non-domestic **plumbing systems**
AC6.4 Fabricate and **bend** non-domestic pipework
AC6.5 Position and fix non-domestic **pipework materials** to specifications
AC6.6 **Joint** non-domestic pipework to specifications

Range

AC6.1 **Requirements**

- prefabrication of pipework
- installing pipework in-situ
- use of sleeves
- fire stopping to pipework
- first and second fix
- pipework protection
- pipe insulation

AC6.2 and AC6.5 **Pipework materials**

- copper
- stainless steel
- low carbon steel
- galvanised low carbon steel
- plastic (hot water, cold water, sanitary, and rainwater pipework)
- cast Iron (sanitary pipework)

AC6.3 **Plumbing systems**

- hot water
- cold water
- sanitary and rainwater

AC6.4 **Bend**

- copper/stainless steel machine bending:
  - 90° bends
  - sets and offset bends
  - passover bends
  - partial passover
- low carbon steel hydraulic machine bending:
  - 90° bends
  - sets and offset bends
  - passover bends

AC6.6 **Joint**

- copper:
  - solder ring and end feed
  - compression (type A and B)
  - push-fit
  - press-fit
  - flanged
- stainless steel:
  - press-fit
  - compression
- corrugated stainless steel:
  - compression
- low carbon steel (LCS)/galvanised low carbon steel pipe:
  - threaded
  - compression
  - flanged
- plastic/composite pipe (hot and cold water pipework):
  - compression
  - proprietary - copper and MDPE

- plastic jointing (sanitary pipework):
    - ring seal
    - compression
    - solvent weld
    - fusion
    - mechanical (grooved)
- cast Iron (sanitary pipework):
    - mechanical

Unit 328 Cold water supply to non-domestic premises

Level:	3
GLH:	34
Assessment type:	e-assessment (multiple choice questions)
Unit aim:	This unit includes the understanding of cold water supply to non-domestic premises.

Learning Outcome

The learner will know and understand:

LO1 Cold water supply to non-domestic premises

Assessment Criteria

AC1.1 Types of **water supply** to **non-domestic premises** and how these are **regulated**
AC1.2 **Types of water** and **uses of water** in non-domestic premises
AC1.3 Water **service to non-domestic premises and isolation points**
AC1.4 **Requirements** to provide water according to Water Supply (Water Fittings) Regulations

Range

AC1.1 **Water supply**
- pains
- Private

AC1.1 **Non-domestic premises**
- high-rise buildings
- hospitals and healthcare
- industrial and commercial
- multi-occupancy buildings
- public buildings
- retail
- schools, colleges and universities
- transport hubs

AC1.1 **Regulated**
- water Supply (Water fittings) regulations
- private supply regulations

AC1.2 **Types of water**
- wholesome water
- unwholesome water:
  - harvested rainwater
  - grey water

AC1.2 **Uses of water**

- specialist water systems for commercial or manufacturing processes
- treatment and filtration systems

AC1.3 **Service to non-domestic premises and isolation points**

- connection methods to the main
- communication pipe detail
- service pipe detail
- main external stop valve location
- meter housings
- external storage tanks
- pump installations
- installation requirements
- methods of entry of the service pipework to non-domestic premises

AC1.4 **Requirements**

- contamination
- erroneous measurement
- misuse
- undue consumption
- waste

Unit 329 Installation of non-domestic plumbing systems

Level:	3
GLH:	197
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Unit aim:	This unit covers the installation of non-domestic plumbing systems: cold water, hot water, sanitary pipework, and rainwater. The scope of the system is from the boundary stop valve into the property feeding the water outlets. The unit enables learners to demonstrate understanding of the layout, appliances, and components of different types of systems in the context of non-domestic premises.

Learning Outcome

The learner will know and understand:

LO1 Layouts of non-domestic plumbing systems

Assessment Criteria

AC1.1 Types and layout features of **cold water systems** in non-domestic premises
AC1.2 Types and layout features of **hot water systems** in non-domestic premises
AC1.3 Types and layout features of **sanitary pipework systems** in non-domestic premises
AC1.4 Types and layout features of **rainwater systems** in non-domestic premises

Range

AC1.1 **Cold water systems**

- wholesome supply:
  - direct cold water system
  - indirect cold water system
  - boosted (non-domestic premises):
    - direct boosted
    - direct boosted to a water header or cistern
    - indirect boosted to a cistern
    - indirect boosted with pressure vessel
- unwholesome supply:
  - harvested rainwater
  - grey water recycling

AC1.2 **Hot water systems**

- vented and unvented (including multiple linked/coupled cylinders)
- direct:
  - immersion
  - direct fired
  - point of use

- indirect:
    - storage
    - instantaneous
    - plate heat exchanger
    - thermal store
    - heat interface unit (HIU)
- secondary circulation
- building regulations (G3) for cylinders over 500 litres

AC1.3 **Sanitary pipework systems**
- primary ventilated stack system
- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system

AC1.4 **Rainwater systems**
- gravity systems
- siphonic systems
- rainwater collection and outfall attenuation
- pumped to gravity drainage
- rainwater reuse

Learning Outcome

The learner will know and demonstrate:

LO2 Cold water systems installation in non-domestic premises

Assessment Criteria

AC2.1 **Fluid categories** of water and uses supplied to non-domestic premises
AC2.2 **Advantages and disadvantages** of **cold water systems** in non-domestic premises
AC2.3 Location and operation of **components** in non-domestic cold water systems
AC2.4 **Layout and installation requirements** for protected cold water storage cisterns with capacity greater than 1000 litres
AC2.5 **Protection** from frost and undue warming of cold water systems
AC2.6 **Sources of information** required when undertaking work on cold water systems in non-domestic premises
AC2.7 **Backflow** risk and required **methods of prevention**
AC2.8 Cold water systems **installation** in non-domestic premises

---

Range

AC2.1 **Fluid categories**
- 1 to 5
- water regulations UK guidance:
    - non-domestic heating systems, washing machines, and catering
    - non-domestic hose union bib tap
    - healthcare and laboratories
    - manufacturing
    - commercial processes
    - agriculture, livestock and farming

AC2.2 **Advantages and disadvantages**

- suitable location
- adequate space
- costs:
    - purchasing
    - installation
    - running
- installation efficiency
- maintenance requirements
- specialist components
- pressure
- flow rate
- storage
- fire resistance

AC2.2 **Cold water systems**

- wholesome supply:
    - direct cold water system
    - indirect cold water system
    - boosted (non-domestic premises):
        - direct boosted
        - direct boosted to a water header or cistern
        - indirect boosted to a cistern
        - indirect boosted with pressure vessel
- unwholesome supply:
    - harvested rainwater
    - grey water recycling

AC2.3 **Components**

- taps, outlets and valves:
    - mixer taps
    - pillar taps
    - bib taps
    - hose union bib taps (internal and external)
    - bi-flow mixer taps
    - ceramic disc taps
    - spray taps
    - knee operated taps
    - infra-red taps
    - non-concussive taps
    - drinking fountain taps
    - stop valves
    - servicing valves
    - pressure reducing valves
    - flow restrictors
    - line strainers
    - full way gate valves
    - spherical plug valves
    - drain valves
    - float operated valves (parts 1–4)
    - Flushing valves
- water meters
- water treatment components:
    - water softeners
    - water filters
    - water conditioners

    - water disinfection (UV and chemical)
- cisterns:
    - cold water storage cisterns
    - cold water feed cisterns
    - WC/urinal flushing cisterns
    - break cisterns
    - sectional (1000 litre+)
- boosted system components:
    - float switch
    - pressure switch
    - accumulator/pressure vessel
    - booster pump sets
    - pressure relief valve
    - pressure gauge
    - drinking water header
- shower mixer valves:
    - manual/thermostatic
    - digital
    - multiple outlets/single outlet
    - concealed/exposed
- shower diverter valves:
    - push-button (non-concussive)
    - digital (button)
    - infra-red
- shower outlets:
    - fixed head/adjustable head
    - exposed/concealed
- shower panel sets:
    - digital (button)
    - manual (push-button)
- large diameter pipework (28mm+)

AC2.4 **Layout and installation requirements**

- typical cistern sizes for non-domestic premises
- linked/married cold water cisterns
- confirm main supply meets the requirements of the system:
    - calculation of pipe sizes for boosted systems
- warning pipe
- overflow arrangements
- inlet/outlet positions
- position of float operated valve
- position of cistern vent
- position of open vent pipe connection
- requirement for a rigid close fitting lid
- service valve requirements
- insect screens
- insulation
- support
- drilling requirement
- maintenance and access requirements
- prevention of stagnation
- weight/structural support

AC2.5 **Protection**

- pipework positioning
- pipework insulation
- cistern insulation
- trace heating

AC2.6 **Sources of information**

- statutory regulation
- industry standards
- manufacturers' technical instructions
- specialist industry-specific standards and specifications
- non-domestic shower considerations:
    - healthcare and users with disabilities
    - bath shower mixer

AC2.7 **Backflow**

- back siphonage
- back pressure

AC2.7 **Methods of prevention**

- air gaps:
    - AA
    - AB
    - AC
    - AD
    - AF
    - AG
    - AUK1
    - AUK2
    - AUK3
    - DC
- mechanical:
    - BA
    - CA
    - DA
    - DB
    - DUK1
    - EA/EB
    - EC/ED
    - HC
    - HUK1
    - LA
    - LB

AC2.8 **Installation**

- commercial washroom
- cistern greater than 1000 litres
- cold water booster set (may be combined with cistern)
- range of 3 appliances
- sanitary appliance facilities for users with disabilities
- large diameter pipework (28mm+)

Learning Outcome

The learner will know and demonstrate:

LO3 Hot water systems installation in non-domestic premises

Assessment Criteria

AC3.1 **Advantages and disadvantages** of **hot water systems** in non-domestic premises
AC3.2 Location and operation of **components** in non-domestic hot water systems
AC3.3 **Protection** from frost and heat loss in non-domestic hot water systems
AC3.4 **Negative effects** of expansion and contraction in non-domestic hot water systems and **methods** to mitigate these
AC3.5 **Secondary circulation hot water systems**
AC3.6 **Sources of information** required when undertaking work on hot water systems in non-domestic premises
AC3.7 **Backflow** risk and required **methods of prevention**
AC3.8 Hot water systems **installation** in non-domestic premises

Range

AC3.1 **Advantages and disadvantages**

- suitable location
- adequate space
- costs:
  - purchasing
  - installation
  - running
- installation efficiency
- maintenance requirements
- specialist components
- available fuels
- pressure
- flow rate
- storage
- fire resistance
- multiple linked/coupled cylinder installation

AC3.1 **Hot water systems**

- vented and unvented (including multiple linked/coupled cylinders)
- direct:
  - immersion
  - direct fired
  - point of use
- indirect:
  - storage
  - instantaneous
  - plate heat exchanger
  - thermal store
  - heat interface unit (HIU)
- secondary circulation

AC3.2 **Components**

- cylinders and calorifiers (vented and unvented):
    - grades available
    - sizes available
    - direct and indirect
    - dual coil
    - external plate heat exchangers
    - thermal storage
- water heaters:
    - multi point
    - point of use
- taps, outlets and valves:
    - mixer taps
    - pillar taps
    - bib taps
    - bi-flow mixer taps
    - ceramic disc taps
    - spray taps
    - non-concussive taps
    - knee operated taps
    - infra-red taps
    - stop valves
    - servicing valves
    - line strainers
    - thermostatic mixing valves
    - pressure reducing valves
    - pressure limiting valves
    - pressure balancing valves
    - expansion relief valves
    - composite valves
    - temperature relief valves
    - pressure relief valves
    - flow restrictors
    - full way gate valves
    - spherical plug valves
    - drain valves
- shower mixer valves:
    - manual/thermostatic
    - digital
    - multiple outlets/single outlet
    - concealed/exposed
- shower diverter valves:
    - push-button (non-concussive)
    - digital (button)
    - infra-red
- shower outlets:
    - fixed head/adjustable head
    - exposed/concealed
- shower panel sets:
    - digital (button)
    - manual (push-button)
- stratification pumps
- secondary circulation pumps
- D1-D2 discharge pipe arrangements
- large diameter pipework (28mm+)

AC3.3 **Protection**

- pipework positioning
- pipework insulation
- trace heating

AC3.4 **Negative effects**

- noise transmission
- joint failure

AC3.4 **Methods**

- expansion loops
- bellows
- flexible pipework
- cushioning material

AC3.5 **Secondary circulation hot water systems**

- pipework layouts
- approved circulators
- time control
- temperature requirements
- trace heating

AC3.6 **Sources of information**

- statutory regulation
- industry standards
- manufacturers' technical instructions
- specialist industry-specific standards and specifications
- non-domestic shower considerations:
    - healthcare and users with disabilities
    - bath shower mixer

AC3.7 **Backflow**

- back siphonage
- back pressure

AC3.7 **Methods of prevention**

- air gaps:
    - AA
    - AB
    - AC
    - AD
    - AF
    - AG
    - AUK1
    - AUK2
    - AUK3
    - DC
- mechanical:
    - BA
    - CA
    - DA
    - DB
    - DUK1
    - EA/EB

- EC/ED
- HC
- HUK1
- LA
- LB

AC3.8 **Installation**

- commercial washroom
- cylinder/calorifier:
  - multiple linked/coupled cylinder configuration
  - two unvented
  - each greater than 120 litres
- range of two washbasins
- sanitary appliance facilities for users with disabilities
- large diameter pipework (28mm+)

Learning Outcome

The learner will know and demonstrate:

LO4 Sanitary appliances and pipework systems installation in non-domestic premises

Assessment Criteria

AC4.1 **Advantages and disadvantages** of **sanitary pipework systems** in non-domestic premises

AC4.2 Layout and principles of **sanitary appliances** and **pipework systems** in non-domestic premises

AC4.3 Location and function of **components** in sanitary appliances and pipework systems

AC4.4 **Negative effects** of expansion and contraction in sanitary pipework systems and **methods** to mitigate these

AC4.5 **Sources of information** required when undertaking work on sanitary appliances and pipework systems in non-domestic premises

AC4.6 Types of **sanitary appliances and components** used in non-domestic premises

AC4.7 Space and position **requirements** to install a range of multiple sanitary appliances

AC4.8 Installation **requirements** of sanitary facilities and equipment for users with disabilities in non-domestic premises

AC4.9 Suitable **below ground drainage systems** to receive waste water from non-domestic premises

AC4.10 Sanitary appliances, pipework systems and components **installation** in non-domestic premises

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Range

AC4.1 **Advantages and disadvantages**

- suitable location
- adequate space
- costs:
  - purchasing
  - installation
- installation efficiency
- maintenance requirements
- discharge rate
- noise transmission
- resistance to corrosion
- mechanical strength
- fire resistance

AC4.1 and AC4.2 **Sanitary pipework systems**

- primary ventilated stack system
- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system
- discharge stacks:
    - soil stack diameters
    - waste stack diameters serving waste appliances only
    - use and types of bends
    - proximity of low level connections
    - location of access/rodding points
- branch discharge:
    - layout of unventilated and ventilated branch discharge pipework
    - maximum pipework lengths and gradients
    - sizes (diameters) of branch discharge pipework for soil and waste appliances
    - use of traps (including chemical dilution recovery traps) and self-sealing valves
    - methods of ventilating branch discharge pipework
    - methods of connecting multiple waste appliances to branch discharge pipework
    - methods of connecting branch discharge pipework into the main stack
- stack ventilation:
    - proximity of vent outlet to openable windows
    - use of air admittance valves
    - cross-venting
- systems and appliances:
    - waste appliance connections to gullies
    - waste appliance connections direct to drain

AC4.2 and AC4.6 **Sanitary appliances and components**

- WCs (Cisterns and flushing valves)
- urinals (Cisterns and flushing valves)
- WC macerators
- flushing cisterns (automatic and manual)
- waste disposal units
- baths
- bidets
- wash hand basins
- washing troughs
- shower tray
- bath/shower screens and cubicles
- sinks (food preparation and cleaning)
- refrigerators
- drinking fountains
- waste water lifters
- non-domestic washing machines (including requirements for healthcare premises)
- non-domestic dishwashers (including requirements for healthcare premises)
- specialist healthcare appliances:
    - appliances for the users with disabilities
    - appliances in hospitals and healthcare premises

AC4.3 **Components**

- plastic and cast iron where applicable
- bend 92½º
- bend 135º
- bend (spigot/socket)

- access/rodding point fitting
- offset bend
- branch tee
- boss pipe/connections/adaptors
- vent terminal
- waste manifold
- pan connectors
- traps (including chemical dilution recovery types)
- grease interceptors/trap
- waterless trap/waste valve
- air admittance valve
- clips/brackets
- coupler
- expansion couplings
- mechanical couplings
- floor gullies

AC4.4 **Negative effects**
- noise transmission
- joint failure

AC4.4 **Methods**
- specialist expansion joints in plastic
- clipping requirements

AC4.5 **Sources of information**
- statutory regulation
- industry standards
- manufacturers' technical instructions

AC4.7 **Requirements**
- heights
- distances between sanitary appliances
- location
- British Standard BS 6465

AC4.8 **Requirements**
- Building regulations (Approved document M)
- manufacturers' instructions

AC4.9 **Below ground drainage systems**
- combined drainage systems
- separate drainage systems
- partially separate drainage systems
- waste water lifter
- pumping station

AC4.10 **Installation**
- commercial washroom
- range of 3 sanitary appliances
- sanitary appliance facilities for users with disabilities
- soil and waste pipework

Learning Outcome

The learner will know and understand:

LO5 Rainwater systems installation in non-domestic premises

Assessment Criteria

AC5.1 **Advantages and disadvantages** of **rainwater systems** in non-domestic premises
AC5.2 Typical **materials** and **components** used in rainwater systems in non-domestic premises
AC5.3 Layout and principles of **rainwater systems** in non-domestic premises
AC5.4 **Sources of information** required when undertaking work on rainwater systems in non-domestic premises
AC5.5 **Negative effects** of expansion and contraction in non-domestic rainwater systems and **methods** to mitigate these

Range

AC5.1 **Advantages and disadvantages**

- costs:
  - purchasing
  - installation
- installation efficiency
- maintenance requirements
- resistance to corrosion
- mechanical strength
- noise transmission of materials

AC5.1 and AC5.3 **Rainwater systems**

- gravity systems
- siphonic systems
- rainwater collection and outfall attenuation
- pumped to gravity drainage
- rainwater reuse

AC5.2 **Materials**

- PVC-u
- extruded aluminium
- cast iron
- copper
- HDPE

AC5.2 **Components**

- pipe (RWP):
  - offsets/bends
  - angles
  - branches
  - hopper heads
  - shoes
- Gutter:
  - running outlets
  - gutter angles
  - gutter unions

    - stop ends
    - unions
    - siphonic outlet
- Internal rainwater pipework:
    - generic sanitary pipework fittings
    - floor outlets/gullies
- attenuation tanks

AC5.4 **Sources of information**

- statutory regulation
- industry standards
- manufacturers' technical instructions

AC5.5 **Negative effects**

- noise transmission
- joint failure

AC5.5 **Methods**

- expansion joints in plastic
- clipping requirements

Unit 330 Decommission non-domestic plumbing systems

Level:	3
GLH:	16
Assessment type:	Practical assignment
Unit aim:	This unit covers the decommissioning procedures for non-domestic plumbing systems: cold water, hot water, sanitary appliances and pipework, and rainwater. The scope of the system is from the boundary stop valve into the property feeding the water outlets.

Learning Outcome

The learner will know and demonstrate:

LO1 Decommissioning of non-domestic plumbing systems

Assessment Criteria

AC1.1 **Decommission** cold water systems in non-domestic premises in accordance with appropriate **procedures**
AC1.2 **Decommission** hot water systems in non-domestic premises in accordance with appropriate **procedures**
AC1.3 **Decommission** sanitary appliances and pipework systems in non-domestic premises in accordance with appropriate **procedures**
AC1.4 **Decommission** rainwater systems in non-domestic premises in accordance with appropriate **procedures**

Range

AC1.1 – AC1.4 **Decommission**

- temporary
- permanent

Procedures

AC1.1 and AC1.2 **Cold and hot water systems**

- obtain permission/permit
- notify responsible person, including building users
- isolate the fuel/electricity supply to the system as appropriate
- isolate water supply
- apply warning notices, signs and barriers
- drain system to a suitable location
- appropriately dispose of contents and any additives
- continuity bonding as required
- temporary capping of pipework sections as required
- alternative supplies as required
- appropriately dispose of materials

- decommissioning certificate

AC1.3 **Sanitary appliances and pipework systems**

- obtain permission/permit
- notify responsible person, including building users
- checks for hazardous materials
- isolate the electricity supply to the system if required
- isolate water supply
- apply warning notices, signs and barriers
- drain waste water to a suitable location
- appropriately dispose of contents
- temporary capping of soil and waste pipework sections as required
- alternative sources of facilities or supplies as required
- safe removal of components
- appropriately dispose of materials
- decommissioning certificate

AC1.4 **Rainwater systems**

- obtain permission/permit
- notify responsible person, including building users
- checks for hazardous materials
- apply warning notices, signs and barriers
- appropriately dispose of contents
- temporary capping/plugging of rainwater pipework as required
- safe removal of components
- appropriately dispose of materials
- decommissioning certificate

Unit 331 Test and commission non-domestic plumbing systems

Level:	3
GLH:	60
Assessment type:	Practical assignment
Unit aim:	This unit covers the soundness test and commissioning procedures for non-domestic plumbing systems: cold water, hot water, sanitary appliances and pipework, and rainwater. The scope of the system is from the boundary stop valve into the property feeding the water outlets. The unit includes flushing and disinfection, commissioning and operational checks, actions when defects are identified, and the handover to the end user.

Learning Outcome

The learner will know and demonstrate:

LO1 Soundness test and commission cold water appliances, systems and components in non-domestic premises

Assessment Criteria

AC1.1 **Information sources** required to complete testing and commissioning **cold water systems** in non-domestic premises
AC1.2 **Soundness test procedure** on cold water systems **pipework** and components in non-domestic premises
AC1.3 **Flushing and approved disinfection requirements** for new and existing cold water systems in non-domestic premises
AC1.4 **Commission and operational checks**
AC1.5 **Actions** that must be taken when soundness testing and commissioning reveal defects
AC1.6 **Procedure** for handing over to the end user

Range

AC1.1 **Information sources**

- building plans, including specifications
- statutory regulations
- industry standards
- manufacturers' technical instructions

AC1.1 **Cold water systems**

- wholesome supply:
  - direct cold water system
  - indirect cold water system
  - boosted (non-domestic premises):
    - direct boosted
    - direct boosted to a water header or cistern
    - indirect boosted to a cistern
    - indirect boosted with pressure vessel
- unwholesome supply:
  - harvested rainwater
  - grey water recycling

AC1.2 **Soundness test procedure**

- plan the test:
  - sectional testing
- obtain permission/permit
- notify responsible person, including building users
- apply warning notices, signs and barriers
- visual inspection of pipework and valves:
  - joints
  - components
    appliances
  - valves, draw-off, outlets and drain-off points isolated
  - correct labelling
  - adequate support and compliance with drawings and specifications
- initial fill
- test to required pressure
- stabilisation for required period
- check for leaks
- check pressures after test period
- complete soundness test certificate
- complete other documentation as required
- notify responsible person that testing is complete

AC1.2 **Pipework**

- metal pipework
- plastic pipework

AC1.3 **Flushing and approved disinfection requirements**

- cold flush:
  - water supply (water fittings) regulations
- disinfection process:
  - water supply (water fittings) regulations
  - ACOP L8 Management of legionella pneumophola
  - calculation of disinfectant content for the system
  - measuring disinfection content (free residual chlorine) at end of testing
  - BS PD 855468 Flushing and disinfection of domestic water services

AC1.4 **Commission and operational checks**

- temperature
- flow rate
- pressures
- operation of components and controls

- water quality checks where required
- setting/checking water levels
- appropriate marking and labelling of system pipework and components
- completion of commissioning documentation

AC1.5 **Actions**
- report to responsible person
- obtain approval to rectify defect
- re-test and commission as required

AC1.6 **Procedure**
- demonstrate safe operation of system and components to customer
- identify maintenance requirements
- handover documentation and manufacturers' instructions

Learning Outcome

The learner will know and demonstrate:

LO2 Soundness test and commission hot water appliances, systems and components in non-domestic premises

Assessment Criteria

AC2.1 **Information sources** required to complete testing and commissioning on **hot water systems** in non-domestic premises
AC2.2 **Soundness test procedure** on hot water systems **pipework** and components in non-domestic premises
AC2.3 **Flushing and approved disinfection requirements** for new and existing hot water systems in non-domestic premises
AC2.4 **Commission and operational checks**
AC2.5 **Actions** that must be taken when soundness testing and commissioning reveal defects
AC2.6 **Procedure** for handing over to the end user

Range

AC2.1 **Information sources**
- building plans, including specifications
- statutory regulations
- industry standards
- manufacturers' technical instructions

AC2.1 **Hot water systems**
- vented and unvented (including multiple linked/coupled cylinders)
- direct:
    - immersion
    - direct fired
    - point of use
- Indirect:
    - storage
    - instantaneous
    - plate heat exchanger

    - thermal store
    - heat interface unit (HIU)
- secondary circulation

AC2.2 **Soundness test procedure**

- plan the test:
    - sectional testing
- obtain permission/permit
- notify responsible person, including building users
- apply warning notices, signs and barriers
- visual inspection of pipework and valves:
    - joints
    - components
    - appliances
    - valves, draw-off, outlets and drain-off points isolated
    - correct labelling
    - adequate support and compliance with drawings and specifications
- initial fill
- test to required pressure
- stabilisation for required period
- check for leaks
- check pressures after test period
- complete soundness test certificate
- complete other documentation as required
- notify responsible person that testing is complete

AC2.2 **Pipework**

- metal pipework
- plastic pipework

AC2.3 **Flushing and approved disinfection requirements**

- cold flush:
    - water supply (water fittings) regulations
- hot flush:
    - water supply (water fittings) regulations
- disinfection process:
    - water supply (water fittings) regulations
    - ACOP L8 Management of legionella pneumophola
    - calculation of disinfectant content for the system
    - measuring disinfection content (free residual chlorine) at end of testing
    - BS PD 855468 (2015) Flushing and disinfection of domestic water services

AC2.4 **Commission and operational checks**

- temperature
- thermostat settings
- flow rate
- pressures
- secondary circulator settings and controls
- balancing valves
- checking of safety controls (unvented systems)
- operation of components and controls
- water quality checks where required
- appropriate marking and labelling of system pipework and components
- completion of commissioning documentation

AC2.5 **Actions**

- report to responsible person
- obtain approval to rectify defect
- re-test and commission as required

AC2.6 **Procedure**

- demonstrate safe operation of system and components to customer
- identify maintenance requirements
- handover documentation and manufacturers' instructions

Learning Outcome

The learner will know and demonstrate:

LO3 Soundness test and commission sanitary appliances, pipework systems and components in non-domestic premises

Assessment Criteria

AC3.1 **Information sources** required to complete testing and commissioning **sanitary pipework systems** in non-domestic premises
AC3.2 **Soundness test procedure** on sanitary pipework systems in non-domestic premises
AC3.3 **Commission and operational checks**
AC3.4 **Actions** that must be taken when soundness testing and commissioning reveal defects
AC3.5 **Procedure** for handing over to the end user

Range

AC3.1 **Information sources**

- building plans, including specifications
- statutory regulations
- industry standards
- manufacturers' technical instructions

AC3.2 **Sanitary pipework systems**

- primary ventilated stack system
- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system

AC3.2 **Soundness test**

- first fix test (carcass pipework)
- second fix test (pipework and traps)

AC3.2 **Procedure**

- dry test
- plan the test:
    - sectional testing
    - multiple stacks
- obtain permission/permit
- notify responsible person, including building users
- apply warning notices, signs and barriers

- visual inspection of pipework and components:
    - joints
    - traps
    - adequate support and compliance with drawings and specifications
    - damage
- air test to required pressure
- check pressure after test period
- leak detection techniques and substances
- complete soundness test certificate
- complete other documentation as required
- notify responsible person that testing is complete

AC3.3 **Commission and operational checks**

- wet test:
    - checking for leaks
    - adequate removal of waste
- trap seal integrity
- signs of siphonage
- setting/checking water levels
- appliance operation and performance test
- completion of commissioning documentation

AC3.4 **Actions**

- report to responsible person
- obtain approval to rectify defect
- re-test and commission as required

AC3.5 **Procedure**

- demonstrate safe operation of system and components to customer
- identify maintenance requirements
- handover documentation and manufacturers' instructions

Learning Outcome

The learner will know and demonstrate:

LO4 Soundness test and commission rainwater systems in non-domestic premises

Assessment Criteria

AC4.1 **Information sources** required to complete testing and commissioning **rainwater systems** in non-domestic premises

AC4.2 **Soundness test and commission procedure** on rainwater systems pipework and components in non-domestic premises

AC4.3 **Actions** that must be taken when soundness testing and commissioning reveal defects

AC4.4 **Procedure** for handing over to the end user

Range

AC4.1 **Information sources**

- building plans, including specifications
- statutory regulations
- industry standards

- manufacturers' technical instructions

AC4.1 **Rainwater systems**

- gravity systems
- siphonic systems
- rainwater collection and outfall attenuation
- pumped to gravity drainage
- rainwater reuse

AC4.2 **Soundness test and commission procedure**

- plan the test:
    - sectional testing
- obtain permission/permit
- notify responsible person, including building users
- apply warning notices, signs and barriers
- visual inspection of pipework and components:
    - joints
    - roof and balcony outlets
    - adequate support and compliance with drawings and specifications
    - damage
    - clear of debris
- internal rainwater drainage system:
    - air test to required pressure
    - check pressure after test period
    - leak detection techniques and substances
- external guttering rainwater system:
    - flow test
    - integrity check
    - no spill over
- complete soundness test certificate
- complete commissioning documentation as required
- notify responsible person that testing is complete

AC4.3 **Actions**

- report to responsible person
- obtain approval to rectify defect
- re-test and commission as required

AC4.4 **Procedure**

- identify maintenance requirements
- handover documentation and manufacturers' instructions

Unit 332 Fault diagnosis and rectification on non-domestic plumbing systems

Level:	3
GLH:	30
Assessment type:	Practical assignment
Unit aim:	This unit covers the diagnosis and rectification of faults in non-domestic plumbing systems: cold water, hot water, sanitary pipework, and rainwater. The scope of the system is from the boundary stop valve into the property feeding the water outlets.

Learning Outcome

The learner will know and demonstrate:

LO1 Fault diagnosis and rectification procedures on cold water systems and components in non-domestic premises

Assessment Criteria

AC1.1 **Sources of information** on system and component **faults** on **cold water systems** in non-domestic premises
AC1.2 Diagnostic, repair and rectification **procedure**

Range

AC1.1 **Sources of information**

- responsible person/building user
- building owner/managing agent
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC1 1 **Faults**

- component seizure or mechanical failure:
    - accumulator/expansion vessel
    - backflow prevention device
    - pump
    - controls
    - pressure relief valve
    - cistern
    - valves
    - wc/urinal flushing valve
    - float switch
    - terminal fittings
    - float operated valves

    - stop and service valves
- system faults:
    - blockages and system debris
    - cross connection of supplies
    - incorrect pressures/flow rates
    - incorrect support to system pipework and storage cisterns
    - excessive noise in pipework systems
    - warning pipe/overflow discharging
    - pipework and appliance damage (accidental or malicious)
- cold water service fault

AC1.1 **Cold water systems**

- wholesome supply:
    - direct cold water system
    - indirect cold water system
    - boosted (non-domestic premises):
        - direct boosted
        - direct boosted to a water header or cistern
        - indirect boosted to a cistern
        - indirect boosted with pressure vessel
- unwholesome supply:
    - harvested rainwater
    - grey water recycling

AC1.2 **Procedure**

- obtain information
- diagnose fault
- consult responsible person to gain approval for work to proceed
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- safe isolation
- decommission
- repair and rectify fault
- test and re-commission
- complete documentation as required
- handover to responsible person

Learning Outcome

The learner will know and demonstrate:

LO2 Fault diagnosis and rectification procedures on hot water systems and components in non-domestic premises

Assessment Criteria

AC2.1 **Sources of information** on system and component **faults** on **hot water systems** in non-domestic premises

AC2.2 Diagnostic, repair and rectification **procedure**

Range

AC2.1 **Sources of information**

- responsible person/building user
- building owner/managing agent
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC2.1 **Faults**

- component seizure or mechanical failure:
    - hot water storage cylinder failure
    - temperature relief valve
    - expansion vessel
    - heat exchanger
    - pump failure
    - expansion/pressure relief valve
    - immersion heater
    - terminal fittings
    - stop and service valves
    - shower mixer
    - thermostatic mixing valves
    - combination valve
    - filter/strainer
    - backflow prevention device
- system faults:
    - blockages and system debris
    - incorrect pressures/flow rates
    - stratification of cylinders
    - incorrect support to hot water system pipework
    - excessive noise in pipework systems
    - leakage
- electrical component failure (not repaired by non-domestic plumber)

AC2.1 **Hot water systems**

- vented and unvented (including multiple linked/coupled cylinders)
- direct:
    - immersion
    - direct fired
    - point of use
- indirect:
    - storage
    - instantaneous
    - plate heat exchanger
    - thermal store
    - heat interface unit (HIU)
- secondary circulation

AC2.2 **Procedure**

- obtain information
- diagnose fault
- consult responsible person to gain approval for work to proceed
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers

- safe isolation
- decommission
- repair and rectify fault
- test and re-commission
- complete documentation as required
- handover to responsible person

Learning Outcome

The learner will know and demonstrate:

LO3 Fault diagnosis and rectification procedures on sanitary pipework systems in non-domestic premises

Assessment Criteria

AC3.1 **Sources of information** on system and component **faults** on **sanitary pipework systems** in non-domestic premises
AC3.2 Diagnostic, repair and rectification **procedure**

Range

AC3.1 **Sources of information**

- responsible person/building user
- building owner/managing agent
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC3.1 **Faults**

- leaks
- blockages and system debris
- trap seal loss
- lack of provision for expansion and contraction
- pipework:
    - gradient (excessive or inadequate)
    - length of pipe
    - incorrect support to system pipework
- condensing boiler condensate
- component failure:
    - wc/urinal cistern and overflows
    - wc/urinal flushing valve
    - excessive splashing/flush
    - wc macerators
    - waste water lifters/pumps
    - sink waste disposal units
    - air admittance valves
- electrical components (not repaired by non-domestic plumber)

AC3.1 **Sanitary pipework systems**

- primary ventilated stack system

- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system

AC3.2 **Procedure**
- obtain information
- diagnose fault
- consult responsible person to gain approval for work to proceed
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- safe isolation
- decommission
- repair and rectify fault
- test and re-commission
- complete documentation as required
- handover to responsible person

Learning Outcome

The learner will know and demonstrate:

LO4 Fault diagnosis and rectification procedures on rainwater systems in non-domestic premises

Assessment Criteria

AC4.1 **Sources of information** on system **faults** in **rainwater systems** in non-domestic premises
AC4.2 Diagnostic, repair and rectification **procedure**

Range

AC4.1 **Sources of information**
- responsible person/building user
- building owner/managing agent
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC4.1 **Faults**
- leaks
- blockages and debris
- inadequate or broken support
- broken gutter/pipe (rainwater pipe (RWP))
- gradient (excessive or inadequate)
- lack of provision for expansion and contraction
- insufficient outlets

AC4.1 **Rainwater systems**
- gravity systems

- siphonic systems
- rainwater collection and outfall attenuation
- pumped to gravity drainage
- rainwater reuse

AC4.2 **Procedure**

- obtain information
- diagnose fault
- consult responsible person to gain approval for work to proceed
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- decommission
- repair and rectify fault
- test and re-commission
- complete documentation as required
- handover to responsible person

Unit 333 Service and maintenance of non-domestic plumbing systems

Level:	3
GLH:	28
Assessment type:	e-assessment (multiple choice questions) Practical assignment
Unit aim:	This unit covers the planned preventative maintenance of non-domestic plumbing systems: cold water, hot water, sanitary pipework, and rainwater. The scope of the system is from the boundary stop valve into the property feeding the water outlets. The unit includes using sources of information to establish the maintenance requirements, and the routine checks required as part of the service and maintenance procedure.

Learning Outcome

The learner will know and demonstrate:

LO1 Service and maintenance on cold water systems in non-domestic premises

Assessment Criteria

AC1.1 **Sources of information** to establish the planned preventative maintenance requirements of **cold water systems** and components
AC1.2 **Routine checks** required on cold water systems and components as part of planned preventative maintenance
AC1.3 Requirements for legionella and bacterial growth **control measures**
AC1.4 **Service and maintenance procedure** for cold water systems in non-domestic premises

Range

AC 1.1 **Sources of information**

- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC 1.1 **Cold water systems**

- wholesome supply:
  - direct cold water system
  - indirect cold water system
  - boosted (non-domestic premises):
    - direct boosted
    - direct boosted to a water header or cistern
    - indirect boosted to a cistern
    - indirect boosted with pressure vessel

- unwholesome supply:
    - harvested rainwater
    - grey water recycling

AC1.2 **Routine checks**

- visual inspection of pipework and valves for correct labelling, leakage, adequate support and insulation
- effective operation of terminal fittings:
    - pressure
    - flow rate
    - temperature
    - water quality checks
- effective operation of float operated valves
- effective operation of valves
- cold water storage cistern:
    - level of water (warning pipe/overflow)
    - float switch
    - insulation
    - condition
    - water quality
    - temperature
    - secure and tight fitting lid/hatch
    - screened vent
    - support
- condition and pressure of accumulator
- strainer/filter inspection and cleaning
- pump operation
- float and pressure switch operation
- pressure relief valves
- Effective backflow protection

AC1.3 **Control measures**

- water hygiene risk assessment requirements
- legionella prevention methods:
    - water quality monitoring
    - flushing
    - component cleaning/replacement

AC1.4 **Service and maintenance procedure**

- obtain information
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- undertake planned preventative maintenance:
    - mains fed and/or boosted cold water system in non-domestic premises
- complete documentation as required
- handover to responsible person

Learning Outcome

The learner will know and demonstrate:

LO2 Service and maintenance on hot water systems in non-domestic premises

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Assessment Criteria

AC2.1 **Sources of information** to establish the planned preventative maintenance requirements of **hot water systems** and components
AC2.2 **Routine checks** required on hot water systems and components as part of planned preventative maintenance
AC2.3 Requirements for legionella and bacterial growth **control measures**
AC2.4 **Service and maintenance procedure** for hot water systems in non-domestic premises

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Range

AC2.1 **Sources of information**

- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC2.1 **Hot water systems**

- vented and unvented (including multiple linked/coupled cylinders)
- direct:
    - immersion
    - direct fired
    - point of use
- indirect:
    - storage
    - instantaneous
    - plate heat exchanger
    - thermal store
    - heat interface unit (HIU)
- secondary circulation

AC2.2 **Routine checks**

- visual inspection of pipework and valves for correct labelling, leakage, adequate support and insulation
- effective operation of terminal fittings:
    - pressure
    - flow rate
    - temperature
    - water quality checks
- effective operation of service valves
- hot water cylinder:
    - insulation
    - condition
    - water quality
    - temperature
    - support
    - signs of scale build up
    - anodic device
- combination valve
- filter/strainer
- temperature and pressure relief valve
- thermostatic mixing valves
- shower mixer valve

- expansion vessel
- secondary circulation pumps

AC2.3 **Control measures**
- water hygiene risk assessment requirements
- legionella prevention methods:
    - water quality monitoring
    - flushing
    - component cleaning/replacement

AC2.4 **Service and maintenance procedure**
- obtain information
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- undertake planned preventative maintenance:
    - hot water storage system (multiple linked/coupled cylinders)
    - isolate whilst maintaining supply of hot water
    - direct or Indirect
    - valves and components
- complete documentation as required
- handover to responsible person

Learning Outcome

The learner will know and demonstrate:

LO3 Service and maintenance on sanitary pipework systems in non-domestic premises

Assessment Criteria

AC3.1 **Sources of information** to establish the planned preventative maintenance requirements of **sanitary pipework systems**
AC3.2 **Routine checks** required on sanitary pipework systems as part of planned preventative maintenance
AC3.3 **Service and maintenance procedure** for sanitary pipework systems in non-domestic premises

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Range

AC3.1 **Sources of information**
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC3.1 **Sanitary pipework systems**
- primary ventilated stack system
- secondary ventilated stack system
- ventilated branch discharge system
- stub stack system

AC3.2 **Routine checks**

- visual pipework checks:
  - gradient
  - connections
  - support
- visual component checks:
  - WC/urinal cistern and overflows
  - WC/urinal flushing valve
  - appliances and their supports
  - WC macerators
  - waste water lifters/pumps
  - sink waste disposal units
  - air admittance valves
  - waste outlet plugs
- operation of flushing cisterns/mechanisms
- operation of appliance traps/self-sealing valves
- operation of specialist healthcare appliances

AC3.3 **Service and maintenance procedure**

- obtain information
- schedule and agree time to carry out the work, and minimise disruption
- obtain permission/permit
- apply warning notices, signs and barriers
- undertake planned preventative maintenance:
  - checks on multiple appliances connected to a sanitary system
- complete documentation as required
- handover to responsible person

Unit 334 Install, commission, service and maintain non-domestic plumbing systems

Level:	3
GLH:	4
Assessment method:	Work log (portfolio of evidence)
Unit aim:	This performance unit covers the requirements for learners to demonstrate their skills in the workplace. It includes installation, commissioning, fault diagnosis and decommissioning across a range of components and non-domestic plumbing systems. The correct preparation of the working area for all such work must also be demonstrated.

Learning Outcome

The learner will know and demonstrate:

LO1 Non-domestic plumbing systems and components installation in the workplace

Assessment Criteria

AC1.1 Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed
AC1.2 Plan the installation and **pipework** on non-domestic plumbing **systems** routes, using relevant job information
AC1.3 Position, fix and **joint pipework** on non-domestic plumbing **systems**
AC1.4 Connect pipework to **appliances, components, and system controls**
AC1.5 **Soundness test** to industry requirements on **systems** pipework and components

Range

AC1.2 and AC1.3 **Pipework**
Candidates must be assessed on **three** of the following:

- copper
- plastic pressure pipe
- steel (screwed or pressed)
- stainless steel
- cast iron
- plastic (sanitary non-domestic)
- plastic (rainwater non-domestic)

AC1.3 **Joint**
Candidates must be assessed on **four** of the following:

- compression
- push fit plastic pressure
- push fit waste
- threaded/screwed

- soft soldered
- crimped/press fit
- solvent weld
- fusion welded (electro-fusion or butt fusion)

AC1.2, AC1.3 and AC1.5 **Systems**

Candidates must be assessed on **cold and hot water systems** (28mm+ pipework) **and one** of the following:

- sanitation pipework systems
- rainwater systems

AC1.4 **Appliances, components and system controls**.

Candidates must be assessed on **six** appliances/components from Group A, and **three** unique appliances/components from Group B

- group A:
    - WCs
    - urinals
    - basins
    - shower (cubicle or communal)
    - non-domestic catering sink
    - laboratory sink
    - cleaner's sink
    - washing trough
    - drinking fountain
    - WC facility (AD M compliant)
    - appliances in a healthcare premises
    - cold water storage cistern (1000 litre+)
    - boosted cold water system pump set
    - low level break cistern (boosted cold water)
    - hot water storage vessel
    - instantaneous multi point
    - point of use water heater
    - heat interface unit (HIU)
- group B:
    - WC/urinal pressure flushing valve
    - delayed action float operated valve
    - float switch (boosted cold water cistern)
    - solenoid valve/urinal infra-red flushing devices
    - hot water secondary circulation pump
    - accumulators/expansion vessels
    - thermostatic mixing valve
    - multiple-shower valve
    - specialist Category 5 supply station
    - animal drinking trough or bowl
    - greywater/rainwater station
    - non-domestic water softener/filter
    - hot/cold drinks machine
    - non-domestic washing machine
    - non-domestic dishwasher
    - non-domestic hose union tap installation
    - type BA (RPZ) backflow prevention device
    - category 5 automatic filling devices
    - pipework expansion/anchoring devices

Learning Outcome

The learner will know and demonstrate:

LO2 Commissioning of non-domestic plumbing systems in the workplace

Assessment Criteria

AC2.1 **Flushing** of **plumbing systems**
AC2.2 Commissioning and operational checks, including **performance readings**
AC2.3 Adjust **system controls** to establish that the system operates to its design specifications
AC2.4 Complete **commissioning documentation**
AC2.5 Instruct the user in the efficient and effective operation of **plumbing systems**

Range

AC2.1 **Flushing**
Candidates must be assessed on **both** of the following:

- cold flush
- hot flush

AC2.1 and AC2.5 **Plumbing systems**
Candidates must be assessed on **two** of the following systems:

- cold water systems
- hot water systems
- sanitation pipework systems

AC2.2 **Performance readings**
Candidates must be assessed on **two** of the following:

- temperatures
- flow rates
- pressures
- water quality checks

AC2.3 **System controls**
Candidates must be assessed on **two** of the following:

- thermostat settings
- secondary circulation pump
- balancing valves
- float operated valves
- expansion vessels
- pressure reducing valves
- combination valve
- booster pumps

AC2.4 **Commissioning documentation**
Candidates must be assessed on **one** of the following:

- manufacturers' documentation
- company/contractor documentation

Learning Outcome

The learner will know and demonstrate:

LO3 Fault diagnosis and rectification procedures on non-domestic plumbing systems

Assessment Criteria

AC3.1 Obtain **information** on **plumbing system faults**
AC3.2 Diagnostic checks for a range of **faults**
AC3.3 **Decommissioning** procedures
AC3.4 Fault repair or replace system component
AC3.5 Re-commission and handover to the client

Range

AC3.1 **Information**
Candidates must be assessed on **two** of the following:

- responsible person/building user
- building owner/managing agent
- manufacturer instructions
- maintenance and servicing schedules and records
- building plans, including specifications
- building management system (BMS)
- facilities records and asbestos reports

AC3.1 **Plumbing system**
Candidates must be assessed on **two** of the following systems:

- cold water systems
- hot water systems
- sanitation pipework systems

AC3.1 and AC3.2 **Faults**
Candidates must be assessed on **three** from Group A and two from Group B

- group A (Component failure):
    - secondary circulation pump
    - cold water booster pump
    - accumulator/expansion vessel
    - cistern
    - float operated valve
    - tap/mixer tap
    - thermostatic mixing valve
    - shower mixing valve
    - solenoid valves not operating
    - hot water cylinder
    - hot water heater
    - WC macerators/waste water lifter
    - float switch
    - relief valves:
        - Expansion/pressure
        - Temperature
    - pressure reducing valve
    - air admittance valves

- group B (System faults):
    - leakage
    - trap seal loss
    - expansion and contraction
    - system debris/blockage
    - cross connection of supplies
    - warning pipe/overflow discharging
    - incorrect pressures/flow rates

AC3.3 **Decommissioning**

Candidates must be assessed on **two** occasions.

Unit 334 Minimum direct observation evidence requirements

Evidence must be gathered across a **minimum of three occasions**; however, it is an expectation that candidates will require more than the minimum three occasions to meet the full range required.

All range items must be assessed unless the number of range items required is identified.

Candidates must be directly observed on **a minimum of three separate occasions** in the workplace by a suitably qualified assessor or occupationally competent witness.

The three occasions could evidence, for example

> **Observation 1** Site preparation and marking out of a significant amount of pipework and associated fixings, fittings and components from the required range.
>
> **Observation 2** Installation of a significant amount of pipework and associated fixings, fittings, appliances and components from the required range.
>
> **Observation 3** Test, commission and handover an installation as detailed in the required range.

The on-site portfolio must also include evidence for the following areas of learning:

Unit 304 Planning and supervision

- LO5 Producing risk assessments and method statements for the plumbing and domestic heating systems industry
- LO6 Producing a work programme for tasks in the plumbing and domestic heating systems industry

Appendix 1 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 **Centre document library** on **www.cityandguilds.com** or click on the links below:

Centre Assessment: Quality Assurance Standards

This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on:

- centre quality assurance criteria and monitoring activities
- administration and assessment systems
- centre-facing support teams at City & Guilds/ILM
- centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the centre contract.

Centre Assessment: Quality Assurance Standards

This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre-assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre assessments.

Access arrangements: When and how applications need to be made to City & Guilds 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 document library** also contains useful information on such things as:

- conducting examinations
- registering learners
- appeals and malpractice.

Useful contacts

Please visit the **Contact us** section of the City & Guilds website.

City & Guilds

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