City & Guilds Level 3 End-point Assessment for Plumbing and Domestic Heating Technician – Domestic Gas Fired Hot Water Heating Appliances Technician (9289-12)

Standard: ST0303

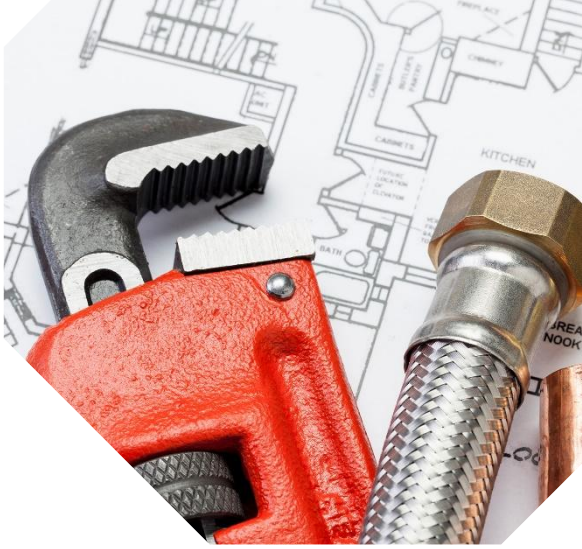
EPA Plan: Version 1.2
QN: 610/5948/1

EPA Pack for Providers and Employers

Version 1.0
Last modified September-2025
For external use

Version	Summary of changes	Section
1.0 September 2025	Document created	N/A

Contents



1. Apprenticeships

This pack will help providers and employers prepare apprentices for their End-point Assessment (EPA) for the City & Guilds Level 3 End-point Assessment for Plumbing and Domestic Heating Technician – Domestic Gas Fired Hot Water Heating Appliances Technician (9289-12). It explains how apprentices will demonstrate the knowledge, skills and behaviours (KSBs) which they developed during their apprenticeship.

This pack must be used alongside the:

- Recording Forms for Providers and Employers
- EPA Knowledge test Guidance
- Resource Pack for Providers and Employers
- EPA Documents Library, which includes the Manual for the End-point Assessment Service, information about the EPA Service, policies about malpractice and appeals, FAQS, and a video about EPA which can be shared with apprentices.

The City & Guilds Manual for the End-point Assessment Service includes information on:

- application, registration and booking
- assessment
- results and post results (including resits)
- fees
- quality assurance.

Full-time apprentices will typically spend 48 months on-programme working towards meeting the Standard, with required off-the-job training as specified by the apprenticeship funding rules. The employer should ensure that the apprentice has access to development opportunities to gain the KSBs, as outlined in the Standard, and must hold regular progress reviews with the provider and apprentice.

Once the apprentice has completed their training, they should be ready to go through 'Gateway' to EPA. See the Gateway and Assessment Instructions sections within this pack to understand what happens.

The EPA for this apprenticeship includes the following assessments which can be taken in any order, as requested by the apprentice, apart from the integrated assessments. The integrated assessments must be taken **after** the other assessments have been completed. Please see *Section 10: Integrated Assessment (9289-707)* for information about the integrated assessments.

- Assessment 1 – Knowledge test Paper 1 (9289-300) **and** Paper 2 (integrated assessment) (9289-707)
- Assessment 2 – Practical planning test (9289-700)
- Assessment 3 – Practical competence test (Core Tasks 1–3 (9289-701) **and** Task 4 (integrated assessment) (9289-707)
- Assessment 4 – Interview underpinned by an apprenticeship portfolio of evidence (9289-702)

Preparing for EPA

In preparation for EPA, providers and employers should:

- read the Assessment instructions sections before reaching Gateway – the EPA Partnership Managers can help with any queries
- review which completed **Recording Forms and evidence** must be submitted, and when
- use the Recording Forms provided in the format laid out, unless indicated otherwise
- plan the venue and resources required for EPA – make sure the assessment environment is secure and comfortable, without interruptions
- use the epaPro portal to help manage the apprentice's progress through EPA
- for on-site assessment, arrange for a designated contact to be available on the day to ensure the correct resources are available.

To help apprentices prepare for EPA, providers and employers should:

- explain the assessments and **Recording Forms** to the apprentice – refer to details in the Assessment Instructions sections of this pack
- agree a realistic timeframe for submission of evidence that meets the EPA deadlines – any delays in submission of evidence will delay the assessments
- make sure the apprentice has the resources and time to prepare for, and undertake, EPA
- take the apprentice through some mock assessments
- share the EPA Preparation Guide with the apprentice, which includes information about system requirements for virtual meetings

- let City & Guilds know if access arrangements are required to support an apprentice through EPA. Information about City & Guilds access arrangements, including reasonable adjustments is on the City & Guilds website, under EPA Documents Library.

Authenticating the apprentice's work

The Independent End-point Assessor (IEPA) must ensure all decisions satisfy Validity, Authenticity, Currency and Sufficiency (VACS). For evidence produced outside controlled conditions, the apprentice will be required to:

- sign a declaration that the work is their own
- reference all sources.

The employer/provider should also aid authentication by:

- supplementary (oral) questioning to gauge familiarity with the topic
- looking out for any changes to the apprentice's usual writing style, unusual sources/examples or the use of US spellings or phrases that might indicate cutting and pasting from the internet
- requiring access to evidence of steps in the process, for example drafts, notes, planning etc.

City & Guilds have produced forms for use when reviewing evidence produced outside of controlled conditions. These forms include a Declaration of Authenticity Form which must be completed when submitting evidence. The forms are incorporated in the Recording Forms document.

City & Guilds Position Statement on artificial intelligence

The following guidance on artificial intelligence (AI) is designed to help candidates/apprentices, teachers and assessors to complete NEAs, coursework and other internal assessments successfully. Please ensure familiarity with it.

Position Statement on AI | City & Guilds

Health & Safety and Codes of Practice

The importance of safe working practices, the demands of the Health and Safety at Work Act and any Codes of Practice associated with the industry **must** always be adhered to.

Following safe working practices is an integral part of all City & Guilds assessments, and it is the responsibility of the provider and employer to ensure that all the health and safety requirements are in place when apprentices are working on any projects or before apprentices begin any EPA.

Should an apprentice fail to follow correct health and safety practices and procedures during an EPA, the IEPA may advise the apprentice to stop and explain why.

Results submission and feedback

The knowledge test component will be delivered using the E-volve on screen test platform. Test results will be available on Walled Garden within 24 hours following the test.

The IEPA will not provide feedback to the apprentice during or immediately following the assessment process. The provider will be informed by the City & Guilds EPA Team of the assessment results.

The IEPA will communicate the grade allocated for each assessment to the Lead Independent End-point Assessor (LIEPA) for quality assurance and sampling. The LIEPA will submit the results to the City & Guilds EPA Team.

Summary feedback will be provided to all apprentices after any grade determination has been carried out. The feedback will cover the areas against which insufficient evidence has been provided, leading to a ‘Fail’. Our ‘End-point Assessment Feedback’ will also cover the areas against which the apprentice’s evidence has resulted in the award of a Pass or Distinction.

If the apprentice has passed EPA, the City & Guilds EPA Team will issue the EPA Statement of Achievement to the provider confirming the grade achieved and will notify Skills England who will issue the apprenticeship certificate.

Professional recognition

This apprenticeship aligns with Engineering Council (EngTech) for Level 3.

Statement of Achievement

A printed EPA Statement of Achievement will be issued to each successful apprentice.

Providers and employers with access can view and download PDF copies of the Statement 24 hours after the results are published. A PDF supports more efficient processing of funding claims by providing evidence of apprentice certification before the apprentice's paper certificate arrives.

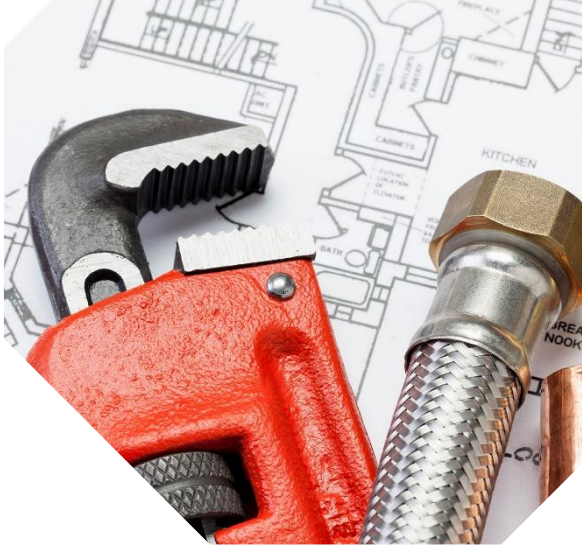
The overall apprenticeship certificate will be issued by Skills England.

Digital credentials

A digital credential is a verified, visual representation of knowledge and skills earned in various learning environments. Please see an example below:

Digital credentials are issued and verified online, making it easy for individuals to demonstrate their competencies to employers, clients and peers online. Each digital credential has a unique URL that can be shared electronically via social media, in an email signature and on a CV. This is a complimentary service in addition to the paper certificate.

For further information, please visit the City & Guilds EPA Digital Credentials webpage and the general terms in respect of our privacy policy or contact digitalsupport@cityandguilds.com.



2. The Apprenticeship Standard

Occupation summary

This occupation is found in the building services sector of the construction industry.

Plumbing & domestic heating technicians size and select, plan and install, service, maintain and commission plumbing and domestic heating systems.

All technicians will be required to work on typical plumbing elements such as hot and cold water systems and storage, supplies to dwellings and associated pipework, above-ground pipework, connection to below-ground, sanitary pipework, fittings and furniture. Appliances and equipment can include central heating boilers, bathroom furniture, sanitary appliances, drainage and rainwater systems. Further to that, technicians can specialise in one of three areas:

Domestic gas fired hot water heating appliances technician: installation and maintenance of domestic natural gas systems and central heating and hot water appliances.

Domestic air source heat pumps and solar thermal systems technician: installation and maintenance of air source heat pumps and solar thermal hot water systems in domestic premises.

Non-domestic plumbing technician: installation and maintenance of plumbing systems in premises such as hospitals and healthcare premises, schools, high rise buildings, public buildings, industrial and commercial premises, etc.

This EPA pack covers the domestic gas fired hot water heating appliances technician area.

In their daily work an employee in this occupation interacts with customers and end users, and as such require a high level of customer service. Technicians can find themselves working inside or outside a customers' property as well as on building sites.

An employee in this occupation will be responsible for working both independently with a minimum of supervision and also as a member of a team involving close liaison and cooperation with site and line management, colleagues and other trades.

Occupational duties

This apprenticeship standard has a number of duties which someone working in the role would typically be able to undertake. These duties are underpinned by a range of KSBs which a successful apprentice will be able to demonstrate.

Core

Duty	KSBs
Duty 1 Plan core plumbing and domestic heating systems to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	K1 – K18 S1 – S13 B1 – B4
Duty 2 Select and size core plumbing and domestic heating systems to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 3 Carry out preparatory work for the Installation of core plumbing and domestic heating systems.	
Duty 4 Install core plumbing and domestic heating systems in accordance with design criteria, manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 5 Test and commission core plumbing and domestic heating system installations in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 6 Carry out appropriate handover procedures for core plumbing and domestic heating systems to customers and or end users including the provision of written information, diagrammatic information, verbal information and demonstration regarding system operation and use.	
Duty 7 Carry out routine service and maintenance procedures on core plumbing and domestic heating systems.	
Duty 8 Perform fault finding, diagnosis and rectification procedures on core plumbing and domestic heating systems.	
Duty 9 Decommission core plumbing and domestic heating systems.	

Duty	KSBs
Duty 10 Conform to all health, safety and welfare in the workplace requirements.	

Domestic gas fired hot water heating appliances technician duties

Duty	KSBs
Duty 11 Plan low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input) to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	K19 – K26 S14 – S18 B1 – B4
Duty 12 Select and size low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input) to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 13 Carry out preparatory work for the Installation of low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input).	
Duty 14 Install low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input) in accordance with design criteria, manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 15 Test and commission low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input) in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	
Duty 16 Carry out appropriate handover procedures for low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input) to customers and or end users including the provision of written	

Duty	KSBs
information, diagrammatic information, verbal information and demonstration regarding system operation and use.	
Duty 17 Carry out routine service and maintenance procedures on low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input).	
Duty 18 Perform fault finding, diagnosis and rectification procedures on low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW net heat input)	
Duty 19 Decommission low pressure natural gas systems (up to 35mm R1¼) to include natural gas fired central heating and hot water appliances (up to 70kW heat input)	

Knowledge, skills and behaviours

Key

KT – Knowledge Test

PPT – Practical Planning Test

PCT – Practical Competence Test

IPE – Interview Underpinned by an Apprenticeship Portfolio of Evidence

Knowledge

Ref.	Knowledge Core	Assessment method
K1	The health and safety legislation, approved Codes of Practice and guidance and safe working practices applicable to work in the building services and wider construction industry.	KT Paper 1 and IPE
K2	The common processes and techniques used in the installation and test of plumbing and domestic heating systems (cold water systems, hot water systems, domestic wet central heating systems, sanitation systems).	KT Paper 1 and PCT
K3	The common processes and techniques used in the installation and test of rainwater systems.	KT Paper 1 and IPE
K4	Scientific and mechanical principles applicable to plumbing and domestic heating systems work.	KT Paper 1
K5	The roles and responsibilities of persons within the plumbing and domestic heating systems and wider construction industry.	KT Paper 1
K6	The legislative requirements and sources of information applicable to plumbing and domestic heating systems system installation, service and repair.	KT Paper 1, PPT and IPE
K7	How to communicate with customers, suppliers, co-workers and members of the public who may come into contact with the work area.	KT Paper 1 and IPE
K8	The layout features, working principles and legislative requirements of plumbing and domestic heating systems.	KT Paper 1, PPT and IPE

Ref.	Knowledge Core	Assessment method
K9	The basic factors which influence system choice for particular applications with regard to the installation of plumbing and domestic heating systems.	KT Paper 1, PPT and IPE
K10	The installation and testing requirements applicable to plumbing and domestic heating systems and components (cold water, hot water, central heating, sanitary appliances and pipework).	KT Paper 1 and PCT
K11	The installation and testing requirements applicable to rainwater systems and components.	KT Paper 1 and IPE
K12	The commissioning requirements applicable to plumbing and domestic heating systems and components.	KT Paper 1 and IPE
K13	The testing and commissioning requirements applicable to electrical control systems and components.	KT Paper 1 and PCT
K14	The decommissioning procedures applicable to plumbing and domestic heating systems.	IPE
K15	The routine service and maintenance procedures applicable to plumbing and domestic heating systems.	KT Paper 1 and IPE
K16	The fault finding, diagnosis and rectification procedures applicable to plumbing and domestic heating systems.	KT Paper 1 and IPE
K17	The procedures for sizing and selecting plumbing and domestic heating systems and components to meet customer's needs.	KT Paper 1, PPT and IPE
K18	The legislative requirements, processes and procedures of electrical supply and control systems applicable to plumbing and domestic heating systems and work including limits to operative competence.	KT Paper 1 and PCT

Ref.	Knowledge Domestic gas fired hot water heating appliances technician	Assessment method
K19	The common processes and techniques used in the installation and maintenance of natural gas systems (up to 35mm R1¼) and	KT Paper 2 integrated with

Ref.	Knowledge Domestic gas fired hot water heating appliances technician	Assessment method
	natural gas fired hot water and central heating appliances (up to 70kW net heat input).	CCN1 and CENWAT or equivalent qualifications
K20	The legislative requirements, approved codes of practice and guidance and sources of information applicable to the installation, service and repair of low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K21	The installation requirements (including system modification and extension) applicable to low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K22	The purging, testing and commissioning requirements applicable to low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K23	The decommissioning procedures (including disconnection and dismantling) applicable to low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K24	The routine service and maintenance procedures applicable to low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K25	The fault finding, diagnosis and rectification procedures applicable to low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
K26	The procedures for sizing and selecting low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input) to meet customer's needs, statutory legislation and approved codes of practice and guidance.	

Skills

Ref.	Skills Core	Assessment method
S1	Operate in a safe working manner by adhering to health and safety legislation, approved codes of practice and guidance and applying safe working practices.	IPE
S2	Carry out and apply the common processes and techniques used in the installation and test of plumbing and domestic heating systems (cold water, hot water, central heating and sanitary appliances and pipework).	PCT
S3	Carry out and apply the common processes and techniques used in the installation and test of rainwater systems.	IPE
S4	Plan tasks within plumbing and domestic heating systems industry.	PPT
S5	Identify and document hazards for the plumbing and domestic heating systems work. Apply control measures.	PPT
S6	Carry out commission and handover procedures and techniques on plumbing and domestic heating systems (cold water, hot water, central heating, sanitary appliances, and rainwater).	IPE
S7	Install, test, and commission, electrical and electrical control systems applicable to plumbing and domestic heating systems.	PCT
S8	Perform routine service, maintenance, fault diagnosis and rectification procedures and techniques on the non-electrical components of plumbing and domestic heating systems.	IPE
S9	Perform routine service, maintenance, fault diagnosis and rectification procedures and techniques on electrical and electrical control systems applicable to plumbing and domestic heating systems including industry safe isolation procedures.	PCT
S10	Decommission plumbing and domestic heating systems.	IPE
S11	Decommission electrical and electrical control systems applicable to plumbing and domestic heating systems.	IPE

Ref.	Skills Core	Assessment method
S12	Plan, size and select cold and hot systems to meet customer's needs in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.	PPT
S13	Plan, size and select domestic heating and rainwater systems to meet customers' needs in accordance with manufacturers' guidance, regulatory requirements and industry recognised standards and procedures.	IPE

Ref.	Skills Domestic gas fired hot water heating appliances technician	Assessment method
S14	Carry out and apply the common installation processes and techniques used in the installation and maintenance of natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input) in the workplace.	PCT integrated with CCN1 and CENWAT or equivalent qualifications
S15	Install, purge, test, commission and handover low pressure natural gas systems (up to 35mm R1¼) and natural gas fired hot water and central heating appliances (up to 70kW net heat input).	
S16	Perform routine service, maintenance, fault diagnosis and rectification procedures and techniques on low pressure Natural Gas systems (up to 35mm R1¼) and Natural Gas fired hot water and central heating appliances (up to 70kW net heat input).	
S17	Decommission (including disconnection and dismantling) low pressure Natural Gas systems (up to 35mm R1¼) and Natural Gas fired hot water and central heating appliances (up to 70kW net heat input).	
S18	Plan, size and select low pressure Natural Gas systems (up to 35mm R1¼) and Natural Gas fired hot water and central heating appliances (up to 70kW net heat input).	

Behaviours

Ref.	Behaviours Core	Assessment method
B1	Acts professionally and ethically to collaborate with colleagues and customers.	IPE
B2	Takes ownership of work within limits of own competence, knowing when to seek advice or assistance.	PCT
B3	Committed to continuous professional development.	IPE
B4	Committed to keeping up to date with industry best practice.	IPE

Overall grade

This End-point Assessment is graded Fail, Pass or Distinction. The EPA will be assessed and graded by the IEPA.

Information about how each assessment is graded can be found in the Assessment Instructions sections of this pack. The apprentice will fail an assessment method if they do not meet the grading descriptors.

Apprentices who fail one or more assessment method will be awarded an overall EPA 'Fail'.

In order to achieve an overall EPA 'Pass', apprentices must achieve at least a 'Pass' in all the assessment methods.

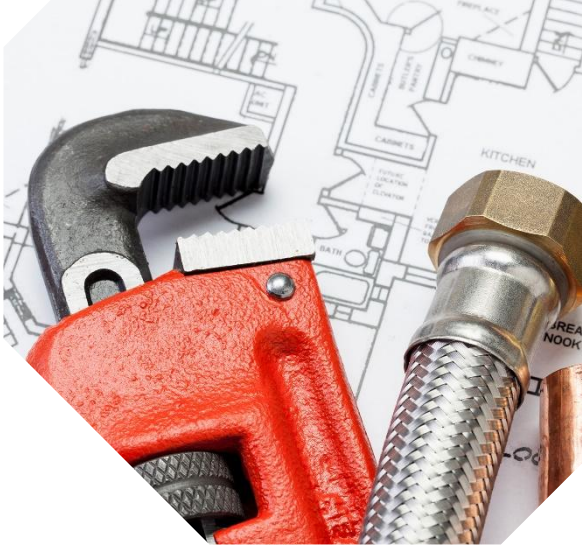
In order to achieve an overall EPA 'Distinction', apprentices must achieve:

- a Distinction in the knowledge test (9289-300)
- a Pass in the practical planning test (9289-700)
- a Pass in the practical competence test (9289-701)
- a Distinction in the interview underpinned by an apprenticeship portfolio of evidence (9289-702)
- a Pass in the integrated assessment (ACS) (9289-707).

Grades from individual assessment methods should be combined in the following way to determine the grade of the EPA as a whole:

Assessment 1: Knowledge test	Assessment 2: Practical planning test	Assessment 3: Practical competence test	Assessment 4: Interview underpinned by portfolio	Overall grade
Fail	Any grade	Any grade	Any grade	Fail
Any grade	Fail	Any grade	Any grade	Fail
Any grade	Any grade	Fail	Any grade	Fail
Any grade	Any grade	Any grade	Fail	Fail
Pass	Pass	Pass	Pass	Pass
Distinction	Pass	Pass	Pass	Pass
Pass	Pass	Pass	Distinction	Pass
Distinction	Pass	Pass	Distinction	Distinction

The overall EPA grade will be capped at a Pass if the apprentice has had to resit or retake any assessment method, however the grade the apprentice has achieved for each component is not capped and will be identified on the Statement of Achievement.



3. Gateway

The EPA period will only start when the **employer** is satisfied that the apprentice is consistently working at, or above, the level of the Standard. The apprentice must be able to evidence that they fully demonstrate the Occupational Standard and required level of professional competence in an authentic workplace context. In making this decision, the employer could take advice from the provider, but the ultimate decision is made solely by the employer.

If there is a **provider** working alongside the employer, they should support the apprentice's preparation for Gateway.

The following must be provided at Gateway:

- evidence they have fulfilled the English and mathematics requirements in line with the apprenticeship funding rules
- evidence they have passed one of the following on-programme qualifications or equivalent in the same pathway as the EPA:
    - City & Guilds Level 3 Diploma in Plumbing and Domestic Heating (610/4672/3)
    - BPEC Level 3 Diploma in Plumbing and Domestic Heating (610/4782/X).
- provider/employer's risk assessment regarding safe use and storage of hand and power tools
- apprenticeship portfolio of evidence with signed and dated Evidence Matrix and Declaration of Authenticity
- confirmation that the Accredited Certification Scheme (ACS) training has been completed, and the assessment for the CCN1 and CENWAT or equivalent qualifications will be completed in compliance with the conditions set out by the Awarding Body (AB); **or** the assessment has been completed in compliance with the conditions set out by the AB and the ACS has a minimum of six months before the certification renewal date.

The following awarding bodies are approved to issue the ACS certificate:

- Adskills Certification
- Blue Flame Certification
- BPEC Certification
- Cert-ain Certification
- ERS Certification
- LCL Awards
- NICEIC Certification
- UK Certification.

The following should be completed on the epaPro platform:

- Gateway Declaration Form signed by the apprentice
- Gateway Declaration by the provider, on behalf of the employer and tutor, confirming that the apprentice has completed the minimum time required on-programme, in line with the apprenticeship funding rules.

City & Guilds will confirm when all the Gateway requirements have been met.

4. Timetable for End-point Assessment

The EPA period is typically completed within 6 months of the EPA Gateway, starting when City & Guilds has confirmed that all Gateway requirements have been met.

Further information about the booking process and timelines can be found in the ILM/City & Guilds Manual for the End-point Assessment Service.

Ongoing during on-programme	Evidence and forms
Provider and employer • Reviews progress as part of their regular performance management process and ensures apprentice's performance is on track. • Identifies any gaps and creates a plan with the apprentice. • Enrols apprentice on epaPro and provides 'Expected Date Ready for EPA.'	N/A
Apprentice • Apprentice fulfils the English and mathematics requirements in line with the apprenticeship funding rules. • Achieve the Level 3 Diploma in Plumbing and Domestic Heating on-programme qualification in advance of Gateway. • Compile an apprenticeship portfolio of evidence.	Compile: • Portfolio of evidence • English and mathematics certifications.

Gateway process	Evidence and forms
Employer • Reviews progress and ensure the apprentice is ready for EPA. • Reviews portfolio of evidence to confirm that it is appropriate and sufficient to meet the Standard.	Signs: • Portfolio of evidence Declaration of Authenticity.
Apprentice • Must have been on-programme for the minimum time required, in line with the apprenticeship funding rules. • Completes and submits evidence and forms.	Submits to provider: • Apprentice Gateway Declaration • Portfolio of evidence with signed and dated Evidence Matrix and Declaration of Authenticity • English and mathematics certifications.
Provider – on epaPro • Books EPA on the epaPro portal, in line with City & Guilds booking timelines in the EPA Manual. • Makes City & Guilds aware of any additional needs of the apprentice so that they can review reasonable adjustments – see the current policy on the City & Guilds website, under EPA Documents Library. • Completes Provider Gateway Declaration on behalf of the employer and tutor. • Uploads portfolio of evidence and forms onto epaPro.	Completes on epaPro: • Provider Gateway Declaration. Signs: • Portfolio of evidence Declaration of Authenticity. Uploads onto epaPro: • Apprentice Gateway Declaration • Portfolio of evidence with signed and dated Evidence Matrix and Declaration of Authenticity • Provider/employer risk assessment • ACS certificate(s) (if available).
City & Guilds EPA Gateway Team • Formally confirms when all the Gateway requirements have been met.	N/A
City & Guilds EPA Team • Agrees on a mutually convenient date for the EPA events with the provider/employer and IEPA.	N/A

End-point Assessment	Evidence and forms

Apprentice
 	
• Completes End-point Assessments.
• The following assessments, which can be taken in any order, must be taken **before** the integrated assessments (ACS):
  ○ Assessment 1 – Knowledge test Paper 1
  ○ Assessment 2 – Practical planning test
  ○ Assessment 3 – Practical competence test Core Tasks 1, 2 and 3
  ○ Assessment 4 – Interview underpinned by an apprenticeship portfolio of evidence.
	Completes:
	
	• Practical planning test Declaration of Authenticity.

Provider and employer • Ensures the apprentice has access to the resources required for the assessments (see the Resources section).	N/A
Provider • Invigilates practical planning test. • Submits practical planning test evidence for marking and Declaration of Authenticity forms to epaPro. • Uploads evidence of ACS, if not previously provided.	Completes: • Practical planning test invigilator record. Uploads onto epaPro: • Completed practical planning test produced by the apprentice • Practical planning test Declaration of Authenticity • ACS certificate(s) (if not previously provided).
IEPA • Reviews the portfolio of evidence prior to EPA events. • Carries out End-point Assessments (excluding PPT). • Grades each assessment, communicates the results to the LIEPA. • Provides feedback for assessments in epaPro. • Confirms ACS evidence submitted on epaPro.	Completes: • Overall Grade and Feedback Recording form.
LIEPA • Samples and quality assure assessments • Confirms overall grade to EPA Team.	Reviews: • Overall Grade and Feedback Recording form.

End-point Assessment	Evidence and forms
City & Guilds EPA Team • Communicates the results to the provider via epaPro. • Processes the overall result if the apprentice has passed all the assessments and advises Skills England, who issue the certificate. The data will be provided to Skills England once a month, on the fourth working day of the month. Please note: The overall result cannot be issued until the apprentice has provided evidence of completing the ACS (9289-707).	N/A

Summary timescales

Providers and employers should check the previous Timetable and the Assessment Instruction sections of this document for the detailed requirements for each stage.

Further information on EPA Service Timelines can be found on www.cityandguilds.com.

On programme	Enrol apprentice on epaPro, including 'expected date ready for EPA' The apprentice passes the on-programme qualification. The apprentice compiles their portfolio of evidence for their EPA.
Gateway process	Provider submits evidence and forms on epaPro.
Gateway	Assessment components can only be booked after Gateway has been approved.
Assessment method 1	Knowledge test (KT) – Paper 1 (non-integrated assessment).
Assessment method 2	Practical planning test (PPT) (non-integrated assessment).
Assessment method 3	Practical competence test (PCT) – Tasks 1, 2, 3 (non-integrated assessment).
Assessment method 4	Interview underpinned by an apprenticeship portfolio of evidence (IPE) (non-integrated assessment).
Integrated assessment	The apprentice passes their ACS after they have completed the non-integrated assessments.

End-point assessment completed

5. End-point Assessment resources

Assessment method	Resources required
Knowledge test	• A quiet room, free from distractions and interruptions. • Access to a computer for taking the knowledge tests on the e-volve platform. • Tests must be invigilated by the provider/employer.

Practical planning test	• A quiet room, free from distractions and interruptions.
	• The test must be invigilated by the provider/employer.
	• The test can be completed on paper or computer; suitable resources must be provided to each apprentice.
	• Each apprentice must have the following normative documents available for use during the test:
	  ○ Water regulations guide
	  ○ Building regulations Approved Document G
	  ○ BS 8558
	  ○ BS 806 Parts 1–5
	  ○ Domestic building services compliance guide
	  ○ manufacturer's technical documents (supplied in the Practical Planning Test Resource Pack).

Practical competence test	• Each apprentice must have a separate work area/bay, materials, tools, equipment, appliances and components to complete skills assessments:
	  ○ Fabricate, install, test and commission domestic cold water, hot water and heating plumbing systems
	  ○ Test, commission and service/maintain a domestic hot water and heating plumbing system.
	• Full details can be found in the Practical Competence Test Resource Pack.

Interview underpinned by an apprenticeship portfolio of evidence	• A quiet room, free from distractions and interruptions. • Access to a computer with video-conferencing software which is tested prior to the assessment starting. The video-conferencing software will be advised at the point of booking.

6. Assessment information: Assessment 1 – Knowledge test (9289-300/707)

Overview

This assessment has two papers:

- Paper 1 (9289-300) – Core
- Paper 2 (9289-707) – Integrated assessment.

The tests give the apprentice the opportunity to demonstrate the knowledge mapped to this assessment method.

Rationale

This EPA assessment method is being used because:

- it allows for the efficient testing of knowledge where there is a right or wrong answer
- it can be conducted remotely and administered to multiple apprentices at the same time, potentially reducing cost
- it allows for flexibility in terms of when, where and how it is taken.

Assessment instructions for Paper 1

Number of questions	60
Marks available	60
Grading	P/D/X To achieve a **Pass**, the apprentice must achieve a minimum of 36 marks (60%). To achieve a **Distinction**, the apprentice must achieve a minimum of 50 marks (83.3%).
Type of questions	Multiple-choice
Duration	2 hours
Marking	The test will be carried out online and marked electronically on the E-volve platform.

Permitted materials	The test is closed book which means that the apprentice cannot refer to reference books or materials while taking the test. The apprentice will have access to a calculator within the E-volve platform if there are any calculate questions in the test.
Location	The apprentice must take the test in a suitably controlled and invigilated environment that is a quiet room, free from distractions and influence.

Assessment specification for Paper 1

Paper 1 is assessed against the following Learning Outcomes (LOs) and Assessment Criteria (ACs) as prescribed in the Assessment Plan. The numbering of these LOs and ACs may not be sequential, as some LOs and ACs will be assessed in a different assessment method.

Learning outcome	Assessment criteria	Number of question(s)
1. Know and apply health and safety legislation that applies to the building services industry.	1.1 Identify health & safety legislation in protecting the workforce and members of the public.	1
	1.2 Identify responsibilities of members of the construction team.	
	1.3 Identify the legal status of health and safety guidance materials.	
	1.4 Identify the role of enforcing authorities.	
	1.5 Identify the control measures of inspectors.	
2. Understand hazardous situations working in the building services industry.	2.1 Identify types of site hazards that may be encountered while at work or by members of the public.	2
	2.2 Identify strategies used to prevent accidents during work activities.	
	2.3 Identify how the hazards of some substances and mixtures can be identified from the labels and packaging.	
	2.4 Identify how to deal with commonly encountered substances including disposal where applicable.	

Learning outcome	Assessment criteria	Number of question(s)
	2.5 Identify common building materials and services components that may contain asbestos	
	2.6 Identify types of asbestos that may be encountered in the workplace.	
	2.7 Identify procedures that must be used to safely work with asbestos cement based materials.	
4. Understand how to respond to accidents.	4.1 Identify requirements for first aid provision in the workplace.	1
	4.2 Identify actions that should be taken when an accident or emergency is discovered.	
	4.3 Identify procedures for dealing with minor injuries.	
	4.4 Identify procedures for dealing with major injuries.	
	4.5 Identify recording procedures for accidents and near misses at work.	
6. Understand how to work safely with heat producing equipment.	6.1 Identify various types of gases used in pipe jointing processes.	1
	6.2 Identify how bottled gases and equipment should be safely transported and stored.	
	6.3 Identify various types of heat producing equipment and how to check them for safety.	
	6.4 Identify how gas heating equipment is safely assembled and used.	
	6.5 Identify the three elements of the fire triangle and how combustion takes place.	
	6.6 Identify the dangers of working with heat producing equipment and how to prevent fires occurring.	
	6.7 Identify the method for fighting small, localised fires that can occur in the workplace in order to aid escape.	

Learning outcome	Assessment criteria	Number of question(s)
7. Understand and safely use access equipment.	7.1 Identify situations where it may be necessary to work at height.	1
	7.2 Identify how to select appropriate access equipment to permit work at heights.	
8. Understand working safely in excavations and confined spaces.	8.1 Identify situations where it may be necessary to work in excavations and confined spaces.	1
	8.2 Identify safe working in excavations and confined spaces.	
	8.3 Identify dangers associated with excavations and confined spaces.	
	8.4 Identify safety measures when working in excavations and confined spaces	
10. Know types of plumbing and domestic heating system pipework and their jointing principles.	10.1 Identify pipework materials and sizes used in dwellings.	1
	10.2 Identify fitting types used in dwellings.	
	10.3 Identify methods of jointing pipework.	
	10.4 Identify methods of bending pipework.	
12. Understand and use clips and brackets to support plumbing and domestic heating pipework and components.	12.2 Identify types of fixing devices.	1
	12.3 Identify clip and bracket types.	
14. Understand units of measurement used in the plumbing and domestic heating systems industry.	14.1 Identify internationally recognised (SI) units of measurement.	1
	14.2 Identify the application and use of SI derived units.	
	14.3 Identify the use of conversion tables for non-SI units.	
15. Understand properties of materials.	15.1 Identify relative densities of common materials.	1
	15.2 Identify properties and applications of solid materials.	

Learning outcome	Assessment criteria	Number of question(s)
	15.3 Identify why solid materials breakdown.	
	15.4 Identify methods of preventing corrosion.	
	15.5 Identify applications of liquids and gases.	
	15.6 Identify basic properties of liquids.	
	15.7 Identify basic properties of gases.	
16. Understand the relationship between energy, heat and power.	16.1 Identify the relationship between the Celsius and Kelvin temperature scales.	2
	16.2 Identify the principles associated with a change of state.	
	16.3 Identify the terms latent and sensible heat as they apply to liquids and gases.	
	16.4 Identify methods of heat transfer.	
	16.5 Identify how units of energy and heat are related and derived.	
	16.6 Carry out heat, energy and power calculations.	
17. Understand principles of force and pressure and their application in the plumbing and domestic heating systems industry.	17.1 Identify the units of force and pressure derived from SI units.	2
	17.2 Identify pressure and flow rate units of measurements.	
	17.3 Identify the application of pressure and flow rate measurements.	
	17.4 Carry out simple force and pressure calculations.	
	17.5 Identify the relationship between velocity, pressure and flow rate in systems.	
	17.6 Identify how restrictions in the pipework effects the flow of liquids and gases.	
	17.7 Identify the principles of a siphon.	
	18.1 Identify principles of simple machines.	1

Learning outcome	Assessment criteria	Number of question(s)
18. Understand mechanical principles in the plumbing and domestic heating systems industry.	18.2 Identify principles of basic mechanics.	
19. Understand principles of electricity in the plumbing and domestic heating systems industry.	19.1 Identify basic principles of electron flow theory.	1
	19.2 Identify the purpose and application of simple units of electrical measurement.	
	19.3 Carry out simple electrical calculations.	
	19.4 Identify the requirements for earthing of electrical circuits.	
	19.5 The testing and commissioning requirements applicable to electrical control systems and components.	
20. Know the sources of renewable and non-renewable energy.	20.1 Identify the different types of non-renewable energy.	1
	20.2 Identify the different types of renewable energy.	
	20.3 Identify the effects of using renewable and non-renewable energy sources.	
21. Know current energy efficiency advice and guidance.	21.1 Identify the benefits of energy efficient products, services and equipment.	1
	21.2 Identify the key factors of the Building Regulations and Guidance that apply to energy efficiency.	
22. Know the role of the construction team within the plumbing and domestic heating systems industry.	22.1 Identify key roles of the site management team.	1
	22.2 Identify key roles of the site operatives.	
	22.3 Identify common site visitors.	
24. Know how to communicate with others.	24.1 Identify methods for effective communication with individual's needs.	1

Learning outcome	Assessment criteria	Number of question(s)
	24.2 Identify suitable communication methods.	
	24.3 Identify appropriate actions to deal with conflicting parties.	
	24.4 Identify the effects of poor communication with individuals.	
25. Understand responsibilities of relevant people in the building services industry.	25.1 Identify different types of client.	1
	25.2 Identify what may be communicated to the client through the progress of a job.	
	25.3 Identify duties and methods for supervising staff.	
26. Understand and produce work programme for tasks in the plumbing and domestic heating systems industry.	26.1 Identify types of projects.	1
	26.3 Identify the impact when materials are not delivered on time against the work programme.	
	26.4 Identify factors which affect working time allocation to work activities.	
28. Understand cold water supply to dwellings.	28.1 Identify the key stages in the rainwater cycle.	2
	28.2 Identify the various sources of water and the typical properties of water from those sources.	
	28.3 Identify the types of water supply to dwellings and how these are regulated.	
	28.4 Identify the different types of water and uses of water in dwellings.	
	28.5 Identify the mains water treatment processes and typical mains water distribution system from treatment works to property.	
	28.6 Identify the private supply water treatment processes.	

Learning outcome	Assessment criteria	Number of question(s)
	28.7 Identify water treatment processes and typical supply pipework and storage systems utilising harvested rainwater and recycled greywater.	
	28.8 Identify water service to the property and isolation points.	
	28.9 Identify the requirements to provide water whilst preventing waste, undue consumption, misuse or contamination.	
29. Understand and recognise the layouts of plumbing and domestic heating systems.	29.1 Identify types and layout features of cold water systems in dwellings.	5
	29.2 Identify the types and layout features of hot water systems in dwellings.	
	29.3 Identify the types and layout features of domestic central heating systems.	
	29.4 Identify the types and layout features of sanitary pipework systems.	
	29.5 Identify the types and layout features of rainwater systems: pipe (RWP) and gutter.	
30. Understand and install cold water systems.	30.1 Identify fluid categories of water and uses of water supplied to dwellings.	3
	30.2 Identify the advantages and disadvantages of cold water systems.	
	30.4 Identify working principles of cold water systems, positioning fixing, connection and operation of components.	
	30.5 Identify layout and installation requirements for protected plastic storage cisterns.	
	30.6 Identify insulation requirements, system frost protection and prevention of undue warming of cold water systems.	
	30.9 Identify backflow risk and required methods of prevention.	

Learning outcome	Assessment criteria	Number of question(s)
31. Understand and install hot water systems.	31.1 Identify advantages and disadvantages of hot water systems.	2
	31.2 Identify types and typical pipe sizes used in hot water systems within dwellings.	
	31.3 Identify working principles of hot water systems, positioning fixing, connection and operation of components.	
	31.4 Identify insulation requirements and system frost protection.	
	31.6 Identify expansion and contraction in hot water systems and negative effects.	
	31.8 Identify secondary circulation and how trace heating can be used.	
	31.10 Identify backflow risk and required methods of prevention.	
32. Understand and install domestic central heating systems.	32.1 Identify advantages and disadvantages of types and layout features of heating systems.	3
	32.3 Identify working principles of types of central heating systems, positioning fixing, connection and operation of components.	
	32.4 Identify the importance of pump positioning.	
	32.5 Identify operating principles for system control.	
	32.6 Identify zoning and control requirements of central heating systems in accordance with statutory legislation.	
	32.7 Identify insulation requirements and system frost protection.	
	32.9 Identify expansion and contraction in central heating systems and negative effects.	
	32.11 Identify procedures for filling and venting system types.	

Learning outcome	Assessment criteria	Number of question(s)
	32.12 Identify the operating principles of heat-producing appliances.	
33. Install sanitary appliances and pipework systems.	33.1 Identify advantages and disadvantages of sanitary appliances pipework systems.	2
	33.3 Identify working principles of sanitary appliances pipework systems and layouts and the positioning, fixing, connection and operation of components.	
	33.5 Identify expansion and contraction in sanitary appliances pipework systems and negative effects.	
	33.7 Identify different types of sanitary appliances and components used in dwellings.	
	33.8 Identify factors that lead to trap seal loss in sanitary pipework systems.	
	33.9 Identify the suitability of below ground drainage systems to receive waste water.	
	33.10 Identify the installation features of sanitary facilities and equipment in dwellings for the disabled including wet rooms.	
	33.12 Identify working principles of greywater recycling systems.	
34. Understand and install rainwater systems.	34.1 Identify advantages and disadvantages of rainwater systems: pipe (RWP) and gutter.	2
	34.2 Identify typical sizes and materials used in rainwater systems: pipe (RWP) and gutter.	
	34.4 Identify expansion and contraction in rainwater systems and negative effects.	
	34.5 Identify factors affecting gutter bracket selection and fixing for buildings.	
36. Understand and perform a soundness test	36.1 Identify information sources required to complete testing and commissioning.	1

Learning outcome	Assessment criteria	Number of question(s)
and commission cold water systems and components.	36.2 Identify how to fill and vent cold water systems.	
	36.5 Identify the flushing requirements including the use of system additives for new and existing cold water systems.	
37. Understand and perform a soundness test and commission hot water systems and components.	37.1 Identify information sources required to complete testing and commissioning.	1
	37.2 Identify how to fill and vent hot water systems.	
	37.5 Identify the flushing requirements including the use of system additives for new and existing hot water systems.	
38. Understand and perform a soundness test and commission central heating systems and components.	38.1 Identify information sources required to complete testing and commissioning.	1
	38.2 Identify how to fill and vent central heating systems.	
	38.5 Identify the flushing requirements including the use of system additives for new and existing central heating systems.	
40. Understand and perform a soundness test and commission rainwater systems and components.	40.1 Identify information sources required to complete testing and commissioning.	1
46. Understand and carry out service and maintenance on cold water systems.	46.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	1
	46.3 Identify types of information to be provided on a maintenance record for cold water systems.	
	46.4 Identify requirements for legionella and bacterial growth control measures.	
47. Understand and carry out service and maintenance of hot water systems.	47.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	1

Learning outcome	Assessment criteria	Number of question(s)
	47.3 Identify types of information to be provided on a maintenance record for hot water systems.	
	47.4 Identify requirements for legionella and bacterial growth control measures.	
48. Understand and carry out service and maintenance on central heating systems.	48.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	1
	48.3 Identify types of information to be provided on a maintenance record for central heating systems.	
49. Understand and carry out service and maintenance on sanitary appliances and pipework systems.	49.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	1
	49.3 Identify types of information to be provided on a maintenance record for sanitary appliances and pipework systems.	
56. Know the basic operating principles of micro-renewable energy technologies.	56.1 Identify the basic operating principles of heat producing micro-renewable energy technologies.	1
	56.2 Identify the basic operating principles of heat-led microcombined heat and power.	
57. Understand requirements to install micro-renewable energy systems to existing systems.	57.1 Identify the suitability of building location and features when installing micro-renewable energy systems.	1
	57.2 Identify statutory regulations affecting installation of microrenewable energy systems.	
	57.3 Identify what would be typically classified as ‘permitted development’ under town and country planning regulations in relation to the deployment of technologies.	
	57.4 Identify which parts of the regulations apply in relation to the installation of environmental technologies.	

Learning outcome	Assessment criteria	Number of question(s)
	57.5 Identify typical advantages and disadvantages associated with environmental technologies.	
58. Understand factors affecting fuel selection.	58.1 Identify the types of fuels used in appliances.	2
	58.2 Identify the factors which affect the selection of fuels.	
	58.3 Identify sources of information for fuel supply installation.	
	58.4 Identify the regulatory type bodies which govern the installation of various fuel types.	
	58.5 Identify the storage requirements for fuels.	
	58.6 Identify factors which could affect storage requirements for fuels.	
59. Know combustion processes of fuel supplied systems.	59.1 Identify the combustion process.	2
	59.2 Identify the main constituents of complete and incomplete combustion.	
	59.3 Identify causes of incomplete combustion.	
	59.4 Identify signs of incomplete combustion.	
	59.5 Identify the symptoms of CO poisoning.	
	59.6 Identify the purpose of CO detectors.	
	59.7 Identify the requirements for ventilation.	
	59.8 Identify the different types of ventilation.	
	59.9 Identify installation practices for ventilation.	
60. Know principles of chimney/flue systems.	60.1 Identify the operating principles of chimney/flue systems.	2
	60.2 Identify types of chimney/flue systems.	

Learning outcome	Assessment criteria	Number of question(s)
	60.3 Identify the components within chimney/flue systems.	
	60.4 Identify the effects of layout on chimney/flue systems.	
	60.5 Identify the layout and features of chimney and flue construction.	
	60.6 Identify termination requirements for chimney/flue systems from relevant documents.	
	60.7 Identify basic inspection and testing procedures for chimney/flue systems.	
61. Understand and perform preinstallation activity prior to undertaking electrical work on plumbing and domestic heating systems.	61.1 Identify the limitations of your responsibility when carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems.	1
	61.2 Identify the applications, advantages and limitations of electrical supplies.	
	61.3 Identify the applications, advantages and limitations of different electrical equipment, cables/wiring and components in relation to the working environment.	
	61.4 Identify the 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.	
	61.5 Identify 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.	
62. Apply industry standard safe isolation procedures.	62.1 Identify the correct means of electrical isolation prior to commencing work.	1
	Total	**60**

Assessment criteria and amplification for Paper 1

In order to support teaching and learning, assessment criteria assessed through the multiple-choice test have been amplified. The full amplification can be found in Appendix 1.

It is important that the amplified content for the EPA is covered though the teaching and learning.

The amplified content for each Assessment Criteria (AC) in the End-point Assessment will either:

- align to the City & Guilds Level 3 Diploma in Plumbing and Domestic Heating (9289-01/02/03/91/92/93) on-programme qualification **or**
- have additional or altered amplification to the assessment criteria in the on-programme qualification.

Providers and employers must ensure that the apprentice is familiar with the amplification content for the EPA as part of their preparation for the knowledge test.

Sample knowledge test for Paper 1

A sample knowledge test is available to prepare apprentices for their assessment. This is available on epaPro and the City & Guilds website.

Apprentices should sit the sample knowledge test under invigilated exam conditions. This will help them to familiarise themselves with the style of questions and develop techniques for answering multiple-choice questions.

Grading for Paper 1

The multiple-choice test for Paper 1 will be graded Fail, Pass or Distinction.

Grade	Marks	%
Fail	0 – 35	N/A
Pass	36 – 49	60%
Distinction	50 – 60	83.3%

Assessment instruction for Paper 2 – Accredited Certification Scheme (ACS)

This is an integrated assessment method.

The Awarding Body (AB) is accountable for this integrated assessment method.

Please see *Section 10: Integrated Assessment (9289-707)*.

Overall Grade for Assessment 1: Knowledge test

To achieve a Pass in the knowledge test, the apprentice must Pass Paper 1 and Paper 2 (integrated assessment). To achieve a Distinction in the knowledge test, the apprentice must achieve a Distinction in Paper 1 and achieve a Pass in Paper 2.

Resits and retakes

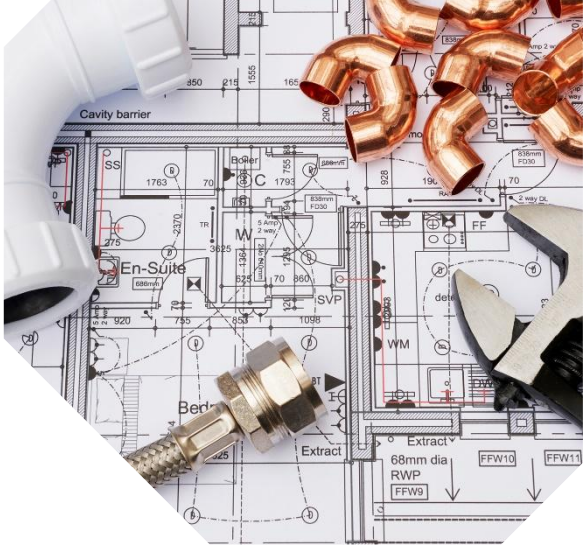
An apprentice who fails the paper will be offered the opportunity to resit or retake.

- A resit is where the apprentice takes the assessment again without the need for new learning.
- A retake is where the employer determines new learning is needed first.

The apprentice will be given a different paper.

The maximum grade the apprentice can achieve for Paper 1 is Distinction.

Please see the *Resits and retakes* section for further information.



7. Assessment information: Assessment 2 – Practical planning test (9289-700)

Overview

In the Practical Planning Test (PPT), the apprentice produces a design plan in a controlled and invigilated environment. It gives the apprentice the opportunity to demonstrate the knowledge and skills mapped to this assessment method.

Rationale

This EPA method is being used because:

- it allows the apprentice to demonstrate knowledge that does not lend itself to a knowledge test
- it allows for the efficient testing of knowledge and skills, using realistic scenarios
- it allows for flexibility in terms of when, where and how it is taken
- it is a holistic assessment method.

Assessment

Grading	P/X To achieve a **Pass** the apprentice must achieve a Pass in all grading descriptors.
Type of assessment	Practical
Duration	5 hours This can be completed over two working days.
Permitted materials	Open book which means that the apprentice can refer to reference books or materials while taking the test. The following normative documents must be available for use: • Water regulations guide • Building regulations Approved Document G • BS 8558 • BS 806 Parts 1–5 • Domestic building services compliance guide • manufacturers' technical documents.

Location	The apprentice must take the practical planning test in a suitably controlled and invigilated environment that is a quiet room, free from distractions and influence. The provider/employer must provide the invigilator and follow the invigilation instructions which can be found later in this section.
Resources	Equipment and resources must be provided and set up by the provider/employer. Each apprentice must have a calculator/calculation software (no internet access) available for use. See the Practical Planning Test Resource Pack for details.

Assessment specification and grading descriptors

Note: The Grading Descriptor (GD) reference is from the Assessment Plan.

Some learning outcomes have the same grading descriptors.

Task planning and risk

KSB: S4 and S5

Learning outcome	Assessment criteria	Pass grading descriptor
Understand information sources in the building services industry.	Interpret workplace information. (underpins GD)	GD63 Complies with company policies and procedures.
	Comply with company policies and procedures.	
Understand and produce work programme for tasks in the plumbing and domestic heating systems industry.	Identify factors to consider when planning activities to job specifications. (underpins GD)	GD61 Produces a simple work programme including: a. planning work with other trades b. material deliveries c. simple work programmes d. simple bar (progress) charts in line with the task requirements.
	Produce a simple work programme including: a. Planning work with other trades b. Material deliveries.	

Learning outcome	Assessment criteria	Pass grading descriptor
	c. Simple work programmes. d. Simple bar (progress) charts.	
Produce risk assessments and method statements for the plumbing and domestic heating systems industry.	Identify different hazards. (underpins GD)	GD62 Produce a risk assessment and method statement for the work to be carried out, in accordance with: a. the plumbing and domestic heating system's design b. the conditions of the working environment c. organisational procedures.
	Identify levels of risk. (underpins GD)	
	Produce a risk assessment for a task.	
	Produce a method statement for a task.	

Technical Planning

KSBs: S12 underpinned by K6, K8, K9 and K17

Learning outcome	Assessment criteria	Pass grading descriptor
Understand and install cold water systems.	Identify types and typical pipe sizes used in cold water systems within dwellings. (underpins GD)	GD64 Plans a cold water system in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.
	Identify sources of information required when undertaking work on cold water systems. (underpins GD)	
	Plan cold water systems.	

Learning outcome	Assessment criteria	Pass grading descriptor
Understand and install hot water systems.	Identify location and function of unvented system components. (underpins GD)	GD65 Plans a hot water system in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.
	Identify sources of information required when undertaking work on hot water systems. (underpins GD)	
	Plan hot water systems.	
Size and select cold water systems and components for dwellings.	Apply factors that affect the selection of cold water systems for dwellings. (underpins GD)	GD64 Plans a cold water system in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.
	Use information sources required to size and select cold water systems and components. (underpins GD)	
	Consider recommended design temperatures within cold water systems. (underpins GD)	
	Calculate cold water system requirements used in dwellings. (underpins GD)	
	Select cold water components in accordance with calculations from predetermined data. (underpins GD)	

Learning outcome	Assessment criteria	Pass grading descriptor
	Present calculations and information in a suitable format for quotation and tender. (underpins GD)	
	Interpret information to complete a detailed materials list. (underpins GD)	GD61 Produces a simple work programme including: a. planning work with other trades b. material deliveries c. simple work programmes d. simple bar (progress) charts in line with the task requirements.
Size and select hot water systems and components for dwellings.	Consider factors that affect the selection of hot water systems for dwellings. (underpins GD)	GD65 Plans a hot water system in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.
	Use information sources required to size and select hot water systems and components. (underpins GD)	
	Consider recommended design temperatures within hot water systems. (underpins GD)	
	Calculate hot water system requirements used in dwellings. (underpins GD)	
	Select hot water components in accordance	

Learning outcome	Assessment criteria	Pass grading descriptor
	with calculations from predetermined data. (underpins GD)	
	Present calculations and information in a suitable format for quotation and tender. (underpins GD)	
	Interpret information to complete a detailed materials list. (underpins GD)	GD61 Produces a simple work programme including: a. planning work with other trades b. material deliveries c. simple work programmes d. simple bar (progress) charts in line with the task requirements.
Understand and perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems.	Produce a risk assessment and method statement for the work to be carried out, in accordance with: a. the plumbing and domestic heating system's design b. the conditions of the working environment c. organisational procedures.	GD62 Produce a risk assessment and method statement for the work to be carried out, in accordance with: a. the plumbing and domestic heating system's design b. the conditions of the working environment c. organisational procedures.

Assessment instructions

Duration

The duration of the practical planning test is 5 hours and it may be completed over two working days.

Delivery

The practical planning test is structured to give the apprentice the opportunity to demonstrate the knowledge and skills mapped to this assessment method as outlined in the grading descriptors.

The provider/employer must book the practical planning test on epaPro, giving the apprentice at least 14 days' notice of the date and time of the test. The provider/employer must confirm that the assessment environment is suitable.

City & Guilds will give the provider/employer contact access to the Practical Planning Test Assessment Pack on epaPro up to five days before the booked EPA event.

On the day of the practical planning test the assessment materials must be provided to the apprentice with the resources required (see the Practical Planning Test Resource Pack). The practical planning test can be computer or paper-based. The provider/employer must maintain the security of the assessment materials. If the assessment materials are printed there must be one copy per apprentice.

Task overview

The apprentice will need to complete a domestic cold and hot water system design capable of meeting a specific job specification.

The apprentice will then produce a design plan incorporating the following aspects:

- hot and cold water pipework sizing
- final layout plans
- materials list
- merchant order
- work programme
- risk assessment and method statement
- present calculations and information in a suitable format for quotation and tender.

Evidence produced

The apprentice can produce their evidence either on computer or paper-based; spell check can be used. The evidence will need to be uploaded to epaPro along with a completed Declaration of Authenticity for **each** apprentice.

Assessment location

The requirements for the controlled environment include a quiet room, away from the normal place of work, with a dedicated workstation, with access to all the required equipment and materials.

Invigilation requirements

The practical planning test must be taken in the presence of an invigilator provided by the provider/employer.

Appointing an invigilator

It is the responsibility of the provider to ensure that invigilators are appropriately trained in their duties.

The role of the invigilator is to ensure that the practical planning test is conducted according to these requirements, in order to:

- confirm the identity of apprentices
- check that apprentices have access to the necessary materials for the practical planning test
- ensure apprentices have an equal opportunity to demonstrate their abilities
- ensure the security of the practical planning test before, during and after the test
- ensure the submitted evidence is an apprentice's own work
- prevent possible malpractice
- prevent possible administrative failures
- deal with hardware, software and communication failures (which may affect individual workstations or the whole network). The invigilator should normally allow the apprentice(s) to continue the assessment session at a different workstation or at a later time, if necessary, without loss of working time. In extreme cases, please contact City & Guilds EPA Team EPA@cityandguilds.com.

The invigilator must **not**:

- make any comment where an apprentice believes that there is an error or omission on the practical panning test. The invigilator must, however, refer the matter immediately to EPA@cityandguilds.com
- give any information about possible mistakes in the practical planning test, unless there is an erratum notice or permission has been given by the City & Guilds EPA Team
- comment on the content of the practical planning test
- re-phrase questions or instructions
- explain any subject-specific or technical terms
- offer any advice or comment on apprentices' work
- carry out any other non-examination related tasks in the room.

Before the assessment

On the day of the assessment, before any assessment can take place, the invigilator must:

- check that the apprentice is present on the date/time of the EPA
- check the apprentice's valid photographic ID
- check that the location where the assessment is to be carried out is safe
- check that application of any Access Arrangements has been granted by City & Guilds.

Attendance of anyone other than the invigilator and apprentices must be agreed with the City & Guilds EPA Team prior to the event.

The invigilator must make signed records of:

- the seating plan
- the invigilation arrangements
- attendance register including apprentice names, enrolment numbers (ENR) and type of evidence provided.

These records and the practical planning test assessment materials must be maintained by the provider/employer until the Statement of Achievement has been received or until any appeal, malpractice of other results entry has been completed, whichever is later.

Before the assessment starts, the invigilator must remind the apprentice:

- of the controlled conditions as set out in the practical planning test assessment materials

- to include their name, enrolment number (ENR) and the date on all the pages that they that will submit for grading
- to complete and sign a Declaration of Authenticity.

During the assessment

Throughout the assessment, invigilators must ensure that:

- all apprentice work is completed in the controlled environment
- the practical planning test is limited to 5 hours; this may be split over two days
- all apprentices are within direct sight of the invigilator throughout the duration of the assessment
- display materials which might aid apprentices have been removed or covered
- apprentices do not have access to e-mail or internet
- apprentices only use resources that are listed within the Practical Planning Test Resource Pack
- apprentices complete their work independently and complete a Declaration of Authenticity. There is no interaction with other apprentices.
- apprentices are not allowed to add to notes and resources between sessions. When the assessment is run over two days all materials must be collected and stored securely at the end of each session (and not made accessible to candidates), including the work to be assessed and the practical planning test assessment materials
- additional precautions are taken if apprentices use computers to store work. This may involve collecting memory sticks for secure storage between sessions or restricting candidates' access to a specific area of the provider or employer's IT network
- only apprentices sitting the assessment are present in the room while the assessment is taking place.

Ending the assessment early

The apprentice may choose to end the assessment method early. The apprentice must be confident they have demonstrated competence against the assessment requirements for the assessment method. The invigilator must ensure the apprentice is fully aware of all assessment requirements. The invigilator cannot suggest or choose to end the assessment early, unless in an emergency. The invigilator may suggest the assessment continues.

The invigilator must document the apprentice's request to end the assessment early in the attendance register.

After the assessment

At the end of the assessment invigilators must:

- tell apprentices to stop working and remind them that they are still under controlled conditions
- remind apprentices to include their name, enrolment number (ENR) and the date on all the pages that they that will submit for marking
- collect all the practical planning tests assessment materials and work completed by apprentices before they are allowed to leave the room
- check that there is practical planning test assessment evidence and a completed Declaration of Authenticity for every apprentice marked as present on the attendance register
- check that the names on the practical planning test assessment materials match the details on the attendance register
- sign the Declaration of Authenticity for each apprentice
- give the practical planning test assessment evidence and Declaration of Authority to the person responsible for uploading them to epaPro.

Storing assessment materials

All live assessment materials remain live at all times and provider/employer staff, including invigilators, must ensure assessment materials are handled securely at all times.

Assessment materials can be stored either:

- on paper, in a strong safe or security cabinet or metal cabinet with locking bar, or
- electronically,

In all cases, access must be restricted to those responsible for administrating the assessment. City & Guilds **must** be informed immediately if the security of any live assessment materials is put at risk.

Submitting the work

Providers/employers must upload the apprentice's practical planning test evidence and completed Declaration of Authenticity to epaPro.

Grading

The practical planning test is graded Fail or Pass. The practical planning test will be graded against all the grading descriptors mapped to this assessment method. The IEPA is fully

responsible for making the grading decision. The results will not be shared with the apprentice on the day of the assessment.

Resits and retakes

An apprentice who fails the practical planning test will be offered the opportunity to resit or retake.

- A resit is where the apprentice takes the assessment again without the need for new learning.
- A retake is where the employer determines new learning is needed first.

The apprentice will be given a different test.

The maximum grade the apprentice can achieve is Pass.

Please see the *Resits and retakes* section for further information.

8. Assessment information: Assessment 3 – Practical competence test (9289-701)

Overview

The IEPA observes the apprentice completing the Practical Competence Test (PCT). The practical competence tasks are set by City & Guilds. This assessment gives the apprentice the opportunity to demonstrate the KSBs mapped to this assessment method.

This assessment has the following tasks:

- Tasks 1, 2 and 3 (core)
- Task 4 (integrated assessment)

Rationale

This EPA method is being used because:

- it allows for a varied range of tasks to be observed, that could not be guaranteed to be achieved through a single observation in the workplace
- this is a practical role, best demonstrated through completing tasks in a realistic work setting
- it allows for consistency of activities to be completed and efficiency in scheduling
- it allows for the testing of related underpinning knowledge, skills and behaviours where an opportunity to observe them has not occurred
- it is a holistic assessment method.

Assessment

Grading	P/X To achieve a **Pass** the apprentice must achieve a Pass in all grading descriptors.
Type of assessment	Practical
Duration	Tasks 1, 2 and 3: 7 hours, must be completed in one day. The independent assessor can increase the time of the practical competence test by up to 10%.
Permitted materials	See the Practical Competence Test Resources Pack.

Location	The practical competence test for non-integrated tasks must take place in a simulated environment at the provider or employer premises. The simulated environment must relate to the apprentice's natural work environment.
Resources	Equipment and resources must be provided and set up by the provider/employer. The equipment and resources must be in good and safe working condition. See the Practical Competence Test Resources Pack for details.

Assessment specification and grading descriptors

Note: The Grading Descriptor (GD) references are from the Assessment Plan.

Some learning outcomes have the same grading descriptor.

Core: Installation and test (mechanical)

KSB: S2, K2, K10

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
Use hand and power tools in plumbing and domestic heating systems work.	Identify the purpose of hand tools and power tools. (underpins GDs)	GD1 Uses and maintains hand and power tools in line with manufacturers' instructions. GD2 Applies the methods of safe storing of tools and equipment in line with organisational procedures.	1, 2, 3
	Use and maintain hand and power tools.	GD1 Uses and maintains hand and power tools in line with manufacturers' instructions.	
Apply site preparation	Apply work methods for preparing and protecting	GD3	1

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
techniques for plumbing and domestic heating systems work.	the building for installation work.	Applies work methods for preparing and protecting the building for installation work in line with industry guidance.	
	Identify the pre-existing damage checks to the building fabric or customer property before the work commences. (underpins GD)		
	Use sources of information for carrying out preparatory work. (underpins GD)		
	Apply the methods of safe storing of tools and equipment.	GD2 Applies the methods of safe storing of tools and equipment in line with organisational procedures.	1, 2
Understand and Use clips and brackets to support plumbing and domestic heating pipework and components.	Measure and mark out fixings for pipework and plumbing and heating components. (underpins GD)	GD4 Uses clips and brackets appropriate to the system pipework and the industry recommended spacing.	1
	Use clips and brackets appropriate to the system pipework and the industry recommended spacing.		
Install plumbing and domestic heating system pipework.	Identify pipework installation requirements. (underpins GD)	GD5 Joins pipework to specification.	1
	Select pipework materials and fittings from instructions.		

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
	(underpins GD)		
	Measure, mark and cut pipework materials for installation. (underpins GD)		
	Fabricate pipework bends to clear obstacles. (underpins GD)		
	Select, position and fix pipework materials to specifications. (underpins GD)		
	Join pipework to specifications.		
Understand and install cold water systems.	Identify the positioning and fixing of pipework within the building fabric. (underpins GD)	GD6 Applies the installation processes and techniques used in the installation of: a. a cold water system b. a hot water system c. a central heating system d. a sanitary appliances and pipework system in line with task requirements.	1
	Apply the processes and techniques used in the installation of a cold water system.		
Understand and install hot water systems.	Identify the positioning and fixing of pipework within the building fabric. (underpins GD)		
	Apply the processes and techniques used in the installation of a hot water system.		

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
Understand and install domestic central heating systems.	Identify the positioning and fixing of pipework within the building fabric. (underpins GD)		
	Apply the processes and techniques used in the installation of a central heating systems.		
Install sanitary appliances and pipework systems.	Identify the positioning and fixing of pipework within the building fabric. (underpins GD)		
	Apply the processes and techniques used in the installation of a sanitary appliances and pipework system.		
Understand and perform a soundness test and commission cold water systems and components.	Carry out a visual inspection of a cold water system to confirm that it is ready to be soundness tested. (underpins GD)	GD7 Applies the processes and techniques used in the soundness testing of: a. a cold water system b. a hot water system c. a central heating system d. a sanitary appliances and pipework system in line with company procedures.	1
	Apply soundness test industry requirements on cold water systems and components. (underpins GD)		
	Apply the processes and techniques used in the soundness testing of a cold water system.		
Understand and perform a	Carry out a visual inspection of a hot water		

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
soundness test and commission hot water systems and components.	system to confirm that it is ready to be soundness tested. (underpins GD)		
	Apply soundness test industry requirements on a hot water system and components. (underpins GD)		
	Apply the processes and techniques used in the soundness testing of a hot water system.		
Understand and perform a soundness test and commission central heating systems and components.	Carry out a visual inspection of a central heating system to confirm that it is ready to be soundness tested. (underpins GD)		
	Apply soundness test industry requirements on a central heating system and components. (underpins GD)		
	Apply the processes and techniques used in the soundness testing of a central heating system.		
Understand and perform a soundness test and commission sanitary appliances, pipework	Carry out a visual inspection of a sanitary appliances and pipework system to confirm that it is ready to be soundness tested. (underpins GD)		

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
systems and components.	Apply soundness test industry requirements on a sanitary appliances and pipework system and components. (underpins GD)		
	Apply the processes and techniques used in the soundness testing of a sanitary appliances and pipework system.		

Core: Installation, fault finding, repair, test and commissioning (electrical)

KSB: S7, S9, K13, K18

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
Apply procedures for electrical safety.	Identify common electrical dangers encountered on construction sites and in private dwellings. (underpins GD)	GD8 Prioritises electrical safety of tools and equipment in line with company procedures and industry practice.	2, 3
	Demonstrate methods of safe supply for electrical tools and equipment on site. (underpins GD)		
	Demonstrate the procedure that should be applied for tools and equipment that fail safety checks. (underpins GD)		

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
	Identify safe isolation procedure when replacing attachments to power tools. (underpins GD)		
	Conduct a visual inspection of a power tool for safe condition before use. (underpins GD)		
	Use temporary continuity bonding when working on pipework components. (underpins GD)		
	Prioritise the electrical safety of tools and equipment.		
Understand and perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems.	Confirm the status of the electrical supply. (underpins GD)	GD9 Carries out the safe isolation of electrical equipment and components associated with the electrical supply of the plumbing and domestic heating system in line with company procedures and industry practice.	2, 3
	Confirm, as necessary, that the electrical supply is suitable for the plumbing and domestic heating systems. (underpins GD)		
	Select, as required, electrical equipment, cables, wiring and components and confirm that they are: a. of the right type and size	GD10 Selects, 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	2, 3

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
	b. fit for purpose in accordance with the plumbing and domestic heating system's design.	accordance with the plumbing and domestic heating system's design.	
Apply industry standard safe isolation procedures.	Carry out the safe isolation of electrical equipment and components associated with the electrical supply of the plumbing and domestic heating system.	GD9 Carries out the safe isolation of electrical equipment and components associated with the electrical supply of the plumbing and domestic heating system in line with company procedures and industry practice.	2, 3
Carry out the safe installation, testing, commissioning and decommissioning of electrical systems.	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.	GD11 Carries 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.	2, 3
	Check that the electrical equipment, cables, wiring and components are in accordance with the requirements of the plumbing and domestic heating system.	GD12 Checks that the electrical equipment, cables, wiring and components are in accordance with the requirements of the	2, 3

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
		plumbing and domestic heating system.	
	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.	GD13 Checks that the electrical equipment, cables, wiring and components are of proper construction in accordance with the requirements of the plumbing and domestic heating system.	2, 3
	Undertake functional testing of 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.	GD14 Undertakes functional testing of 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.	2, 3
	Commission electrical control systems in accordance with: a. industry recognised methods and procedures b. manufacturers' instructions c. legislative requirements.	GD15 Commissions electrical control systems components in accordance with: a. industry recognised methods and procedures b. manufacturers' instructions	2, 3

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
		c. legislative requirements.	
Carry out the identification of faults and safe repair of electrical work.	Identify and rectify electrical faults and deficiencies on plumbing and domestic heating systems in accordance with: a. industry recognised methods and procedures b. manufacturers' instructions.	GD16 Identifies and rectifies electrical faults and deficiencies on plumbing and domestic heating systems in accordance with: a. industry recognised methods and procedures b. manufacturers' instructions.	3

Core: Ownership

KSB: B2

Learning outcome	Assessment criteria	Pass grading descriptor	Task reference
Use hand and power tools in plumbing and domestic heating systems work.	N/A	Takes ownership by completing the tasks and outlines the limits of the role and how they escalate, seek advice and assistance, in line with company policy.	1, 2, 3

Task 4 Achievement of CCN1 and CENWAT or equivalent qualifications

This is an integrated assessment method.

The Awarding Body (AB) is accountable for this integrated assessment method.

Please see *Section 10: Integrated Assessment (9289-707)*.

Assessment instructions

Duration

Tasks 1, 2 and 3 must be completed over one working day with a total assessment time of 7 hours. The Assessment Plan does not stipulate how long apprentices must be given to complete each individual task. Apprentices should plan their work to complete all of the tasks within 7 hours. They can use the following durations as a guide:

- Task 1 – 4.5 hours
- Task 2 – 1.5 hours
- Task 3 – 1 hour.

Task 4 must be completed after all non-integrated assessment methods (Knowledge test Paper 1, Practical planning test, Practical competence test Tasks 1, 2 and 3 and Interview underpinned by an apprenticeship portfolio of evidence) have been completed.

The IEPA can increase the time of the practical competence test by up to 10%. This time is to allow the apprentice to complete a task or respond to a question if necessary.

A working day is typically considered to be 8.5 hours long, including breaks.

Ending the assessment early

The apprentice may choose to end the assessment method early. The apprentice must be confident they have demonstrated competence against the assessment requirements for the assessment method. The IEPA must ensure the apprentice is fully aware of all assessment requirements. The IEPA cannot suggest or choose to end the assessment methods early, unless in an emergency. The IEPA is responsible for ensuring the apprentice understands the implications of ending an assessment early if they choose to do so. The IEPA may suggest the assessment continues. The IEPA must document the apprentice's request to end the assessment early.

Delivery

The practical competence test is structured to give the apprentice the opportunity to demonstrate the KSBs mapped to this assessment method, as outlined in the grading descriptors.

The IEPA:

- will conduct and assess the practical competence test
- can observe up to four apprentices

- will introduce themselves and their role and give the apprentice the opportunity to ask questions. The IEPA cannot answer any questions that will aid interpretation
- will explain to the apprentice the format and timescales of the practical competence test before it starts. This does **not** count towards the assessment time
- will ensure that no assistance is provided to the apprentice during the assessment. This includes breaks and moving between locations
- will provide the apprentice with the EPA assessment pack on the day of the assessment
- will ask the apprentice a minimum of one question as part of each task:
    - the time for questioning is included in the overall assessment time. To remain as unobtrusive as possible, the IEPA will ask questions during natural breaks rather than disrupting the apprentice's flow
    - the purpose of the questions is:
        - to seek clarification where required
        - to assess the level of competence against the grading descriptors.

The apprentice must inform the IEPA when they reach specified stages of tasks to undertake safe isolation and reactivation of electrical systems; these are specified in the relevant tasks in the assessment packs.

Task overview

The following tasks must be completed by the apprentice, as prescribed in the Assessment Plan.

Task 1

The apprentice will be required to complete the part installation and testing of a domestic plumbing system, incorporating:

- fabricating a domestic pipework layout
- a branch connection from a water closet (WC) and a waste pipe branch from a wash basin to a soil stack
- a hot and cold water tap connections to a wash basin
- the installation of a double panel radiator, this is also intended to demonstrate manual handling techniques
- utilising different pipework materials, including copper, plastic pressure and plastic soil and waste pipe
- utilising simple jointing techniques, e.g. push fit, solvent welded
- utilising complex jointing techniques including soldered, compression and press fit

- pipe bending (offset and passover) techniques
- utilising brackets and fixings
- dimensional tolerances of ±2 mm on the lengths and ±2° on the angles
- soundness testing
- testing the system, pressure pipework to withstand a pressure test of 3 bar for 5 minutes, soil and waste pipework must maintain an air test of 38 mm water gauge for 3 minutes. Soundness testing of the soil and waste pipework to require the use of a stepladder or hop up work platform.

The apprentice will be asked a minimum of one question by the IEPA.

Task 2

The apprentice will be required to complete the installation, testing and commissioning of electrical components and electrical controls of a domestic heating and hot water system, incorporating:

- installing and wiring either a room thermostat or cylinder thermostat (one of which may be pre-installed)
- safe isolation
- testing the system
- commissioning the system.

The apprentice will be asked a minimum of one question by the IEPA.

Task 3

The apprentice will be required to complete servicing and maintenance including fault finding, diagnosis, repair and testing procedures, of the electrical components of a domestic hot water system, incorporating:

- finding 2 electrical faults in the system
- diagnosing the 2 faults
- repairing the 2 faults
- testing the system.

The apprentice will be asked a minimum of one question by the IEPA.

Task 4 – Achievement of CCN1 and CENWAT or equivalent qualifications

This is an integrated assessment method.

The Awarding Body (AB) is accountable for this integrated assessment method.

Please see *Section 10: Integrated Assessment (9289-707)*.

Assessment location

The practical competence test will take place in a simulated environment at the training provider/employer's premise.

The simulated environment must relate to the apprentice's natural work environment. Equipment and resources must be provided and set up by the provider/employer. The equipment and resources must be in good and safe working condition.

Information about the equipment and resources required and the set up of the test is provided in the Practical Competence Test Resource Pack. The Practical Competence Test Resource Pack must be treated as part of the assessment materials and **must not** be shared with apprentices.

If an apprentice is new to a venue they must be inducted to the assessment area in terms of orientation, evacuation procedures and all health and safety policies and procedures. This does **not** count towards the assessment time.

Administration

The provider/employer must book the practical competence test at least two weeks' in advance.

The IEPA will provide the apprentice with the assessment materials on the day(s) of the assessment.

The provider/employer must provide a dedicated contact for the IEPA. Before the assessment begins the IEPA will confirm that the assessment area has been set up as required. If the IEPA has any concerns they will report to the City & Guilds EPA Team who will make the final decision.

At the end of each task within the practical competence test the IEPA will confirm to the provider/employer that the task is complete; the provider/employer **must** remove/cover any resources to ensure that the assessment is not visible to other apprentices.

Where the assessment task runs over more than one day, at the end of each day the provider/employer **must** cover any resources to ensure that the assessment is not visible to other apprentices and secure the assessment area, eg lock the door.

Grading

The practical competence test is graded Fail or Pass. The practical competence test will be graded against all the grading descriptors mapped to this assessment method. The IEPA is fully responsible for making the grading decision. The results will not be shared with the apprentice on the day of their assessment.

Resits and retakes

An apprentice who fails the practical competence test will be offered the opportunity to resit or retake.

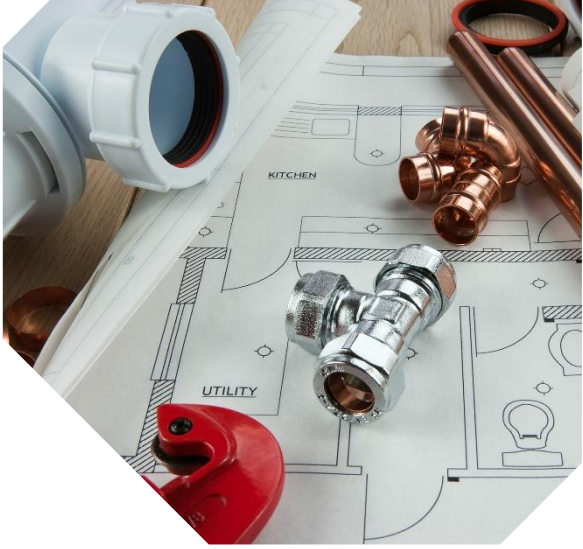
- A resit is where the apprentice takes the assessment again without the need for new learning.
- A retake is where the employer determines new learning is needed first.

The IEPA will observe the apprentice under the same circumstances.

Only those task(s) failed will need to be resat or retaken. The apprentice will be given a different task/set of tasks.

The maximum grade the apprentice can achieve is Pass.

Please see the *Resits and retakes* section for further information.



9. Assessment information: Assessment 4 – Interview underpinned by an apprenticeship portfolio of evidence (9289-702)

Overview

In The Interview Underpinned by an Apprenticeship Portfolio of Evidence (IPE), an IEPA will ask the apprentice questions to give the apprentice the opportunity to demonstrate the KSBs mapped to this assessment method. The apprentice can refer to and illustrate their answers with evidence from their apprenticeship portfolio of evidence.

Rationale

This EPA method is being used because:

- it allows the apprentice to be assessed against KSBs which may not naturally occur during the practical competence test
- it is underpinned by an apprenticeship portfolio of evidence, enabling the apprentice to demonstrate the application of skills and behaviours as well as knowledge
- it allows for testing of responses where there are a number of potential answers that could not be tested through a knowledge test.

Assessment

Grading	P/D/X To achieve a **Pass** the apprentice must achieve a Pass in all grading descriptors. To achieve a **Distinction** the apprentice must achieve Distinctions in all grading descriptors.
Type of assessment	Minimum of 10 questions.
Duration	1 hour The IEPA can increase the time of the assessment by up to 10%. This time is to allow the apprentice to respond to a question if necessary.
Permitted materials	The apprentice's apprenticeship portfolio of evidence and the Evidence Matrix.
Location	The interview will be conducted by video conference.

Resources	A quiet room, free from distractions and interruptions. Access to a computer with video-conferencing software which is tested prior to the assessment starting. The video-conferencing software will be advised at the point of booking.

Assessment specification and grading descriptors

Note: The Grading Descriptor (GD) reference is from the Assessment Plan.

Some learning outcomes have the same grading descriptors.

Core:

Health and safety

KSB: S1 underpinned by K1

Installation and test of domestic rainwater systems

KSB: S3 underpinned by K3, K11

Commissioning and handover

KSB: S6 underpinned by K12

Servicing, maintenance, fault diagnosis and rectification (mechanical parts)

KSB: S8 underpinned by K15, K16

Decommissioning

KSB: S10, S11 underpinned by K14

Technical planning

KSB: S13 underpinned by K6, K8, K9, K17

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
Know and apply health and safety legislation that applies to the building services industry.	Explain how to operate in a safe working manner by adhering to health and safety legislation, approved codes of practice and guidance and	GD69 Explains how to operate in a safe working manner by adhering to health and safety legislation, approved codes of practice and	GD69 Explains the importance to individuals and the business of operating safely and adhering to health and safety legislation,

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	applying safe working practices.	guidance and applying safe working practices.	approved codes of practice and guidance.
Apply personal protection measures.	Understand the purpose of personal protective equipment (PPE). (underpins GD)	GD47 Explain how they apply and use personal protective equipment (PPE) in line with regulatory requirements and company procedures.	GD47 Explain the importance of using PPE correctly and the consequences of not doing so.
	Explain how to apply and use personal protective equipment (PPE).		
	Understand procedures for manual handling. (underpins GD)	GD48 Explain how they carry out correct manual handling in line with industry standards.	GD48, GD49, GD50 Explain the importance of safe manual handling techniques to the individual and the business. Explain the importance of using manufacturers' instructions when using mechanical lifting aids or access equipment.
	Explain how to carry out correct manual handling.		
	Explain how to use mechanical lifting aids.	GD49 Explains how they use mechanical lifting aids in line with manufacturers' instructions.	
Understand and safely use access equipment.	Identify safety checks to be carried out on access equipment. (underpins GD)	GD50 Explain how they use access equipment in line with manufacturers' instructions.	
	Explain how to use access equipment.		
Understand and install domestic	Identify typical pipe sizes used in	GD66	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
central heating systems.	central heating systems types and layouts within dwellings. (underpins GD)	Explains how to plan central heating systems in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.	
	Identify sources of information required when undertaking work on central heating systems. (underpins GD)		
	Explain how to plan central heating systems.		
Install sanitary appliances and pipework systems.	Identify typical pipe sizes and maximum and minimum distances permitted in sanitary appliances pipework systems within dwellings. (underpins GD)	GD67 Explains how to plan sanitary appliances and pipework system in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.	N/A
	Identify sources of information required when undertaking work on sanitary appliances and pipework systems. (underpins GD)		
	Identify jointing methods used in sanitary appliances pipework systems. (underpins GD)		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	Plan sanitary appliances and pipework systems.		
Understand and install rainwater systems.	Identify working principles of rainwater systems (positioning fixing, connection and operation of components). (underpins GD)	GD51 Explains how to install rainwater systems in-line with manufacturer's guidance and customer requirements.	GD51 Explains how they accommodate changes to customer requirements during installation.
	Identify sources of information required when undertaking work on rainwater systems. (underpins GD)		
	Identify working principles of rainwater recycling systems. (underpins GD)		
	Explain how to install rainwater systems.		
	Explain how to plan rainwater harvesting or greywater reuse systems.	GD68 Explains how to plan rainwater harvesting or greywater reuse systems in line with task requirements, manufacturers' guidance, regulatory requirements and	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
		industry recognised standards.	
Decommission plumbing and central heating systems.	Explain how to carry out decommissioning of cold water systems in accordance with company procedures.	GD57 Explains how they carry out decommissioning of: a. cold water systems b. hot water systems c. central heating systems d. sanitary appliances and pipework systems e. rainwater systems f. electrical systems in accordance with company procedures.	GD57 Explains the impact of not decommissioning correctly, on the customer and on the business.
	Explain how to carry out decommissioning of hot water systems in accordance with company procedures.		
	Explain how to carry out decommissioning of central heating systems in accordance with company procedures.		
	Explain how to carry out decommissioning of sanitary appliances and pipework systems in accordance with company procedures.		
	Explain how to carry out decommissioning of rainwater systems in		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	accordance with company procedures.		
Understand and perform a soundness test and commission cold water systems and components.	Identify operational checks required during commissioning. (underpins GD)	GD53 Describes how they carry out commissioning procedures for: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components in line with company procedures.	GD53 Justifies their decisions when their commissioning has found defects.
	Identify the range of information that would be detailed on commissioning documentation. (underpins GD)		
	Identify actions that must be taken when commissioning reveals defects. (underpins GD)		
	Describe how to carry out commissioning procedures for cold water systems and components.		
	Describe the procedure for handing over to the end user.	GD54 Describes the procedure for handing over to the end user: a. cold water systems and components	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
		b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components f. electrical control systems and components in line with company procedures.	
Understand and perform a soundness test and commission hot water systems and components.	Identify operational checks required during commissioning. (underpins GD)	GD53 Describes how they carry out commissioning procedures for: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components	GD53 Justifies their decisions when their commissioning has found defects.
	Identify the range of information that would be detailed on commissioning documentation. (underpins GD)		
	Identify actions that must be taken when commissioning reveals defects. (underpins GD)		
	Describe how to carry out		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	commissioning procedures for hot water systems and components.	e. rainwater systems and components in line with company procedures.	
	Describe the procedure for handing over to the end user.	GD54 Describes the procedure for handing over to the end user: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components f. electrical control systems and components in line with company procedures.	N/A
Understand and perform a soundness test and commission central heating	Identify operational checks required during commissioning. (underpins GD)	GD53 Describes how they carry out commissioning procedures for:	GD53 Justifies their decisions when their commissioning has found defects.

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
systems and components.	Identify the range of information that would be detailed on commissioning documentation. (underpins GD)	a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components in line with company procedures.	
	Identify actions that must be taken when commissioning reveals defects. (underpins GD)		
	Describe how to carry out commissioning procedures for central heating systems and components.		
	Describe the procedure for handing over to the end user.	GD54 Describes the procedure for handing over to the end user: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
		e. rainwater systems and components f. electrical control systems and components in line with company procedures.	
Understand and perform a soundness test and commission sanitary appliances, pipework systems and components.	Identify information sources required to complete testing and commissioning. (underpins GD)	GD53 Describes how they carry out commissioning procedures for: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components in line with company procedures.	GD53 Justifies their decisions when their commissioning has found defects.
	Identify operational checks required during commissioning. (underpins GD)		
	Identify the range of information that would be detailed on commissioning documentation. (underpins GD)		
	Identify actions that must be taken when commissioning reveals defects. (underpins GD)		
	Describe how to carry out commissioning procedures for sanitary appliances,		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	pipework systems and components.		
	Describe the procedure for handing over to the end user.	GD54 Describes the procedure for handing over to the end user: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components f. electrical control systems and components in line with company procedures.	N/A
Understand and perform a soundness test and commission rainwater systems and components.	Carry out a visual inspection of a rainwater system to confirm that it is ready to be soundness tested. (underpins GD)	GD52 Explains how to carry out a soundness test in-line with company procedures.	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	Apply soundness test industry requirements on rainwater systems and components. (underpins GD)		
	Explain how to carry out a soundness test.		
	Identify operational checks required during commissioning. (underpins GD)	GD53 Describes how they carry out commissioning procedures for: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components in line with company procedures.	GD53 Justifies their decisions when their commissioning has found defects.
	Identify the range of information that would be detailed on commissioning documentation. (underpins GD)		
	Identify actions that must be taken when commissioning reveals defects. (underpins GD)		
	Describe how to carry out commissioning procedures for rainwater systems and components.		
	Describe the procedure for handing over to the end user.	GD54 Describes the procedure for	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
		handing over to the end user: a. cold water systems and components b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components f. electrical control systems and components in line with company procedures.	
Perform fault diagnosis and rectification procedures on cold water systems and components.	Apply methods of obtaining information on system faults. (underpins GD)	GD55 Explain how to carry out identification and rectification procedures and techniques to deal with a range of faults on: a. cold water systems and components	GD55 Justifies their fault-finding approach.
	Carry out diagnostic checks for a range of faults. (underpins GD)		
	Explain how to carry out identification and		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	rectification procedures and techniques to deal with a range of faults.	b. hot water systems and components c. central heating systems and components d. sanitary appliances, pipework systems and components e. rainwater systems and components in line with company procedures.	
Perform fault diagnosis and rectification procedures on hot water systems and components.	Apply methods of obtaining information on system faults. (underpins GD)		
	Carry out diagnostic checks for a range of faults. (underpins GD)		
	Explain how to carry out identification and rectification procedures and techniques to deal with a range of faults.		
Perform fault diagnosis and rectification procedures on central heating systems and components.	Apply methods of obtaining information on system faults. (underpins GD)		
	Carry out diagnostic checks for a range of faults. (underpins GD)		
	Explain how to carry out identification and rectification procedures and		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	techniques to deal with a range of faults.		
Perform fault diagnosis and rectification procedures on sanitary appliances, pipework systems and components.	Apply methods of obtaining information on system faults. (underpins GD)		
	Carry out diagnostic checks for a range of faults. (underpins GD)		
	Explain how to carry out identification and rectification procedures and techniques to deal with a range of faults. (underpins GD)		
Perform fault diagnosis and rectification procedures on rainwater systems and components.	Apply methods of obtaining information on system faults. (underpins GD)		
	Carry out diagnostic checks for a range of faults. (underpins GD)		
	Explain how to carry out repair and rectification procedures to deal		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	with a range of faults.		
Understand and carry out service and maintenance on cold water systems.	Understand routine checks required on cold water system components and pipework as part of a periodic maintenance programme. (underpins GD)	GD56 Explain how to carry out: a. service or maintenance of cold water systems b. service or maintenance of hot water systems c. service or maintenance of central heating systems d. routine checks of sanitary appliances and pipework systems in line with company procedures.	N/A
	Explain how to carry out service or maintenance of cold water systems.		
Understand and carry out service and maintenance of hot water systems.	Understand routine checks required on hot water system components and pipework as part of a periodic maintenance programme. (underpins GD)		
	Explain how to carry out service or maintenance of hot water systems.		
Understand and carry out service and maintenance on central heating systems.	Understand routine checks required on central heating system components and pipework as part of a periodic maintenance programme.		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	(underpins GD)		
	Explain how to carry out service or maintenance of central heating systems.		
Understand and carry out service and maintenance on sanitary appliances and pipework systems.	Understand routine checks required on sanitary appliances and pipework systems as part of a periodic maintenance programme. (underpins GD)		
	Explain how to carry out routine checks of sanitary appliances and pipework systems.		
Size and select rainwater harvesting and greywater reuse systems and components for dwellings.	Consider the design requirements for types and layouts of rainwater harvesting systems. (underpins GD)	GD68 Explains how to plan rainwater harvesting or greywater reuse systems in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.	N/A
	Consider the design requirements for types and layouts of greywater reuse systems. (underpins GD)		
	Consider the information requirements used to select, size and		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	position components. (underpins GD)		
	Confirm the pre-installation design requirements. (underpins GD)		
	Calculate rainwater harvesting or greywater reuse system requirements used in dwellings. (underpins GD)		
Size and select central heating systems and components for dwellings.	Consider factors that affect the selection of central heating systems for dwellings. (underpins GD)	GD66 Explains how to plan central heating systems in line with task requirements, manufacturers' guidance, regulatory requirements and industry recognised standards.	N/A
	Use information sources required to size and select central heating systems and components. (underpins GD)		
	Consider the principles of heat loss and heat gain and how this affects heating requirements. (underpins GD)		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	Calculate central heating system requirements used in dwellings. (underpins GD)		
	Select central heating system components in accordance with calculations from predetermined data. (underpins GD)		
	Interpret information to complete a detailed materials list. (underpins GD)		
	Present calculations and information in a suitable format for quotation and tender. (underpins GD)		
Size and select sanitary appliances pipework systems and components for dwellings.	Consider factors that affect the selection of sanitary appliances pipework systems for dwellings. (underpins GD)	GD67 Explains how to plan sanitary appliances and pipework system in line with task requirements, manufacturers' guidance, regulatory requirements and	N/A
	Use information sources required to size and select sanitary appliances pipework systems.		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	(underpins GD)	industry recognised standards.	
	Calculate sanitary appliance pipework system requirements used in dwellings. (underpins GD)		
	Select sanitary system components in accordance with calculations from predetermined data. (underpins GD)		
	Interpret information to complete a detailed materials. (underpins GD)		
	Present calculations and information in a suitable format for quotation and tender. (underpins GD)		
Size and select rainwater systems components for dwellings.	Consider factors that affect the selection of rainwater systems for dwellings. (underpins GD)	GD68 Explains how to plan rainwater harvesting or greywater reuse systems in line with task requirements, manufacturers' guidance, regulatory requirements and	N/A
	Use information sources required to size and select rainwater systems components.		

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
	(underpins GD)	industry recognised standards.	
	Calculate rainwater systems requirements used in dwellings. (underpins GD)		
	Select rainwater system components in accordance with calculations from predetermined data. (underpins GD)		
	Interpret information to complete a detailed materials. (underpins GD)		
	Present calculations and information in a suitable format for quotation and tender. (underpins GD)		
Understand and perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems.	Explain how to apply and use personal protective equipment (PPE).	GD47 Explain how they apply and use personal protective equipment (PPE) in line with regulatory requirements and company procedures.	GD47 Explain the importance of using PPE correctly and the consequences of not doing so.
Carry out the safe installation, testing, commissioning	Explain how to carry out decommissioning of electrical systems in	GD57 Explains how they carry out	GD57 Explains the impact of not decommissioning

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
and decommissioning of electrical systems.	accordance with company procedures.	decommissioning of: a. cold water systems b. hot water systems c. central heating systems d. sanitary appliances and pipework systems e. rainwater systems f. electrical systems in accordance with company procedures.	correctly, on the customer and on the business.

Core: Professionalism

KSBs: B1, B3, B4, underpinned by K7

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
Professionalism	N/A	Explains how their collaboration and communication with customers and colleagues is achieved by acting professionally and upholding ethical principles. Outlines the planned and unplanned learning and development activities they have carried out and shows a commitment to future continued professional development to maintain and enhance competence. Describes how they	N/A

Learning outcome	Assessment criteria	Pass grading descriptor	Distinction grading descriptor
		keep up to date with industry best practice.	

Apprenticeship portfolio of evidence requirements

The apprentice must submit an apprenticeship portfolio of evidence at Gateway.

The apprentice must compile an apprenticeship portfolio of evidence during the on-programme period of the apprenticeship. It should only contain evidence related to the KSBs and grading descriptors that will be assessed by the interview.

The portfolio of evidence will typically contain 10 discrete pieces of evidence. Evidence must be mapped against the KSBs and grading descriptors in the Evidence Matrix provided in the Recording Forms for Providers/employers. Evidence may be used to demonstrate more than one grading descriptor; a qualitative as opposed to quantitative approach is suggested. If the apprentice is using evidence from their on-programme work log, they should review what evidence is submitted for the EPA to ensure it is their best evidence.

Evidence sources may include workplace documentation and records, for example:

- workplace policies and procedures
- witness statements
- annotated photographs
- video clips with a maximum total duration of 10 minutes; the apprentice must be in view and identifiable.

This is not a definitive list; other evidence sources can be included.

The apprenticeship portfolio of evidence must **not** include reflective accounts or any methods of self-assessment.

Any employer contributions should focus on direct observation of performance, for example, witness statements, rather than opinions. The evidence provided should be valid and attributable to the apprentice; the apprenticeship portfolio of evidence must contain a Declaration of Authenticity signed by the employer and apprentice confirming this.

The IEPA will **not** assess the apprenticeship portfolio of evidence directly as it underpins the interview. The IEPA will review the apprenticeship portfolio of evidence to prepare questions for the interview. The IEPA will **not** provide feedback on the apprenticeship portfolio of evidence.

The completed portfolio, including the Declaration of Authenticity and Evidence Matrix must be submitted at Gateway. The submission of a fully completed Evidence Matrix is mandatory.

Apprentice preparation for the interview

Apprentices must prepare for the interview by reviewing their apprenticeship portfolio and how it meets the grading descriptors. The Evidence Matrix shows the grading descriptors grouped into themes. The IEPA's interview questions will be structured around these themes.

Apprentices may not have work-based evidence for every grading descriptor, for example installing rainwater systems; however they must be prepared to answers questions about every grading descriptor.

The IEPA will make the grading decision against all grading descriptors for this assessment method. There are a number of grading descriptors to cover in the interview, so the apprentice must be ready to make the most of the time available.

Assessment instructions

Duration

The assessment duration is 1 hour.

The IEPA can increase the time by up to 10%. This time is to allow the apprentice to respond to a question if necessary.

Ending the assessment early

The apprentice may choose to end the assessment method early. The apprentice must be confident they have demonstrated competence against the assessment requirements for the assessment method. The IEPA must ensure the apprentice is fully aware of all assessment requirements. The IEPA cannot suggest or choose to end the assessment methods early, unless in an emergency. The IEPA is responsible for ensuring the apprentice understands the implications of ending an assessment early if they choose to do so. The IEPA may suggest the assessment continues. The IEPA must document the apprentice’s request to end the assessment early.

Delivery

The interview underpinned by an apprenticeship portfolio of evidence is structured to give the apprentice the opportunity to demonstrate the KSBs and grading descriptors mapped to this assessment method to the highest available grade.

The IEPA:

- will conduct and assess the interview underpinned by an apprenticeship portfolio of evidence individually with each apprentice
- will introduce themselves and their role, explain the format of the interview and give the apprentice the opportunity to ask questions to clarify the requirements
- will ask the apprentice a minimum of 15 questions.

The apprentice must have access to their apprenticeship portfolio of evidence during the interview. The apprentice can refer to and illustrate their answers with evidence from their apprenticeship portfolio of evidence. Apprentices can give examples that have not been included in their portfolio of evidence.

Assessment location

The assessment will be conducted by video conferencing. The apprentice must be in a quiet room, free from distractions and influence.

City & Guilds has processes in place to verify the identity of the apprentice and ensure that the apprentice is not being aided.

Face-to-face assessments can be arranged via the City & Guilds EPA Partnership Manager.

Administration

The provider/employer must book the interview underpinned by an apprenticeship portfolio of evidence at least two weeks' in advance. The IEPA must have at least two weeks to review the portfolio of evidence.

Before the assessment begins the IEPA will confirm that the assessment has been set up as required. If the IEPA has any concerns they will report to the City & Guilds EPA Team who will make the final decision.

Grading

The interview underpinned by an apprenticeship portfolio of evidence is graded Fail, Pass or Distinction. The interview will be graded against all the grading descriptors mapped to this assessment method. The IEPA is fully responsible for making the grading decision. The results will not be shared with the apprentice on the day of the assessment.

Resits and retakes

An apprentice who fails the interview underpinned by an apprenticeship portfolio of evidence will be offered the opportunity to resit or retake.

- A resit is where the apprentice takes the assessment again without the need for new learning.
- A retake is where the employer determines new learning is needed first.

The apprentice may choose to submit an amended portfolio of evidence. This could be a mixture of new evidence and evidence previously submitted. The same requirements apply, including typically providing 10 pieces of evidence and submitting an Evidence Matrix and Declaration of Authenticity. However, the portfolio does **not** need to be resubmitted if no amendments are made to it.

The interview will be carried out in the same way as the original assessment.

The maximum grade the apprentice can achieve is Distinction.

Please see the *Resits and retakes* section for further information.

10. Assessment information: Integrated Assessment (9289-707)

Overview

This End-point Assessment has an integrated qualification which means both the qualification and this apprenticeship should be completed, passed and awarded during the same period.

It incorporates the requirements for the Accredited Certification Scheme (ACS) and is an industry recognised and mandatory entry route for gas engineers to attain the necessary qualifications and competence required to work under the Gas Safe Register.

The following qualifications apply:

- CCN1 – Core domestic gas safety
- CENWAT – Domestic gas central heating boilers and water heaters
- or other equivalent qualifications which meet the relevant Matters of Gas Safety requirements equivalent to the above.

These qualifications are integrated into the knowledge test and the practical competency test.

The awarding body (AB) is accountable for the integrated assessment method. They must deliver and mark the integrated assessment methods.

City & Guilds will take responsibility for all other non-integrated assessment methods in this EPA.

The EPA outcome is determined by City & Guilds. City & Guilds will combine the outcomes of the integrated and non-integrated assessment methods to determine the apprentice's overall grade.

The apprentice must apply to join the Gas Safe Register and is required to meet the requirements of gas safe registration on successful completion of the CCN1 and CENWAT or equivalent qualifications. This application is not part of the EPA.

Assessment method 1: Knowledge test Paper 2

This paper is an integrated assessment method.

It will consist of:

- the CCN1 or equivalent theory tests for the core domestic gas safety qualification

- the CENWAT or equivalent theory test for domestic gas central heating boilers and water heaters. The integrated assessment method forms part of the apprenticeship's EPA as well as awarding of the qualifications.

The KSBs assessed are K19–K26.

Assessment and delivery instructions

The awarding body (AB) is accountable for this integrated assessment paper.

The administration will align with the conditions set out by the AB.

They will deliver and mark this integrated assessment paper.

The apprentice must apply to join the Gas Safe Register and is required to meet the requirements of gas safe registration on successful completion of the CCN1 and CENWAT or equivalent qualifications. This application is **not** part of the EPA.

Assessment method 3: Practical Competence test Task 4

Task 4 is an integrated assessment method.

The integrated qualifications are the practical assessments used in the:

- CCN1 – Core domestic gas safety
- CENWAT – Domestic gas central heating boilers and water heaters
- Or other equivalent qualifications which meet the relevant matters of Gas Safety requirements equivalent to the above.

The KSBs aligned to this integrated assessment method will be assessed and graded by the AB and contribute to the overall outcome of this apprenticeship.

This assessment method is used because it incorporates the industry recognised and mandatory entry route for gas engineers to attain the necessary requirements as part of the Accredited Certification Scheme (ACS), to work under the Gas Safe Register.

The KSBs assessed are S14–S18.

Delivery

Apprentices must complete the required practical tasks. The delivery of the practical competence test must align with the conditions set out by the AB for the integrated qualifications.

Assessment location

The practical competence test must take place in a suitable venue selected by the AB for the qualifications.

Resource development

The resource development requirements must align with the conditions set out by the AB for the qualifications.

Administration

The provider will confirm, at Gateway, that the ACS training has been completed, and the assessment for the CCN1 and CENWAT or equivalent qualifications will be completed in compliance with the conditions set out by the AB; **or** the assessment has been completed in compliance with the conditions set out by the AB and the ACS has a minimum of six months before the certification renewal date.

Grading

Grade
UKAS-approved Nationally Accredited Certification Scheme (ACS) for Gas fitting Operatives theory test, as specified by the awarding body.

11. Resits and retakes

Apprentices who fail one or more assessments will be offered the opportunity to take a resit or retake. The apprentice's employer needs to agree that a resit or retake is appropriate.

- A resit is where the apprentice takes the assessment again without the need for new learning.
- A retake is where the employer determines new learning is needed first.

The employer and the EPAO should agree the timescale for a resit or retake.

A resit is typically taken within three months of the EPA outcome notification. The timescale for a retake is dependent on how much re-training is required and is typically taken within six months of the EPA outcome notification.

Failed assessment methods must be resat or retaken within a six-month period from the EPA outcome notification, otherwise the entire EPA will need to be resat or retaken in full.

Resits and retakes are not offered to an apprentice wishing to move from Pass to a higher grade.

The apprentice will get a maximum overall EPA grade of Pass if they need to resit or retake one or more assessment methods, unless the EPAO determines there are exceptional circumstances.

Please see the resits and retakes section for each individual assessment method for further information.

12. Security, confidentiality and copyright of End-point Assessment materials

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- any EPA Assessment Materials are made accessible to Apprentices only during formal EPA assessment as governed by the assessment conditions specified for the individual Apprenticeship Standard;
- whilst the portfolio of an Apprentice may contain EPA assessment results referenced to the EPA assessment taken from time to time, they do not at any time contain the EPA Assessment Materials, unless otherwise stated in the individual Apprenticeship Standard; and the content of any EPA Assessment Materials is not made public in any format, whether in part or in full, at any time;

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ILM Customer Services Team	01543 266 867 customer@i-l-m.com
Digital Sales: On-programme delivery resources	Digitalsales@cityandguilds.com
Digital Credentials	digitalsupport@cityandguilds.com
Digital Credentials: Bulk email uploads	DCServiceTeam@cityandguilds.com

Appendix 1 – Assessment criteria amplification for Knowledge test Paper 1 (9289-300)

Learning outcome 1 – Know and apply health and safety legislation that applies to the building services industry.

Assessment criteria	Content – What needs to be covered
1.1 Identify health & safety legislation in protecting the workforce and members of the public.	The purpose of: • The Health & Safety at Work etc. Act • Construction (Design and Management) Regulations • 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 and Use) Regulations • Health & Safety (First Aid) Regulations • Health & Safety (Signs and Signals) Regulations • Lifting Operations and Lifting Equipment Regulations • Manual Handling Operations Regulations • Personal Protective Equipment at Work Regulations • Provision and Use of Work Equipment Regulations (PUWER) • Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) • Work at Height Regulations

1.2 Identify responsibilities of members of the construction team.	• Employers (including employer representatives)
	  ○ compliance with health and safety
	  ○ communication
	  ○ employee welfare
	  ○ training and development
	  ○ employee workplace safety
	  ○ issue and replace personal protective equipment (PPE)
	• Designers
	  ○ design safety considerations
	  ○ compliance with legislation
	  ○ communication of risks
	  ○ site visits and inspections
	• Main contractors
	  ○ health and safety management
	  ○ compliance with legislation
	  ○ risk assessments
	  ○ communication and training
	  ○ site supervision and monitoring
	  ○ coordinating with subcontractors
	  ○ incident reporting and investigation
	  ○ emergency procedures

Assessment criteria	Content – What needs to be covered
	○ welfare facilities • Sub-contractors ○ compliance with legislation ○ risk assessments ○ safe systems of work ○ training and compliance ○ use and supply personal protective equipment (PPE) ○ incident reporting and investigation ○ follow emergency procedures • Employees ○ personal safety ○ safety using equipment ○ risk awareness ○ use of personal protective equipment (PPE) ○ reporting hazards ○ follow emergency procedures • Clients (customers) ○ personal safety ○ appoint designers and contractors ○ provide project information ○ risk awareness ○ compliance with legislation ○ emergency procedures
1.3 Identify the legal status of health and safety guidance materials.	• Non-statutory
1.4 Identify the role of enforcing authorities.	• Inspection • Compliance monitoring and enforcement • Advising • Investigation • Training • Issuing notices • Withdrawing approval • Issuing cautions
1.5 Identify the control measures of inspectors.	• Issuing improvement notices • Issuing prohibition notices • Powers of prosecution • Providing advice and guidance

Learning outcome 2 – Understand hazardous situations working in the building services industry.

Assessment criteria	Content – What needs to be covered
2.1 Identify types of site hazards that may be encountered while at work or by members of the public.	• Trips • Slips • Falls • Burns • Cuts • Falling objects (tools)
2.2 Identify strategies used to prevent accidents during work activities.	• Training • Near miss of accidents reported • Risk assessments • Method statements • Permit to work systems • Safety notices • Construction Skills Certification Scheme (CSCS) card

2.3 Identify how the hazards of some substances and mixtures can be identified from the labels and packaging.	• Pictograms and/or written warnings
	  ○ physical hazards
	  ▪ explosive
	  ▪ flammable gases
	  ▪ oxidising liquids
	  ▪ corrosive
	  ○ health hazards
	  ▪ acute toxicity
	  ▪ skin corrosion/irritation
	  ▪ eye damage/irritation
	  ▪ respiratory/skin sensitisation
	  ○ environmental hazards
	  ▪ hazardous to the aquatic environment

2.4 Identify how to deal with commonly encountered substances including disposal where applicable.	• Lead – solid and fumes
	  ○ dealing with
	  ▪ extractors and ventilation
	  ▪ skin protection
	  ▪ PPE
	  ○ disposal
	  ▪ recycling
	• Substances covered by COSHH
	  ○ dealing with
	  ▪ assess the risk
	  ▪ read the labelling
	  ▪ use PPE
	  ▪ ventilation
	  ▪ training

Assessment criteria	Content – What needs to be covered
	○ disposal ▪ licenced ▪ unlicenced ▪ disposal guidelines ▪ training ▪ personal protective equipment ▪ transportation
2.5 Identify common building materials and services components that may contain asbestos.	• Flue • Soil pipework • Rainwater pipes • Gutters • Tanks and cisterns • Artex • Small gaskets and seals • Bath panels/panelling • Floor tiles
2.6 Identify types of asbestos that may be encountered in the workplace.	• Chrysotile ○ white • Amosite ○ brown or grey • Crocidolite ○ blue
2.7 Identify procedures that must be used to safely work with asbestos cement based materials.	• Complete an asbestos awareness training • Conduct a risk assessment before carrying out the following: ○ wear appropriate PPE ○ set up a controlled work area ○ use warning signs to restrict access ○ handle materials to avoid breakage ○ avoid sanding, drilling or cutting where possible ○ follow emergency procedures for accidental disturbance

Learning outcome 4 – Understand how to respond to accidents.

Assessment criteria	Content – What needs to be covered
4.1 Identify requirements for first aid provision in the workplace.	• First aiders • First aid kit • First aid information • First aid training • Record keeping • Emergency procedures

Assessment criteria	Content – What needs to be covered

4.2 Identify actions that should be taken when an accident or emergency is discovered.	• Actions for accidents in the following order:
	  ○ ensure personal safety
	  ○ raise the alarm
	  ○ evaluate the situation
	  ○ call first aiders
	  ○ contact emergency services
	  ○ record accident
	• Actions for emergencies in the following order:
	  ○ ensure personal safety
	  ○ raise the alarm to evacuate
	  ○ call emergency services
	  ○ assist with evacuation
	  ○ administer first aid
	  ○ go to the assembly point

4.3 Identify procedures for dealing with minor injuries.	• Dealing with cuts in the following order:
	  ○ wash the wound area
	  ○ clean the cut
	  ○ apply first aid
	  ○ seek medical advice
	• Dealing with minor burns and scalds in the following order:
	  ○ cool with water
	  ○ cover the burn
	  ○ avoid creams
	  ○ treat for shock
	  ○ seek medical advice
	• Dealing with objects in the eye in the following order:
	  ○ do not rub
	  ○ wash hands
	  ○ inspect
	  ○ clean with a sterile solution
	  ○ cover the eye
	  ○ seek medical advice
	• Dealing with exposure to fumes in the following order:
	  ○ personal safety
	  ○ evacuate or ventilate area
	  ○ check for breathing
	  ○ loosen clothing
	  ○ seek medical advice

4.4 Identify procedures for dealing with major injuries.	• Procedures in the following order:
	  ○ ensure personal safety
	  ○ assess the situation, assisting if it is safe to do so
	  ○ call for help – first aider
	  ○ contact the emergency services
	  ○ record the incident

Assessment criteria	Content – What needs to be covered

4.5 Identify recording procedures for accidents and near misses at work.	• Statutory requirements for the reporting of accidents/serious occurrences
	• Recording details in the company accident book for minor and major accidents
	• Consider the requirements of RIDDOR
	  ○ death in the workplace
	  ○ fractures
	  ○ amputation
	  ○ serious burns

Learning outcome 6 – Understand how to work safely with heat producing equipment.

Assessment criteria	Content – What needs to be covered

6.1 Identify various types of gases used in pipe jointing processes.	• Propane
	  ○ stored in red bottle
	• Methyl acetylene-propadiene-propane (MAPP) gas
	  ○ stored in yellow bottle
	• Butane
	  ○ stored in blue bottle
	• Oxygen
	  ○ stored in black bottle with a white shoulder
	• Acetylene
	  ○ stored in maroon bottle

6.2 Identify how bottled gases and equipment should be safely transported and stored.	• Transported
	  ○ secured in open top vehicles, containers or trailers
	  ○ vehicles, containers and trailers must be labelled with warning signage
	• Storage
	  ○ bottles and equipment kept upright
	  ○ stored open to the atmosphere
	  ○ positioned away from drains, excavation or trenches
	  ○ kept in a secured location

6.3 Identify various types of heat producing equipment and how to check them for safety.	• Types
	  ○ propane torches
	  ○ oxy-acetylene welding equipment
	• Safety checks
	  ○ inspect gas cylinders
	  ○ inspect hoses and valves
	  ○ check regulators
	  ○ check gauges

Assessment criteria	Content – What needs to be covered
	○ correct storage ○ correctly secured ○ flashback arrestors ○ control valves
6.4 Identify how gas heating equipment is safely assembled and used.	• Assembled ○ inspect components ○ secure cylinders ○ attach regulators ○ check hoses ○ assembly torch ○ test for leaks ○ set pressure • Used ○ ensure adequate ventilation of work area ○ ensure access to fire extinguisher ○ ignite torch safely ○ adjust flame to required heat ○ maintain safe distance from flammable material ○ monitor safe operation of work ○ shut down torch appropriately ○ store equipment safely
6.5 Identify the three elements of the fire triangle and how combustion takes place.	• Elements ○ oxygen ○ heat ○ fuel • Combustion ○ heat raises fuel to its ignition point ○ fuel reacts with oxygen and starts burning ○ combustion continues while heat, fuel and oxygen are all present
6.6 Identify the dangers of working with heat producing equipment and how to prevent fires occurring.	• Dangers ○ fire hazard ○ burns ○ explosions ○ electrical hazards ○ heat stress • Prevention ○ remove combustible materials ○ flame protection ○ maintenance ○ inspection ○ fire extinguishers ○ dampening areas ○ risk assess/hot works permit ○ use of appropriate PPE

Assessment criteria	Content – What needs to be covered

6.7 Identify the method for fighting small, localised fires that can occur in the workplace in order to aid escape.	• Selection of extinguisher by fire type
	  ○ water extinguisher (red label) suitable for class A fires
	  ▪ wood
	  ▪ paper
	  ▪ textiles
	  ○ foam extinguisher (cream label) suitable for class A and B fires
	  ▪ flammable liquids
	  ▪ flammable solids
	  ○ dry powder extinguisher (blue label) suitable for class A, B and C fires
	  ▪ solids
	  ▪ flammable liquids
	  ▪ flammable gases
	  ○ carbon dioxide (CO_2) extinguisher (black label) suitable for Class B and electrical fires
	  ▪ electrical equipment
	  ▪ flammable liquids
	  ○ wet chemical extinguisher (yellow label) suitable for Class F fires
	  ▪ cooking oils and fats
	• Correct use of fire extinguisher
	• Follow evacuation procedures

Learning outcome 7 – Understand and safely use access equipment.

Assessment criteria	Content – What needs to be covered
7.1 Identify situations where it may be necessary to work at height.	• External roof work • Installing and maintaining external soil stack and waste systems • Maintaining rainwater systems • Accessing internal roofs voids and spaces for installation and maintenance

7.2 Identify how to select appropriate access equipment to permit work at heights.	• Types of access equipment
	  ○ step ladders
	  ○ ladders
	  ○ harnesses
	  ○ roof ladders
	  ○ crawling boards
	  ○ mobile tower scaffolds
	  ○ fixed scaffolds
	  ○ mobile elevated work platforms (MEWP)
	• Factors to be considered
	  ○ duration of work

Assessment criteria	Content – What needs to be covered
	○ type of activity ○ the height ○ weather conditions ○ location ○ ground condition ○ weight of tools and equipment to be used ○ number of workers required

Learning outcome 8 – Understand working safely in excavations and confined spaces.

Assessment criteria	Content – What needs to be covered
8.1 Identify situations where it may be necessary to work in excavations and confined spaces.	• Drainage systems • Rainwater harvesting systems • Cold water mains • Work in attic space • Work under timber suspended floor void
8.2 Identify safe working in excavations and confined spaces.	• Safety plan in place • No lone working • Equipping with appropriate PPE • Secure the area • Barrier and vehicle stops • Measurement of the atmosphere inside • Ventilation of the confined area • Authorisation to enter
8.3 Identify dangers associated with excavations and confined spaces.	• Inadequate ventilation • Inadequate lighting • Flooding • Obstruction of an escape route • Explosion • Collapse • Gases • Asphyxiation
8.4 Identify safety measures when working in excavations and confined spaces.	• Warning signs • Barrier stop • Vehicle stops • Permit to work • Use qualified and competent employees

Learning outcome 10 – Know types of plumbing and domestic heating system pipework and their jointing principles.

Assessment criteria	Content – What needs to be covered

10.1 Identify pipework materials and sizes used in dwellings.	• Pipework up to and no greater than 28 mm
	• Copper (BS EN 1057)
	  ○ R220 soft coils
	  ○ R250 half hard lengths
	  ○ R290 hard lengths
	  ▪ carbon steel
	  ▪ stainless steel
	  ▪ corrugated stainless steel
	  ○ medium grade
	• Plastic pipework (hot, cold, heating)
	  ○ polyethylene (MDPE and HDPE)
	  ○ cross linked polyethylene (PEX)
	  ○ polybutylene (PB)
	• Plastic pipework (underfloor heating)
	  ○ PE-RT (underfloor heating)
	  ○ plastic – metal composite or multilayer pipe for underfloor heating
	• Plastic pipework (sanitary pipework up to and no greater than 110 mm)
	  ○ PVC-u
	  ○ polypropylene
	  ○ PVC-mu
	  ○ ABS
	• Lead

10.2 Identify fitting types used in dwellings.	• Couplers • Elbows and bends • Equal tees • Reducing tees • Reducers • Tap connectors • Flexible connectors • Manifolds • Tank connectors • Stop ends • Union

10.3 Identify methods of jointing pipework.	• Copper pipe
	  ○ solder integral ring and end feed
	  ○ compression
	  ▪ type A
	  ▪ type B
	  ○ push-fit
	  ○ press-fit

Assessment criteria	Content – What needs to be covered

	• 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 for sanitary pipework
	  ○ ring seal
	  ○ compression
	  ○ solvent weld
	• Lead
	  ○ proprietary fitting

10.4 Identify methods of 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 bending machine
	  ○ 90º bends
	  ○ sets and offset bends
	  ○ passover bends
	• Plastic/composite pressure pipe
	  ○ spring bend
	  ○ cabling technique
	  ○ cold forming bend
	  ○ minimum bend radius

Learning outcome 12 – Understand and use clips and brackets to support plumbing and domestic heating pipework and components.

Assessment criteria	Content – What needs to be covered

12.2 Identify types of 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

12.3 Identify clip and bracket types.	• Clips
	  ○ saddle clips
	  ○ stand-off plastic clips
	  ○ school board clips
	• Brackets
	• Munsen rings

Learning outcome 14 – Understand units of measurement used in the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered
14.1 Identify internationally recognised (SI) units of measurement.	• Pressure – pascal (Pa) • Length – metre (m) • Mass – kilogram (kg) • Time – second (s) • Temperature – kelvin (K) • Electric current – ampere (A)

14.2 Identify the application and use of SI derived units.	• Pascal (Pa)
	  ○ pressure
	  ▪ pressure vessel
	  ▪ sealed systems

Assessment criteria	Content – What needs to be covered

	• Velocity (m/s)
	  ○ speed
	  ▪ flow of water in pipeworks
	• Area (m^2)
	  ○ size
	  ▪ heat loss
	  ▪ rainwater intensity
	  ▪ underfloor heating design
	• Volume (m^3)
	  ○ capacity
	  ▪ storage
	  ▪ expansion
	  ○ consumption
	  ▪ water storage
	  ▪ gas
	  ▪ flush
	• Length (mm and cm)
	  ○ area of floor

14.3 Identify the use of conversion tables for non-SI units.	• Converting non-SI units to SI units • Ensuring accuracy to minimise the chance of calculation errors • Technical measurements • Comparison • Consistency

Learning outcome 15 – Understand properties of materials.

Assessment criteria	Content – What needs to be covered

15.1 Identify relative densities of common materials.	• Aluminium
	  ○ 2.7
	• Copper
	  ○ 8.9
	• Lead
	  ○ 11.3
	• PVCu
	  ○ 1.35

15.2 Identify properties and applications of solid materials.	• Pure metals
	  ○ properties
	  ▪ high electrical conductivity
	  ▪ high malleability
	  ▪ ductility

Assessment criteria	Content – What needs to be covered
	○ application ▪ copper ☐ electrical wiring ☐ water pipes ☐ earthing – copper rods ▪ connectors and terminals • Ferrous metals ○ properties ▪ high strength ▪ magnetic ▪ corrosion-prone ▪ hardness ○ application ▪ baths ▪ radiators • Alloys including solders ○ properties ▪ enhanced strength ▪ corrosion resistance ▪ hardness ▪ low melting point ○ application ▪ fittings ▪ solder ▪ valves ▪ taps • Thermoplastics ○ properties ▪ lightweight ▪ malleable when heated ▪ good insulators ▪ hardness ▪ resistant to chemicals ○ application ▪ pipework ▪ insulation • Thermo-setting plastics ○ properties ▪ rigid ▪ strong ▪ heat resistant ▪ durable ○ application ▪ worktops ▪ countertops

Assessment criteria	Content – What needs to be covered
	▪ electrical sockets • Fireclays/ceramics o properties ▪ heat resistance ▪ hard ▪ brittle ▪ corrosion resistant o application ▪ sanitaryware
15.3 Identify why solid materials breakdown.	• Atmospheric corrosion • Oxidisation of metals • Ultraviolet (UV) damage to plastics • Heat damage to plastics • Electrolytic corrosion • Electromotive series • Dissimilar metals in the presence of an electrolyte (water) • Erosion corrosion
15.4 Identify methods of preventing corrosion.	• Internal o inhibitor • External o paint o tape o coating
15.5 Identify applications of liquids and gases.	• Liquids o water ▪ plumbing systems ▪ hydraulic systems o anti-freeze/glycol mixes ▪ HVAC systems ▪ solar water heating systems ▪ industrial cooling systems ▪ geothermal systems ▪ refrigeration systems o fuel oils ▪ heating appliances ▪ power generation ▪ diesel engines o lubricants/greases ▪ construction equipment ▪ HVAC systems o biocides ▪ water treatment ▪ cooling systems

Assessment criteria	Content – What needs to be covered

	• Gases
	  ○ air and steam
	  ▪ cooling
	  ▪ pneumatic systems
	  ○ Liquefied Petroleum Gas (LPG)
	  ▪ cooking
	  ▪ heating
	  ○ natural gas
	  ▪ cooking
	  ▪ heating
	  ○ carbon dioxide
	  ▪ fire extinguishers
	  ▪ freezing
	  ○ refrigerants gases
	  ▪ heat pumps

15.6 Identify basic properties of liquids.	• Liquid has a fixed volume • No fixed shape • Cannot be compressed • Low density compared to solids • Different boiling points • Different freezing points
15.7 Identify basic properties of gases.	• Easy to compress • Expands to fill their container • Lower density than liquids and solids • Exerts pressure equally in all directions • Gas behaviour changes with high temperature

Learning outcome 16 – Understand the relationship between energy, heat and power.

Assessment criteria	Content – What needs to be covered
16.1 Identify the relationship between the Celsius and Kelvin temperature scales.	• One unit increase in the Kelvin scale is the same as a one-degree increase in the Celsius scale • Converting from Kelvin to Celsius involves subtracting 273.15 from the given temperature in Kelvin
16.2 Identify the principles associated with a change of state.	• Melting • Freezing • Boiling • Evaporating • Condensing

Assessment criteria	Content – What needs to be covered

16.3 Identify the terms latent and sensible heat as they apply to liquids and gases.	• Latent heat
	  ○ the heat that is needed to change the state of a substance without changing its temperature or pressure
	• Sensible heat
	  ○ the amount of heat or energy needed to change the temperature of the substance without changing the phase of the substance

16.4 Identify methods of heat transfer.	• Conduction • Convection • Radiation

16.5 Identify how units of energy and heat are related and derived.	• Energy and heat are related
	  ○ the units of energy is joule (J). Since heat is a form of energy, its SI unit is also joule
	• Energy and heat are derived
	  ○ energy derived from heat refers to the extraction to energy from a source of heat, through applying temperature

16.6 Carry out heat, energy and power calculations.	• Heat
	  ○ specific heat capacity x mass x temperature rise = heat kJ
	• Energy
	  ○ specific heat capacity x mass x temperature rise = energy kJ
	• Power
	  ○ specific heat capacity x mass x temperature rise
	  ---------- = power kW
	  Seconds in an hour

Learning outcome 17 – Understand principles of force and pressure and their application in the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered
17.1 Identify the units of force and pressure derived from SI units.	• Acceleration (m/s^2) • Force – Newton (N) • Pressure (N/m^2) • Atmospheric pressure – Pascal (Pa)

17.2 Identify pressure and flow rate units of measurements.	• Pressure
	  ○ Bar/millibar
	  ○ kPa
	  ○ Psi
	  ○ metre head

Assessment criteria	Content – What needs to be covered

	• Flow rate
	  ○ m^3/s
	  ○ l/s
	  ○ kg/s

17.3 Identify the application of pressure and flow rate measurements.	• Pressure
	  ○ pressure gauge
	• Flow rate measurements
	  ○ weir cup

17.4 Carry out simple force and pressure calculations.	• Force
	  ○ Mass (kg) x 9.81 m/s^2 = Newtons (force)
	• Pressure
	  ○ 1 m = 10 kpa/ 0.1 bar
	  ○ Head (m) x Kilopascals (kpa) = pressure

17.5 Identify the relationship between velocity, pressure and flow rate in systems.	• Pressure and flow rate
	  ○ when pressure increases, so does flow rate, as long as other variables remain constant
	• Velocity and pressure
	  ○ when velocity increases, pressure decreases, and when velocity decreases, pressure increases
	• Flow rate and velocity
	  ○ flow rate is the product of velocity and the cross-sectional area through which fluid flows

17.6 Identify how restrictions in the pipework effects the flow of liquids and gases.	• Reduced flow capacity • Increase pressure loss • Increase noise • Reduced waterfall • Increased void friction
17.7 Identify the principles of a siphon.	• Gravity pulls down on the taller column of liquid in a siphon, creating a lower pressure at the top • The pressure difference between the ends of the siphon causes the liquid to flow • Cohesive forces prevent the liquid column from separating under its own weight

Learning outcome 18 – Understand mechanical principles in the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered

18.1 Identify principles of simple machines.	• Levers
	  ○ pivots on a fulcrum and moves a load on the other end
	• Pulleys
	  ○ a simple machine which is made up of wheels and ropes to lift or move loads
	• Archimedes screws
	  ○ a helical screw inside a hollow pipe, which, when rotated, lifts water from a lower level to a higher level
	• Inclined planes
	  ○ an inclined plane is a ramp that allows a load to move to a higher level with less force than lifting it vertically

18.2 Identify principles of basic mechanics.	• Theory of moments • Action and reaction • Centre of gravity • Equilibrium • Velocity and ratio

Learning outcome 19 – Understand principles of electricity in the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered
19.1 Identify basic principles of electron flow theory.	• Alternating current (AC) and direct current (DC) • The flow of electrons is from negative to positive • Electric current creates its own magnetic field around the wire • Magnetic lines have direction and change direction when the current flow changes in the wire from one direction to another • As current increases the field strengthens

19.2 Identify the purpose and application of simple units of electrical measurement.	• Current (Amps)
	  ○ purpose
	  ▪ helps determine the appropriate wire sizes
	  ▪ ensures that circuits do not exceed safe current levels
	  ▪ indicates the power consumption
	  ○ application
	  ▪ unit of electrical measurement
	  ▪ measuring and managing electric current

Assessment criteria	Content – What needs to be covered

	• Voltage (Volts)
	  ○ purpose
	  ▪ energy transfer delivered to an electrical device or load.
	  ▪ driving current through a circuit
	  ▪ power distribution delivering to devices
	  ○ application
	  ▪ household voltage supply
	  ▪ measurement used for test equipment
	  ▪ high-voltage transmission along distances
	  ▪ determining battery compacity
	• Resistance (Ohms)
	  ○ purpose
	  ▪ used to control the flow of current in electrical circuits
	  ▪ prevent excessive current from flowing, protecting devices from overheating or short circuits
	  ○ application
	  ▪ resistors in electrical circuits
	  ▪ resistance is used in temperature sensors (thermistors)
	• Power (Watts)
	  ○ purpose
	  ▪ measuring the rate of energy consumed
	  ▪ measuring the rate of energy produced
	  ○ application
	  ▪ rating of electrical appliances and devices
	  ▪ to evaluate the power ratings of portable devices and batteries

19.3 Carry out simple electrical calculations.	• Current
	  ○ I = V x R
	• Resistance
	  ○ R = V ÷ I
	• Power
	  ○ P = V x I
	• Voltage
	  ○ V = R ÷ I
	• Amps
	  ○ A = W ÷ V

19.4 Identify the requirements for earthing of electrical circuits.	• Diverts current to the ground • Overcurrent protection • Equipment protection

Assessment criteria	Content – What needs to be covered

19.5 The testing and commissioning requirements applicable to electrical control systems and components.	• Wiring integrity check
	  ○ inspect all electrical connections against wiring diagrams to verify correct installation and secure terminations
	  ○ ensure appropriate cable types and ratings are used, adhering to safety standards
	• Electrical safety checks
	  ○ polarity check
	  ▪ verify correct polarity at all outlets, controls and motorized valves to ensure safe operation
	  ▪ check that Live (L), Neutral (N) and Earth (E) are correctly wired in all components
	  ○ earth continuity test
	  ▪ test continuity between exposed metal parts and the main earth terminal
	  ▪ confirm earth bonding complies with current wiring regulations
	  ○ earth loop impedance test
	  ▪ measure the earth fault loop impedance to ensure a low-resistance path for fault currents, allowing protective devices to trip effectively
	  ○ insulation resistance test (IR Test)
	  ▪ apply 500 volt DC between Live/Neutral conductors and Earth to check for insulation breakdown
	  ▪ minimum acceptable reading: 1 MΩ (per current wiring regulations)
	• Control system functionality
	  ○ thermostats and timers
	  ▪ verify correct operation of room and cylinder thermostats by adjusting setpoints and observing system response
	  ▪ ensure timers/programmers switch circuits on/off as scheduled
	  ○ motorized valve operation
	  ▪ check the correct movement of 2-port (S plan) or 3-port (Y plan) valves
	  ▪ confirm valves respond to control signals and isolate zones correctly
	  ○ boiler interlocks
	  ▪ ensure controls like thermostats and valves provide a proper interlock to prevent boiler dry-firing or unnecessary operation
	• Performance and final electrical checks
	  ○ voltage supply verification
	  ▪ measure supply voltage at key points (boiler, controls) to ensure it falls within manufacturer tolerances

Assessment criteria	Content – What needs to be covered
	○ load testing ▪ simulate operational load conditions to confirm stability under normal running currents ▪ monitor for abnormal voltage drops or overcurrent ○ functional safety testing ▪ simulate fault conditions • Documentation and compliance ○ test results log ▪ record all test results for compliance and future maintenance ○ labelling and identification ▪ ensure all key circuits and control elements are correctly labelled ○ handover pack ▪ provide the end-user with system schematics, test certificates and operation manuals

Learning outcome 20 – Know the sources of renewable and non-renewable energy.

Assessment criteria	Content – What needs to be covered
20.1 Identify the different types of non-renewable energy.	• Gas • Oil • Solid fuel (mineral)
20.2 Identify the different types of renewable energy.	• Electricity generated by renewable energy sources ○ solar ○ wind ○ hydro ○ geothermal • Solid fuel (biomass) • Hydrogen
20.3 Identify the effects of using renewable and non-renewable energy sources.	• Renewable ○ reduced greenhouse emissions ○ lower pollution ○ sustainable resources ○ reduced energy cost • Non-renewable ○ global warming ○ increase air pollution ○ increased greenhouse emissions ○ not sustainable ○ high energy cost

Learning outcome 21 – Know current energy efficiency advice and guidance.

Assessment criteria	Content – What needs to be covered
21.1 Identify the benefits of energy efficient products, services and equipment.	• Reduction in greenhouse gas • Reduction in pollution • Waste reduction • Lower energy demand • Improved carbon footprint • Economic benefits

21.2 Identify the key factors of the Building Regulations and Guidance that apply to energy efficiency.	• Document L Volume 1 Dwellings
	  ○ conservation of fuel and power
	• Document L Volume 2 Buildings other than Dwellings
	  ○ conservation of fuel and power
	• Domestic Building Services Compliance Guide
	  ○ installation of energy efficient systems
	• Non-domestic Building Services Compliance Guide
	  ○ installation of energy efficient systems
	• PAS 2035
	  ○ covers retro fit

Learning outcome 22 – Know the role of the construction team within the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered
22.1 Identify key roles of the 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 construction design and management (CDM)

Assessment criteria	Content – What needs to be covered
22.2 Identify key roles of the site operatives.	• Supervisor • Manager • Building services engineer • Heating engineer • Plumber • Gas engineer

22.3 Identify common site visitors.	• Inspectors
	  ○ building control
	  ○ water
	  ○ HSE
	  ○ electrical services
	• Members of the public
	• Delivery drivers
	• Clients

Learning outcome 24 – Know how to communicate with others.

Assessment criteria	Content – What needs to be covered
24.1 Identify methods for effective communication with individual's needs.	• Listening • Feedback • Verbal communication • Written communication • Visual aids • Adaptive and inclusive communication
24.2 Identify suitable communication methods.	• In person • Online • Telephone • E-mail • Letter • Text messaging • Social media
24.3 Identify appropriate actions to deal with conflicting parties.	• Mediation • Negotiating • Compromising • Escalation
24.4 Identify the effects of poor communication with individuals.	• Misunderstandings • Errors • Frustration • Reduced productivity • Low morale • Delays

Assessment criteria	Content – What needs to be covered
	• Dissatisfaction • Potential safety issues • Loss of reputation

Learning outcome 25 – Understand responsibilities of relevant people in the building services industry.

Assessment criteria	Content – What needs to be covered
25.1 Identify different types of client.	• Private customer • Contracting customer • Internal customer within same company • Public sector customer
25.2 Identify what may be communicated to the client through the progress of a job.	• Updates • Issues • Changes • Costs to date vs budget • Quality control • Safety compliance • Client decisions • Date adjustments • Recommendations

25.3 Identify duties and methods for supervising staff.	• Duties
	  ○ guiding and directing staff
	  ○ monitoring performance
	  ○ maintaining workplace discipline
	  ○ motivating and supporting staff
	  ○ managing workflow and deadlines
	  ○ handling conflicts and resolving issues
	  ○ reporting to senior management
	• Methods
	  ○ direct supervision
	  ▪ overseeing work, with immediate feedback and guidance
	  ○ delegation and trust-based supervision
	  ○ regular performance reviews and feedback
	  ○ staff training and development
	  ○ use of technology for supervision
	  ○ encouraging open communication
	  ○ lead by example

Learning outcome 26 – Understand and produce work programme for tasks in the plumbing and domestic heating systems industry.

Assessment criteria	Content – What needs to be covered

26.1 Identify types of projects.	• Private installation work
	• Private service/maintenance work
	• New-build installation contract work
	• Service/maintenance contract work
	  ○ planned
	  ○ reactive

26.3 Identify the impact when materials are not delivered on time against the work programme.	• Alteration of work schedule • Late delivery of materials • Possible extra work • Additional cost
26.4 Identify factors which affect working time allocation to work activities.	• Labour resources • Planning work with other trades • Material deliveries

Learning outcome 28 – Understand cold water supply to dwellings.

Assessment criteria	Content – What needs to be covered
28.1 Identify the key stages in the rainwater cycle.	• Evaporation • Condensation • Precipitation

28.2 Identify the various sources of water and the typical properties of water from those sources.	• Surface sources
	  ○ lakes and reservoirs
	  ▪ contains low to moderate mineral content
	  ▪ has organic matter, sediments and biological organisms
	  ○ rivers and streams
	  ▪ more oxygenated compared to lakes
	  ▪ lower mineral content compared to groundwater
	• Underground sources
	  ○ deep and shallow wells
	  ▪ free from biological contaminants but may contain dissolved gases like hydrogen sulphide
	  ○ artesian wells
	  ▪ high in mineral content due to long underground flow

Assessment criteria	Content – What needs to be covered
	○ boreholes ▪ water is usually mineral-rich and free from biological contamination ○ springs ▪ clean and free from pathogens ▪ mineral content varies based on rock composition • Harvested rainwater ○ low in minerals • Recycled greywater ○ contains organic matter, soap residues, and minor contaminants
28.3 Identify the types of water supply to dwellings and how these are regulated.	• Mains ○ The Water Supply (Water Fittings) Regulations 1999 • Private ○ The Private Water Supplies (England) Regulations 2016
28.4 Identify the different types of water and uses of water in dwellings.	• Wholesome water ○ drinking water ○ general use ○ food preparation • Unwholesome water (stored) ○ flushing toilets ○ washing clothes ○ washing cars ○ watering plants and gardens ○ hot water storage
28.5 Identify the mains water treatment processes and typical mains water distribution system from treatment works to property.	• Treatment ○ screening ○ coagulation and flocculation ○ sedimentation ○ filtration ○ disinfection ○ reverse osmosis • Distribution system ○ treatment works ○ storage reservoirs ○ pumping stations ○ trunk mains ○ distribution mains ○ service reservoirs ○ water mains
28.6 Identify the private supply	• Pre-treatment (screening and sedimentation) • Filtration • Disinfection • pH adjustment

Assessment criteria	Content – What needs to be covered

water treatment processes.	• Water softening
	  ○ ion exchange
	  ○ reverse osmosis

28.7 Identify water treatment processes and typical supply pipework and storage systems utilising harvested rainwater and recycled greywater.	• Treatment
	  ○ pre-treatment
	  ▪ screening
	  ▪ sedimentation
	  ○ biological treatment
	  ○ filtration
	  ○ disinfection
	• Supply pipework and storage systems
	  ○ storage tanks
	  ○ treatment units
	  ○ pipework
	  ○ pumps

28.8 Identify water service to the property and isolation points.	• Connection methods to the main
	• Communication pipe detail
	• Service pipe detail
	  ○ main external stop valve location
	  ○ installed at a depth of 750 mm – 1350 mm
	• Meter housings
	• Pump installations
	• Installation requirements
	• Methods of entry of the service pipework to a property
	  ○ insulated
	  ○ ducted
	  ○ sealed at both ends

28.9 Identify the requirements to provide water whilst preventing waste, undue consumption, misuse or contamination.	• Preventing waste
	  ○ leak prevention
	  ○ efficient appliances
	  ○ water meter
	• Undue consumption
	  ○ regulated supply pressure
	  ○ timers and controllers
	• Misuse or contamination
	  ○ mechanical backflow protection
	  ○ no-mechanical backflow protection

Learning outcome 29 – Understand and recognise the layouts of plumbing and domestic heating systems.

Assessment criteria	Content – What needs to be covered

29.1 Identify types and layout features of cold water systems in dwellings.	• Wholesome water supply
	  ○ direct cold water system
	  ▪ all outlets fed from a rising main
	  ○ indirect cold water system
	  ▪ outlets fed from the same cistern
	  ○ direct booster
	  ▪ pumps connected to the mains with no cistern at ground level
	  ○ indirect boosted
	  ▪ Incorporate a break cistern and pumps
	• Unwholesome water supply
	  ○ harvested rainwater system
	  ▪ 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 system
	  ▪ takes water from domestic appliances to flush WC

29.2 Identify the types and layout features of hot water systems in dwellings.	• Direct vented cylinder
	  ○ centrally located and supplies to all outlets in the property
	  ○ heated with an immersion heater directly via a boiler
	  ○ does not have a coil
	  ○ water is stored in a large cylinder
	• Indirect vented cylinder
	  ○ centrally located and supplies water to all outlets in the property
	  ○ passes hot water through a coil
	  ○ water is heated by an external boiler or heat source
	  ○ water is stored in a large cylinder
	• Thermal store
	  ○ high pressure
	  ○ no storage cistern
	  ○ passes cold water through a coil
	  ○ supplies water to one outlet or appliance
	• Combination boiler
	  ○ is connected to radiators
	  ○ instantaneous hot water
	  ○ does not store water
	  ○ does not have a coil

Assessment criteria	Content – What needs to be covered
	○ supplies water to all outlets in the property • Multi-point heater ○ small unit that supplies water to multiple appliances ○ does not have a coil ○ instantaneous hot water • Single-point (point of use) water heater ○ small unit that supplies hot water to a tap/single appliance which is located near by ○ instantaneous hot water
29.3 Identify the types and layout features of domestic central heating systems.	• Types ○ wet central heating ▪ open vented heating systems for heat only boiler ○ sealed heating systems ▪ system boiler ▪ combination boiler ○ warm air ○ storage heaters ○ heat networks (district heating) ▪ heat interface unit • Layout ○ one pipe ▪ one pipe forming a loop connected to each side of a radiator ○ two pipe ▪ consists of a separate flow and return pipe to each radiator ○ three pipe ▪ all radiators are connected together ○ manifold (micro and minibore) ▪ each radiator is supplied from a central manifold with individual pipes connected to each radiator ○ underfloor heating ▪ closed-loop pipework system that circulates warm water beneath the floor surface to heat a room evenly ○ configuration ▪ pumped heating gravity hot water ▪ fully pumped, 2 × two port valves (S plan) ▪ fully pumped, 3 × two port valves (S plan+) ▪ fully pumped, 3-port valve (mid position/diverting) (Y/W plans) ▪ fully pumped with a low loss header

Assessment criteria	Content – What needs to be covered

29.4 Identify the types and layout features of sanitary pipework systems.	• primary ventilated stack system
	  ○ contains one vertical pipe which vent/terminates to the atmosphere
	• secondary ventilated stack system
	  ○ two vertical pipes which both vent/terminate to the atmosphere (all vents are outside)
	• ventilated branch stack system
	  ○ contains two vertical pipes connected to the branch pipework which vent/terminates to the atmosphere
	• stub stack system
	  ○ one vertical pipe which vent/terminates above the appliance in the same room

29.5 Identify the types and layout features of rainwater systems: pipe (RWP) and gutter.	• Pipe (RWP)
	  ○ round section
	  ○ square section
	• Gutter
	  ○ half round
	  ○ square
	  ○ ogee
	  ○ high capacity

Learning outcome 30 – Understand and install cold water systems.

Assessment criteria	Content – What needs to be covered

30.1 Identify fluid categories of water and uses of water supplied to dwellings.	• Fluid Category 1 – wholesome water – no health risk
	  ○ drinking and culinary purpose water
	  ○ general use
	• Fluid Category 2 – slight impairment
	  ○ hot water
	  ○ stored cold water
	• Fluid Category 3 –slight health hazard
	  ○ domestic washing machine
	  ○ dishwasher
	  ○ central heating water
	  ○ hose pipes
	  ○ garden use
	• Fluid Category 4 – significant health hazard
	  ○ irrigation
	  ○ industrial cleaning
	• Fluid Category 5 – serious health hazard
	  ○ drainage water
	  ○ sewage systems

Assessment criteria	Content – What needs to be covered

30.2 Identify the advantages and disadvantages of cold water systems.	• Direct cold water systems (mains and private supplies)
	  ○ advantages
	  ▪ water quality
	  ▪ easier to install
	  ▪ lower installation cost
	  ▪ no stagnant water
	  ▪ high pressure system
	  ○ disadvantages
	  ▪ not easy to install
	  ▪ no backup supply
	  ▪ potential noise
	  ▪ not suitable for low pressure components
	  ▪ demand can reduce pressure
	• Indirect cold water systems (mains and private supplies)
	  ○ advantages
	  ▪ back supply
	  ▪ less noisy
	  ▪ low operating pressure
	  ▪ consistent pressure
	  ○ disadvantages
	  ▪ contamination
	  ▪ space
	  ▪ cost to install
	  ▪ low pressure system
	  ▪ high maintenance
	• Rainwater harvesting and greywater reuse
	  ○ advantages
	  ▪ reduces reliance on mains water
	  ▪ reduces water bills over time
	  ▪ eco-friendly
	  ▪ can be used in multiple applications
	  ▪ reduces soil erosion and flooding
	  ○ disadvantages
	  ▪ high initial cost of setup
	  ▪ poor water quality
	  ▪ limited supply
	  ▪ storage space needed
	  ▪ potential contamination

30.4 Identify working principles of cold water systems, positioning fixing, connection and operation of components.	• Cold water systems
	  ○ delivering potable water to taps, toilets and appliances
	  ○ direct system (mains-fed system)
	  ▪ water is supplied directly from the mains to all fixtures
	  ○ indirect system (storage cistern system)
	  ▪ water is first stored in a cold water storage cistern (usually in the loft)
	  ▪ gravity supplies water to outlets water to outlets

Assessment criteria	Content – What needs to be covered
	▪ one outlet remains directly from mains supply • Positioning fixing, connection and operation of components o mains water inlet entry point for water from service pipe supply ▪ located at ground level, typically near the main stopcock ▪ connects to the main water meter and stop valve o stop valve (main shut-off valve) ▪ controls water supply to the house ▪ installed at the main entry point inside the building ▪ operated manually to turn water on/off for maintenance o cold water storage cistern (for indirect systems) ▪ stores water for gravity-fed distribution ▪ positioned in lofts or high spaces for gravity pressure ▪ connected to the mains via a float-operated inlet valve to maintain water level o float valve (ball valve) ▪ regulates water entry into the storage tank ▪ inside the cold water cistern ▪ opens/closes based on water level o overflow pipe ▪ prevents overflow in case of float valve failure ▪ connected from storage cistern to an external point ▪ water flows out if the cistern overfills o distribution pipework ▪ delivers water to fixtures (taps, toilets, appliances) ▪ runs from the cistern or mains to fixtures ▪ concealed under floors/walls ▪ uses copper, PVc or PEX pipes with compression or push-fit joints o gate/service valves controls ▪ supply to individual appliances ▪ near each major water outlet (bath, sink, toilet) ▪ allows maintenance without shutting off the entire supply o taps and fixtures ▪ dispense cold water at the point of use ▪ installed at sinks, baths and outdoor locations ▪ connected to pipework with standard threaded or compression fittings o pressure reducing valve (PRV) ▪ regulates water pressure to prevent damage ▪ installed on the main supply line or before appliances ▪ automatically adjusts pressure based on flow

Assessment criteria	Content – What needs to be covered
	○ check valve (non-return valve) ▪ prevents backflow contamination ▪ fitted in appliances like washing machines, dishwashers ▪ ensures one-way water flow to avoid contamination risks • Non-potable cold water supplies (unwholesome) ○ rainwater harvesting ▪ rainwater is collected from surfaces ▪ it passes through gutters and downpipes into a storage system ▪ filtration removes debris, leaves and sediments before storage ▪ water is stored in an above-ground or underground tank ▪ a pump system (or gravity) distributes water to outlets for reuse ▪ additional filtration or disinfection may be required for potable use ○ greywater reuse ▪ greywater is collected ▪ water is filtered to remove solids, soap residues and contaminants ▪ biological or chemical treatment used to improve quality ▪ treated greywater is stored in a tank before reuse ▪ a pump system or gravity distributes water to flushing toilets, irrigation or cleaning • Positioning fixing, connection and operation of components ○ catchment surface ▪ collects rainwater (rooftop, paved surfaces) ▪ roofs must be clean, non-toxic (no lead/asbestos) ▪ water flows into gutters and down pipes ○ gutters and downpipes ▪ directs rainwater into the system ▪ fixed along roof edges and walls ▪ sloped towards a collection point ○ first flush diverter ▪ prevents initial dirty runoff from entering storage ▪ installed between downpipe and tank inlet ▪ discards first flow, allowing cleaner water into the tank ○ pre-filtration system ▪ removes debris, leaves and sediments ▪ before the storage tank (mesh filters, sand filters) ▪ requires periodic cleaning ○ storage tank ▪ holds collected rainwater

Assessment criteria	Content – What needs to be covered
	▪ placed above or underground with a stable base ▪ connects to the pump and outlet pipes ○ pump (if required) ▪ pressurises stored water for use ▪ near the tank or inside the building ▪ delivers water to fixtures when needed ○ overflow pipe ▪ directs excess water to drainage ▪ connected to storm drains or soakaways ▪ prevents flooding ○ filtration and UV treatment (if potable use required) ▪ removes bacteria and pathogens ▪ near the distribution point ▪ essential for drinking water applications ○ distribution pipes ▪ delivers water to toilets, washing machines, irrigation ▪ separate from mains supply to prevent cross-contamination ▪ pipes must be labelled as non-potable
30.5 Identify layout and installation requirements for protected plastic storage cisterns.	• Typical cistern sizes for dwellings ○ the minimum size cold water storage cistern for an indirect cold water system is 230 litres ○ the minimum size cold water storage cistern for a direct cold water system supplying hot water only is 110 litres • Warning pipe (overflow) arrangements ○ 25 mm from warning pipe to the float operated valve (FOV) • Inlet/outlet position ○ opposite ends • Position of float operated valve ○ installed on the side of a cistern • Position of cistern vent ○ located on the top of the cistern • Position of open vent pipe connection ○ located on the top of the cistern, connected using a grommet • Requirement for a rigid close-fitting lid ○ to allow access for maintenance and prevent anything from entering the cistern • Service valve requirements ○ requires a service valve on the inlet and outlet pipe • Insect screens • Insulation • Support • Drilling requirement • Maintenance and access requirements

Assessment criteria	Content – What needs to be covered
	• Prevention of stagnation • Linking multiple cisterns

30.6 Identify insulation requirements, system frost protection and prevention of undue warming of cold water systems.	• Insulation requirements
	  ○ insulation types
	  ▪ nitrile rubber
	  ▪ mineral wool
	  ▪ foam
	  ○ insulation locations
	  ▪ in a loft
	  ▪ under a suspended floor
	  ▪ where subject to frost
	  ▪ outbuildings
	  ▪ non-heated areas
	• System frost protection and prevention
	  ○ trace heating
	  ○ insulation
	  ○ frost and pipe thermostat
	• Prevention of undue warming
	  ○ pipe separation
	  ○ UV protection

30.9 Identify backflow risk and required methods of prevention.	• Backflow risk
	  ○ back pressure
	  ○ back siphonage
	• Methods of prevention
	  ○ air gaps
	  ▪ AA
	  ▪ AB
	  ▪ AD
	  ▪ AG
	  ▪ AUK1
	  ▪ AUK2
	  ▪ AUK3
	  ▪ DC
	  ○ mechanical
	  ▪ BA
	  ▪ CA
	  ▪ DB
	  ▪ EA/EB
	  ▪ EC/ED
	  ▪ HA
	  ▪ HUK1
	  ▪ HC

Learning outcome 31 – Understand and install hot water systems.

Assessment criteria	Content – What needs to be covered

31.1 Identify advantages and disadvantages of hot water systems.	• Vented storage
	  ○ advantages
	  ▪ meets high demand
	  ▪ backup of hot water
	  ▪ works with low pressure
	  ○ disadvantages
	  ▪ high running costs
	  ▪ high installation cost
	• Unvented storage
	  ○ advantages
	  ▪ meets high demand
	  ▪ has high pressure
	  ○ disadvantages
	  ▪ high running costs
	  ▪ high installation cost
	• Instantaneous
	  ○ advantages
	  ▪ low installation cost
	  ▪ space saving
	  ▪ energy efficient
	  ○ disadvantages
	  ▪ no backup
	  ▪ requires high pressure
	• Solar thermal
	  ○ advantages
	  ▪ reduces running costs
	  ▪ environmentally friendly
	  ○ disadvantages
	  ▪ high installation cost
	  ▪ limited efficiency

31.2 Identify types and typical pipe sizes used in hot water systems within dwellings.	• Gravity hot water pumped heating systems
	  ○ 22 mm hot water distribution
	  ○ 28 mm primary flow and return
	  ○ 22 mm cold feed
	• Fully pumped hot water system
	  ○ 22 mm hot water distribution
	  ○ 22 mm primary flow and return
	  ○ 22 mm cold feed
	• Instantaneous hot water system
	  ○ 15 mm hot water distribution
	  ○ 15 mm cold feed

Assessment criteria	Content – What needs to be covered

31.3 Identify working principles of hot water systems, positioning fixing, connection and operation of components.	• Working principles
	  ○ water heated using a boiler, immersion heater or renewable energy (solar, heat pumps)
	  ○ hot water stored in a cylinder (vented or unvented) or heating it on demand (combi boiler)
	  ○ hot water distributed to fixtures and appliances through insulated pipework
	  ○ controlling temperature and pressure using thermostats, expansion vessels and pressure relief valves
	• Positioning fixing, connection and operation of components
	  ○ bath
	  ▪ provides hot water for bathing
	  ▪ positioned against walls with secure support
	  ▪ hot and cold water feeds connect to mixer taps
	  ○ WCs (toilets)
	  ▪ uses cold water for flushing, not hot
	  ▪ fixed against walls, floor-mounted or wall-hung
	  ▪ cold water supply from mains or storage cistern
	  ○ bidets
	  ▪ provides warm water for personal hygiene
	  ▪ wall-mounted or floor-standing
	  ▪ requires a thermostatic mixing valve to prevent scalding
	  ○ wash hand basins
	  ▪ supplies hot and cold water for washing hands and face
	  ▪ wall-mounted or vanity-fitted
	  ▪ mixer taps or separate hot/cold taps
	  ○ sinks (kitchen and utility)
	  ▪ supplies hot and cold water for washing dishes
	  ▪ secured into worktops with plumbing underneath
	  ▪ connects to hot water system and drainage
	  ○ washing machines
	  ▪ uses hot and cold water for washing clothes
	  ▪ free standing or under counter integrated, near drainage
	  ▪ direct connection to hot and cold supply pipes (or cold feed only with internal heater)

31.4 Identify insulation requirements and system frost protection.	• Building Regulations Approved Document L
	• Water Supply (Water Fittings) Regulations 1999
	• Insulation requirements
	  ○ Insulation types
	  ▪ nitrile rubber
	  ▪ mineral wool
	  ▪ foam

Assessment criteria	Content – What needs to be covered
	○ Insulation locations ▪ in a loft ▪ under a suspended floor ▪ where subject to frost ▪ outbuildings ▪ non-heated areas ▪ pipework connected to a cylinder ▪ secondary circulation
31.6 Identify expansion and contraction in hot water systems and negative effects.	• Expansion and contraction ○ physical change in length of the pipes due to temperature changes ○ pipes lengthen when heated (expands) ○ pipes shorten when cooled (contract) ○ joint and support failure • Negative effects ○ pipework damage ○ damage to fittings ○ noise ○ damage to fixings ○ joint and support failure
31.8 Identify secondary circulation and how trace heating can be used.	• Secondary circulation ○ bronze circulating pump ○ pipework ○ cylinder ○ timer ○ insulation • How trace heating can be used ○ preventing fluid from freezing ○ preventing bacteria growth in dead legs sections
31.10 Identify backflow risk and required methods of prevention.	• Backflow risk ○ back pressure ○ back siphonage • Methods of prevention ○ air gaps ▪ AA ▪ AB ▪ AD ▪ AUK2 ▪ AUK3 ▪ DC ○ mechanical ▪ BA ▪ CA ▪ DB ▪ EA/EB ▪ EC/ED

Assessment criteria	Content – What needs to be covered
	▪ HA ▪ HC

Learning outcome 32 – Understand and install domestic central heating systems.

Assessment criteria	Content – What needs to be covered
32.1 Identify advantages and disadvantages of types and layout features of heating systems.	• Pumped heating gravity hot water ○ advantages ▪ even heat distribution throughout the property ▪ reliable hot water supply ▪ simple design ○ disadvantages ▪ limited hot water pressure ▪ lack of controls ▪ inefficient when distributing the heat to the hot water cylinder • Fully pumped, 2 × two port valves (S plan) ○ advantages ▪ independent control ▪ energy efficient ▪ fast heat distribution ▪ compliant Part L ○ disadvantages ▪ higher installation costs ▪ complex wiring ▪ space requirements • Fully pumped, 3 × two port valves (S plan+) ○ advantages ▪ independent zone control ▪ energy efficient ▪ flexibility to add another zone ▪ compliant Part L ○ disadvantages ▪ higher installation costs ▪ complex wiring ▪ space requirements • Fully pumped, 3-port valve (mid position/diverting) (Y/W plans) ○ advantages ▪ simplified design ▪ lower installation cost ▪ compact system ▪ easy setup

Assessment criteria	Content – What needs to be covered
	○ disadvantages ▪ less energy efficient ▪ no zoning capability ▪ slower response times • Fully pumped with a low loss header ○ advantages ▪ hydraulic separation ▪ improved efficiency ▪ balanced flow rates ▪ flexible design ○ disadvantages ▪ higher installation costs ▪ space requirements ▪ complex installation ▪ increased maintenance • Low temperature hot water central heating systems ○ advantages ▪ high energy efficiency ▪ low running costs ▪ even heat distribution ▪ compatible with renewable energy ▪ long system lifespan ▪ reduced carbon emissions ○ disadvantages ▪ high installation costs ▪ slow heat response ▪ requires good insulation ▪ not always compatible with older homes ▪ large heating surfaces needed • Layout – one pipe ○ advantages ▪ simple design ▪ cost-effective ▪ reduced material use ○ disadvantages ▪ uneven heating ▪ lower efficiency ▪ limited flow control ▪ slow response time • Layout – two pipes ○ advantages ▪ even heat distribution ▪ efficient operation ▪ faster heating ▪ easier balancing

Assessment criteria	Content – What needs to be covered
	○ disadvantages ▪ higher installation costs ▪ complex installation ▪ maintenance challenges • Manifold (micro and minibore) ○ advantages ▪ reduced material use ▪ easier installation ▪ lower installation costs ▪ compact design ▪ aesthetic benefits ○ disadvantages ▪ blockages ▪ reduced flow rates ▪ not ideal for large properties ▪ high maintenance requirements • Underfloor heating – series ○ advantages ▪ simple design ▪ cost-effective ▪ reliable flow path ▪ ideal for small areas ○ disadvantages ▪ uneven heat distribution ▪ limited pipe length ▪ not suitable for large areas ▪ harder to balance • Underfloor heating – spiral ○ advantages ▪ even heat distribution ▪ efficient heating ▪ ideal for large areas ▪ personal comfort as provides a natural, even, and consistent warmth maintaining a consistent room temperature ○ disadvantages ▪ complex installation ▪ higher installation costs ▪ skilled labour required ▪ overlapping zones risk
32.3 Identify working principles of types of central heating systems, positioning fixing, connection and	• Wet central heating ○ sealed systems ▪ system boiler □ heats hot water in a storage cylinder and provides space heating

Assessment criteria	Content – What needs to be covered
operation of components.	▪ combination boiler ▫ heats hot water on demand and provides space heating from one unit ▪ heat only boiler (with external expansion vessel) ○ open vented systems ▪ heat only boiler • Warm air • Storage heaters • Heat networks (district heating) ○ heat interface unit • 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/lock shield valves ○ circulating pumps – uses an impeller to distribute water around the system ○ pump valves ○ thermo-mechanical cylinder control valves ○ anti-gravity valve ○ drain valves ○ additives ▪ inhibitor ▪ de-scaler ▪ de-sludger ○ primary and secondary heating circuits: ▪ low loss headers for multiple boiler installations ▪ buffer tanks ○ corrosion filters ○ controls ▪ zone valves (2-port, 3-port, mid position and diverter) ▪ programmer ▪ timer ▪ thermostats ▫ programmable room stat ▫ cylinder stat ▫ frost stat ▪ optimizer

Assessment criteria	Content – What needs to be covered
	▪ weather compensator ▪ wiring centre o automatic by-pass o heat emitters ▪ bespoke heat emitters ▪ panel radiators ▪ column radiators ▪ low surface temperature radiators ▪ fan convectors ▪ plinth heaters o underfloor heating components ▪ manifolds ▪ pump control unit ▪ insulation ▪ pipework ▪ manifold isolation ball valves ▪ supports o 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
32.4 Identify the importance of pump positioning.	• Optimal performance • Prevents airlocks • Minimises wear and tear • Energy efficiency • Maintains system balance • Improves lifespan • Noise reduction
32.5 Identify operating principles for system control.	• Time • Temperature • Weather compensation o delayed start o 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

Assessment criteria	Content – What needs to be covered

32.6 Identify zoning and control requirements of central heating systems in accordance with statutory legislation.	• Compliance with statutory legislation
	  ○ central heating systems must meet zoning and control requirements for efficiency, comfort and energy conservation
	• Zoning requirements
	  ○ separate zones for different areas (over 150 m²)
	  ○ independent thermostats for each zone
	  ○ hot water and heating separation
	  ○ smart controls and multi-zone systems
	• Control requirements
	  ○ programmable room thermostats
	  ○ thermostatic radiator valve (TRV) installed
	  ○ boiler interlock
	  ○ time and temperature control
	  ○ weather and load compensation (for modern systems)

32.7 Identify insulation requirements and system frost protection.	• Building Regulations Approved Document L
	• Water Supply (Water Fittings) Regulations 1999
	• Insulation requirements
	  ○ Insulation types
	  ▪ nitrile rubber
	  ▪ mineral wool
	  ▪ foam
	  ○ Insulation locations
	  ▪ in a loft
	  ▪ under a suspended floor
	  ▪ where subject to frost
	  ▪ outbuildings
	  ▪ non-heated areas
	  ▪ pipework connected to a cylinder
	  ○ boiler frost protection
	  ○ frost thermostat

32.9 Identify expansion and contraction in central heating systems and negative effects.	• Expansion and contraction
	  ○ physical change in volume of water within the system as it heats up (expands) and cools down (contacts)
	• Negative effects
	  ○ pipework damage
	  ○ damage to fittings
	  ○ damage to fixings
	  ○ noise

32.11 Identify procedures for filling and venting system types.	• Sealed system in the following order
	  ○ locate filling loop
	  ○ open filling loop
	  ○ monitor pressure
	  ○ close filling loop
	  ○ vent the lowest radiator first

Assessment criteria	Content – What needs to be covered
	○ release air ○ finish venting the highest radiator ○ re-check pressure ○ top up via filling loop if needed • Open system in the following order ○ locate feed and expansion cistern ○ fill and check fall leaks ○ wait for cistern to stop filling ○ open automatic air vents ○ vent the lowest radiator first ○ release air ○ finish venting the highest radiator ○ bleed air from pump
32.12 Identify the operating principles of heat-producing appliances.	• Gas boiler ○ fuel combustion ▪ burns natural gas or LPG to generate heat ○ heat exchanger ▪ transfers heat from combustion gases to water in the system ○ flue system ▪ expels waste gases safely outside the property ○ control system ▪ thermostats, timers and modulating burners regulate heat output ○ types ▪ combi boilers ▪ system boilers ▪ conventional boilers • Oil boiler ○ fuel atomization and combustion ▪ atomizes and burns heating oil to generate heat ○ heat transfer ▪ a heat exchanger transfers heat from combustion gases to water ○ flue and ventilation ▪ exhaust gases are expelled via a flue or chimney ○ efficiency features ▪ modern condensing oil boilers recover heat from exhaust gases to improve efficiency • Heat pumps (air-source and ground-source) ○ refrigerant cycle ▪ extracts heat from the air, ground or water using a refrigerant

Assessment criteria	Content – What needs to be covered
	○ compression and heat exchange ▪ the refrigerant is compressed to increase its temperature, then transfers heat to water or air ○ energy efficiency ▪ high coefficient of performance (COP); typically, 1 kW of electricity can produce 3–5 kW of heat • Biomass boiler ○ fuel combustion ▪ burns organic material (wood pellets, logs or chips) to produce heat ○ heat exchange ▪ transfers heat from burning fuel to water for heating or hot water supply ○ automated fuel feeding (in some models) ▪ pellet-fed systems automatically supply fuel for continuous operation ○ low carbon footprint ▪ considered a renewable energy source when sourced sustainably • Electric boiler ○ resistive heating elements ▪ uses electricity to heat water directly via immersion heaters ○ no combustion required ▪ no fuel burning, making it safer and more suitable for homes without a gas supply ○ efficiency ▪ nearly 100% efficient as all electrical energy is converted into heat ○ types ▪ direct electric boilers ▪ thermal storage boilers

Learning outcome 33 – Install sanitary appliances and pipework systems.

Assessment criteria	Content – What needs to be covered

33.1 Identify advantages and disadvantages of sanitary appliances pipework systems.	• Primary ventilated stack system
	  ○ advantages
	  ▪ simplified installation
	  ▪ cost-effective
	  ▪ reduces airlocks
	  ○ disadvantages
	  ▪ limited to certain buildings
	  ▪ design restrictions
	  ▪ increased potential noise
	• Secondary ventilated stack system
	  ○ advantages
	  ▪ additional venting
	  ▪ good airflow
	  ▪ improves efficiency
	  ○ disadvantage
	  ▪ more expensive
	  ▪ installation complexity
	  ▪ requires more space
	  ▪ increased maintenance
	• Ventilated branch discharge system
	  ○ advantages
	  ▪ prevents trap seal
	  ▪ reduces siphonage and pressure
	  ▪ ideal for complex layouts
	  ○ disadvantage
	  ▪ more expensive
	  ▪ increased complexity
	  ▪ uses more space
	  ▪ higher maintenance
	• Stub stack system
	  ○ advantages
	  ▪ simplifies installation
	  ▪ saves space
	  ▪ cost-effective
	  ▪ no vent needed to outside
	  ○ disadvantages
	  ▪ limited to low-rise buildings
	  ▪ requires being close to appliances
	  ▪ over-reliance on air admittance valves

33.3 Identify working principles of sanitary appliances pipework systems	• Sanitary appliances pipework systems
	  ○ primary ventilated stack system
	  ▪ appliances connected to the stack via sloped branch pipes
	  ▪ centralised location for close grouping of appliances

Assessment criteria	Content – What needs to be covered
and layouts and the positioning, fixing, connection and operation of components.	▪ appliances use water traps to prevent smells ▪ allowance for expansion ▪ ventilated stack to atmosphere ○ secondary ventilated stack system ▪ appliances connected to the stack via sloped branch pipes ▪ the secondary stack provides additional air circulation ▪ the secondary stack may connect to the primary stack or a separate vent system ▪ allowance for expansion ▪ ventilated stack to atmosphere ○ ventilated branch discharge system ▪ appliances connected to the stack via sloped branch pipes ▪ branch discharge pipes are vented to ensure pressure equalisation ▪ ventilation allows air to enter the system, ensuring that wastewater can flow freely ▪ allowance for expansion ▪ ventilated stack to atmosphere ○ stub stack system ▪ limited vertical connection ▪ compact design ▪ vented using an air admittance valve • Layouts ○ discharge stacks ▪ soil stack sizes based on WC outlet size ▪ waste stack sizes serving waste appliances only ▫ basin 32 mm ▫ bath 40 mm ▫ shower 40 mm ▫ sink 40 mm ▪ 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

Assessment criteria	Content – What needs to be covered
	○ stack ventilation ▪ proximity of vent outlet to openable windows is 900 mm above an openable window when within 3 metres ▪ use of air admittance valves ○ systems and appliances ▪ waste appliance connections to gullies ▪ waste appliance connections direct to drain ▪ WC connection direct to drain • Components ○ bend ▪ male and 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
33.5 Identify expansion and contraction in sanitary appliances pipework systems and negative effects.	• Expansion and contraction ○ physical change in length of the pipes due to temperature changes ○ pipes lengthen when heated (expands) ○ pipes shorten when cooled (contracts) • Negative effects ○ pipework damage ○ damage to fittings leading to leaks ○ damage to fixings ○ noise
33.7 Identify different types of sanitary appliances and components used in dwellings.	• Appliances ○ conventional WC ○ flushing cisterns (automatic and manual) ○ waste disposal units ○ baths ○ bidets ○ wash hand basins ○ shower tray

Assessment criteria	Content – What needs to be covered
	○ bath/shower screens and cubicles ○ sinks ○ WC macerators ○ waste water lifters/pumps used in domestic dwellings • Components ○ waste traps – P trap, S trap, bottle trap ○ overflow pipes ○ soil and vent pipes ○ waste pipes ○ stop valves ○ isolation valves ○ ball valves (in toilet cisterns) ○ flush mechanisms – syphon, push-button, dual-flush ○ shower pumps ○ tundish (for safety discharge) ○ gully traps ○ air admittance valves (AAVs) ○ pipe insulation ○ sealants and gaskets ○ flexible hoses ○ water filters ○ anti-scald valves ○ backflow prevention devices
33.8 Identify factors that lead to trap seal loss in sanitary pipework systems.	• Self-siphonage • Induced siphonage • Compression • Wavering out • Evaporation • Capillary • Gradient • Pipe size
33.9 Identify the suitability of below ground drainage systems to receive waste water.	• Combined drainage system ○ allows waste and rainwater to discharge into a common sewer • Separate drainage system ○ waste and rainwater are discharge through separate pipes • Partially separate drainage system ○ a hybrid system where some surface water is discharged separately but wastewater may still be combined with other flows • Soakaway ○ manages surface water runoff • Cesspit ○ sealed tanks that collect wastewater

Assessment criteria	Content – What needs to be covered
	• Septic tanks ○ properties not connected to public sewer and used where soil is permeable

33.10 Identify the installation features of sanitary facilities and equipment in dwellings for the disabled including wet rooms.	• Features
	  ○ wide doorways
	  ○ wheelchair-accessible layout
	  ○ non-slip floors
	  ○ level-entry shower (wet room)
	• Equipment
	  ○ grab rails
	  ○ lever taps
	  ○ thermostatic controls
	  ○ wall mounted seats

33.12 Identify working principles of greywater recycling systems.	Stages in the following order: • Collection • Filtration • Treatment • Storage • Reuse

Learning outcome 34 – Understand and install rainwater systems.

Assessment criteria	Content – What needs to be covered

34.1 Identify advantages and disadvantages of rainwater systems: pipe (RWP) and gutter.	• Pipe (RWP)
	  ○ advantages
	  ▪ efficient drainage
	  ▪ prevents water damage
	  ▪ low maintenance
	  ○ disadvantages
	  ▪ blockages
	  ▪ installation costs
	  ▪ visual impact
	• Gutter
	  ○ advantages
	  ▪ prevents roof damage
	  ▪ protects walls and foundations
	  ○ disadvantages
	  ▪ blockages
	  ▪ high maintenance
	  ▪ weather damage

Assessment criteria	Content – What needs to be covered

34.2 Identify typical sizes and materials used in rainwater systems: pipe (RWP) and gutter.	• Pipe (RWP)
	  ○ square size
	  ▪ 65 mm
	  ○ round size
	  ▪ 68 mm
	  ○ materials
	  ▪ PVCu
	  ▪ extruded aluminium
	  ▪ cast iron
	  ▪ copper
	  ▪ lead
	• Gutter
	  ○ size
	  ▪ 112 mm
	  ▪ 150 mm
	  ○ materials
	  ▪ PVCu
	  ▪ cast iron
	  ▪ aluminium
	  ▪ copper

34.4 Identify expansion and contraction in rainwater systems and negative effects.	• Expansion and contraction
	  ○ temperature variation
	  ○ incorrect installation
	  ○ material stress
	• Negative effects
	  ○ fitting failure
	  ○ distortion
	  ○ broken fixings
	  ○ leakage

34.5 Identify factors affecting gutter bracket selection and fixing for buildings.	• Fascia boards
	  ○ fascia brackets
	• Exposed rafters
	  ○ rafter brackets
	• No fascia board
	  ○ rise and fall brackets
	• Gutter and rainwater material selection

Learning outcome 36 – Understand and perform a soundness test and commission cold water systems and components.

Assessment criteria	Content – What needs to be covered
36.1 Identify information sources required to complete testing and commissioning.	• Statutory regulations • Industry standards • Manufacturer's technical instructions

36.2 Identify how to fill and vent cold water systems.	• Fill and vent cold water systems in the following order:
	  ○ isolate taps
	  ○ fill with water
	  ○ monitor for leaks
	  ○ vent taps
	  ○ final flush

36.5 Identify the flushing requirements including the use of system additives for new and existing cold water systems.	• Flushing requirement during commissioning
	  ○ cold flush with wholesome water
	• Use of system additives during commissioning
	  ○ disinfection with chlorine
	  ○ biocidal treatment
	  ○ final flush

Learning outcome 37 – Understand and perform a soundness test and commission hot water systems and components.

Assessment criteria	Content – What needs to be covered
37.1 Identify information sources required to complete testing and commissioning.	• Statutory regulations • Industry standards • Manufacturer's technical instructions

37.2 Identify how to fill and vent hot water systems.	• Fill and vent hot water systems in the following order:
	  ○ isolate taps
	  ○ fill with water
	  ○ monitor for leaks
	  ○ vent taps
	  ○ final flush

Assessment criteria	Content – What needs to be covered

37.5 Identify the flushing requirements including the use of system additives for new and existing hot water systems.	• Flushing requirement during commissioning
	  ○ cold flush with wholesome water
	• Use of system additives during commissioning
	  ○ disinfection with chlorine
	  ○ biocidal treatment
	  ○ final flush

Learning outcome 38 – Understand and perform a soundness test and commission central heating systems and components.

Assessment criteria	Content – What needs to be covered
38.1 Identify information sources required to complete testing and commissioning.	• Statutory regulations • Industry standards • Manufacturer's technical instructions

38.2 Identify how to fill and vent central heating systems.	• Fill and vent sealed systems in the following order:
	  ○ locate filling loop
	  ○ open filling loop
	  ○ monitor pressure
	  ○ close filling loop
	  ○ vent the lowest radiator first
	  ○ release air
	  ○ finish venting the highest radiator
	  ○ re-check pressure
	  ○ top up via filling loop if needed
	• fill and vent open systems in the following order:
	  ○ locate feed and expansion cistern
	  ○ fill and check for leaks
	  ○ wait for cistern to stop filling
	  ○ open automatic air vents
	  ○ vent the lowest radiator first
	  ○ release air
	  ○ finish venting the highest radiator
	  ○ bleed air from pump

38.5 Identify the flushing requirements including the use of system additives	• Flushing requirements
	  ○ cold flush
	  ○ hot flush
	  ○ cleaning

Assessment criteria	Content – What needs to be covered

for new and existing central heating systems.	• Use of systems additives
	  ○ neutralisers for neutralising any acid in the system
	  ○ cleanser for cleaning and maintaining the system
	  ○ descaler for dissolving limescale and calcium carbonate deposits
	  ○ inhibitor for preventing rust and internal corrosion occurring

Learning outcome 40 – Understand and perform a soundness test and commission rainwater systems and components.

Assessment criteria	Content – What needs to be covered
40.1 Identify information sources required to complete testing and commissioning.	• Statutory regulations • Industry standards • Manufacturer's technical instructions • British Standard (BS) 12056 and Approved Document H building regulations

Learning outcome 46 – Understand and carry out service and maintenance on cold water systems.

Assessment criteria	Content – What needs to be covered

46.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	• Review service requirements
	  ○ visual inspection of pipework for 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
	  ○ strainer/filter inspection and cleaning
	  ○ pump operation
	  ○ float and pressure switch operation
	  ○ pressure relief valves
	• Reasons for checking
	  ○ to check safety requirements
	  ○ to identify replacement components
	  ○ to determine service intervals

46.3 Identify types of information to be provided on a	• Components checked • Status • Actions taken

Assessment criteria	Content – What needs to be covered
maintenance record for cold water systems.	• Repairs carried out

46.4 Identify requirements for legionella and bacterial growth control measures.	• Health and Safety Executive (HSE), Approved Code of Practice (ACoP) L8 and Water Regulations
	  ○ temperature control
	  ○ regular flushing
	  ○ water storage and distribution
	  ○ chemical and filtration treatments
	  ○ risk assessment and monitoring every six months
	  ○ proper system design and maintenance

Learning outcome 47 – Understand and carry out service and maintenance of hot water systems.

Assessment criteria	Content – What needs to be covered

47.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	• Review service requirements
	  ○ visual inspection of pipework for leakage, adequate support and insulation
	  ○ effective operation of terminal fittings
	  ○ effective operation of float operated valve for open vented systems
	  ○ effective operation of service valves
	  ○ condition of hot water cylinder
	  ○ condition of storage cisterns
	  ○ condition of unvented cylinder and controls
	  ○ effective operation of thermostatic control devices
	  ○ temperature and pressure relief valve
	  ○ expansion vessel
	  ○ composite valve
	  ○ pumps
	• Reasons for checking:
	  ○ to check safety requirements
	  ○ to identify replacement components
	  ○ to establish service intervals

47.3 Identify types of information to be provided on a maintenance record for hot water systems.	• Components checked • Status • Actions taken • Repairs carried out

Assessment criteria	Content – What needs to be covered

47.4 Identify requirements for legionella and bacterial growth control measures.	• Health and Safety Executive (HSE), Approved Code of Practice (ACoP) L8 and Water Regulations
	  ○ temperature control
	  ○ regular flushing
	  ○ water storage and distribution
	  ○ chemical and filtration treatments
	  ○ risk assessment and monitoring
	  ○ proper system design and maintenance

Learning outcome 48 – Understand and carry out service and maintenance on central heating systems.

Assessment criteria	Content – What needs to be covered

48.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	• Review service requirements
	  ○ visual inspection of pipework for leakage, adequate support and insulation
	  ○ effective operation of float operated valves
	  ○ effective operation of valves
	  ○ condition of cistern for open vented systems
	  ○ effective operation of thermostatic control devices
	  ○ temperature and pressure relief valve
	  ○ expansion vessel
	  ○ pumps
	  ○ condition of heat emitters
	  ○ performance checks
	• Reasons for checking:
	  ○ to check safety requirements
	  ○ to identify replacement components
	  ○ to establish service intervals

48.3 Identify types of information to be provided on a maintenance record for central heating systems.	• Components checked • Status • Actions taken • Repairs carried out

Learning outcome 49 – Understand and carry out service and maintenance on sanitary appliances and pipework systems.

Assessment criteria	Content – What needs to be covered

49.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.	• Review service requirements
	  ○ 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
	• Reasons for checking:
	  ○ to check safety requirements
	  ○ to identify replacement components
	  ○ to establish service intervals

49.3 Identify types of information to be provided on a maintenance record for sanitary appliances and pipework systems.	• Manufacturer's information • Date of activity • Location of activity • Access arrangements • Activity (what has been done) • Operative details • Asset code or reference • Date of next activity

Learning outcome 56 – Know the basic operating principles of micro-renewable energy technologies.

Assessment criteria	Content – What needs to be covered

56.1 Identify the basic operating principles of heat producing micro-renewable energy technologies.	• Solar thermal (hot water)
	  ○ uses solar collectors mounted on a roof to obtain energy from the sun to heat domestic hot water
	• Ground source heat pump
	  ○ uses a loop buried in the ground to extract heat which is converted by a heat pump into useful heat for heating purposes
	• Water source heat pump
	  ○ uses a loop located in a body of water such as a lake to extract heat which is converted by a heat pump into useful heat for heating purposes

Assessment criteria	Content – What needs to be covered

	• Air source heat pump
	  ○ uses an external unit to draw in outside air which is converted by a heat pump into useful heat for heating purposes
	• Biomass
	  ○ uses a sustainable wood source to burn and produce useful heat for heating or hot water

56.2 Identify the basic operating principles of heat-led micro-combined heat and power.	• Combined heat and power (CHP) boilers simultaneously produce both electricity and heat from a single fuel source • The system prioritises heat production, with electricity generated as a by-product

Learning outcome 57 – Understand requirements to install micro-renewable energy systems to existing systems.

Assessment criteria	Content – What needs to be covered
57.1 Identify the suitability of building location and features when installing micro-renewable energy systems.	• Structural • Orientation • Listed buildings • Environmental conditions • Adjacent structures and obstructions • Geographical

57.2 Identify statutory regulations affecting installation of micro-renewable energy systems.	• Building Regulations Approved Document
	  ○ Part A
	  ○ Part E
	  ○ Part G
	  ○ Part H
	  ○ Part F
	• Town and country planning regulations

57.3 Identify what would be typically classified as 'permitted development' under town and country planning regulations in relation to the	• Solar thermals
	  ○ installation of collectors/arrays
	• Heat pumps
	  ○ location of the outdoor unit
	• Biomass boilers and flues
	  ○ location of fuel storage
	• Rainwater harvesting
	  ○ installation of tanks

Assessment criteria	Content – What needs to be covered
deployment of technologies.	

57.4 Identify which parts of the regulations apply in relation to the installation of 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)
	• Building Regulations
	  ○ Approved Document A
	  ▪ covers structure and securing components to the building
	  ○ Approved Document G
	  ▪ sanitation
	  ○ Approved Document L
	  ▪ energy efficiency
	  ○ Approved Document P
	  ▪ electrical safety

57.5 Identify typical advantages and disadvantages associated with environmental technologies.	• Advantages
	  ○ reduces pollution – lowers carbon emissions and waste
	  ○ sustainable energy – uses renewable sources like solar and wind
	  ○ long-term cost savings – reduces energy bills and reliance on fossil fuels
	  ○ energy efficiency – improves resource use and reduces waste
	  ○ government incentives – grants, tax breaks and subsidies available
	  ○ creates jobs – expands employment in green industries
	  ○ improves public health – reduces air and water pollution, benefiting health
	• Disadvantages
	  ○ high initial costs – expensive to install and set up
	  ○ technology limitations – some solutions depend on weather conditions
	  ○ infrastructure challenges – requires updates to grids and distribution networks
	  ○ resource demand – production of green tech relies on scarce materials
	  ○ land and space requirements – large-scale renewables need significant space
	  ○ intermittency issues – energy storage solutions are needed for reliability

Learning outcome 58 – Understand factors affecting fuel selection.

Assessment criteria	Content – What needs to be covered

58.1 Identify the types of fuels used in appliances.	• Natural gas
	  ○ CH_4
	• Liquefied petroleum gas (LPG)
	  ○ butane (C_4H_{10})
	  ○ propane (C_3H_8)
	• Oil
	  ○ kerosene grade C2
	• Solid fuel
	  ○ coal
	  ○ coke
	  ○ peat
	• Hydrogen (H)
	• Biomass
	  ○ wood chips
	  ○ wood pellets

58.2 Identify the factors which affect the selection of fuels.	• Client preference • Availability • Appliance type • Fuel storage requirements • Environmental considerations • Smoke control legislation • Cost
58.3 Identify sources of information for fuel supply installation.	• Industry standards • Statutory regulations • Manufacturer's instructions • Guidance notes
58.4 Identify the regulatory type bodies which govern the installation of various fuel types.	• Gas Safe • Oil Firing Technical Association (OFTEC) • Heating Equipment Testing and Approval Scheme (HETAS) • Microgeneration Certification Scheme (MCS)

58.5 Identify the storage requirements for fuels.	• Oil
	  ○ stored in a tank
	• Propane
	  ○ stored in a tank or cylinder
	• Natural gas
	  ○ does not require storage as supplied via mains
	• Biomass
	  ○ stored in a fuel store or silo

Assessment criteria	Content – What needs to be covered

58.6 Identify factors which could affect storage requirements for fuels.	• Space
	  ○ biomass and solid fuel
	• Delivery requirements
	  ○ oil, LPG, biomass and solid fuel
	• Weather conditions
	  ○ biomass and solid fuel
	• Distribution
	  ○ natural gas
	• Proximity to dwelling
	  ○ oil and LPG

Learning outcome 59 – Know combustion processes of fuel supplied systems.

Assessment criteria	Content – What needs to be covered
59.1 Identify the combustion process.	• Fuel and oxygen combine to produce heat and combustion products ○ $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

59.2 Identify the main constituents of complete and incomplete combustion.	• Complete
	  ○ carbon dioxide (CO_2)
	  ○ water vapor (H_2O)
	• Incomplete
	  ○ carbon monoxide (CO)
	  ○ soot (carbon particles)
	  ○ water vapor (H_2O)

59.3 Identify causes of incomplete combustion.	• Insufficient air
	  ○ too much fuel
	  ○ vitiated air
	  ○ flame impingement

59.4 Identify signs of incomplete combustion.	• Poor flame picture • Soot deposits • Staining
59.5 Identify the symptoms of CO poisoning.	• Headache • Dizziness • Weakness • Nausea and vomiting • Rapid heartbeat • Shortness of breath • Seizures • Chest pain

Assessment criteria	Content – What needs to be covered
	• Loss of consciousness • Disorientation
59.6 Identify the purpose of CO detectors.	• Alerts people with early warning so can evacuate or fix issue • Detects dangerous levels of carbon monoxide gas in the air
59.7 Identify the requirements for ventilation.	• Combustion air • Cooling air
59.8 Identify the different types of ventilation.	• Natural • Mechanical
59.9 Identify installation practices for ventilation.	• Adequately sized • Continuous free area • Sleeved • Permanently open • Fly screen removed • Correctly positioned

Learning outcome 60 – Know principles of chimney/flue systems.

Assessment criteria	Content – What needs to be covered
60.1 Identify the operating principles of chimney/flue systems.	• Remove combustion products • Draw in combustion air

60.2 Identify types of chimney/flue systems.	• Open flued
	  ○ natural draught
	  ○ forced draught
	• Room sealed
	  ○ natural draught
	  ○ forced draught

60.3 Identify the components within chimney/flue systems.	• Primary flue
	  ○ creates initial flue draught
	• Draught diverter/stabiliser
	  ○ allows products of combustion to be diluted with air
	• Secondary flue
	  ○ transfers products of combustion to atmosphere

Assessment criteria	Content – What needs to be covered
	• Terminal ○ protects debris from falling into the flue
60.4 Identify the effects of layout on chimney/flue systems.	• Equivalent height • Internal temperature • External temperature • Air quality • Humidity • Route • Bends • Termination • Type of material

60.5 Identify the layout and features of 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)

60.6 Identify termination requirements for chimney/flue systems from relevant documents.	• Industry standards • Approved documents • Manufacturer's instructions

60.7 Identify basic inspection and testing procedures for chimney/flue systems.	• Visual inspection
	  ○ carried out prior to any test to check for defects
	• Flue flow
	  ○ used to check the integrity of a chimney
	• Spillage test
	  ○ used to check appliance operation – open flued
	• Combustion analysis
	  ○ used to check appliance operation – room sealed

Learning outcome 61 – Understand and perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems.

Assessment criteria	Content – What needs to be covered
61.1 Identify the limitations of your responsibility when carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems.	• Can replace like for like • Can connect to a fuse spur • Can replace a damaged cable • Cannot install a new circuit • Cannot replace a consumer unit • Cannot carry out any additions or alterations to an existing circuit in a special location

61.2 Identify the applications, advantages and limitations of electrical supplies.	• Control
	  ○ applications
	  ▪ thermostats
	  ▪ motorised valves
	  ▪ pumps
	  ▪ programmer/time clocks
	  ○ advantages
	  ▪ optimise the operation
	  ▪ desired settings
	  ▪ energy efficient
	  ○ limitations
	  ▪ power dependant
	  ▪ maintenance costs
	• Heating
	  ○ applications
	  ▪ power electric boilers
	  ▪ operate controls
	  ○ advantages
	  ▪ quick response
	  ▪ precise control
	  ○ limitations
	  ▪ installation retrofit
	  ▪ power outages
	• Power
	  ○ applications
	  ▪ heating components
	  ▪ pumps
	  ▪ controls
	  ○ advantages
	  ▪ easier to install and maintain
	  ▪ suitable for lower power loads

Assessment criteria	Content – What needs to be covered
	○ limitations ▪ limited power capacity ▪ voltage drops over long distances
61.3 Identify the applications, advantages and limitations of different electrical equipment, cables/wiring and components in relation to the working environment.	• Isolators ○ applications ▪ electrical isolation ▪ emergency shutoff ○ advantages ▪ safety assurance ▪ simple operation ▪ clear visual indication ▪ reliable isolation ○ limitations ▪ manual operation ▪ no fault protection ▪ limited use • Circuit breakers ○ applications ▪ overcurrent protection ▪ short circuit protection ▪ fault isolation ▪ load management ▪ residual current device (RCD) ▪ residual current breaker with over-current (RCBO) ○ advantages ▪ automatic protection ▪ reusability ▪ improved safety ○ limitations ▪ cost ▪ complex maintenance ▪ limited lifespan ▪ false tripping • Electrical fuses ○ applications ▪ protect household wiring and appliances ▪ used in industrial machines and motor circuits ▪ found in car electrical systems ▪ protect circuit boards in electronics ▪ safeguard power distribution systems ○ advantage ▪ fast protection against overcurrent ▪ low cost and easy to install ▪ no maintenance required ▪ compact size for space-saving ▪ reliable and automatic operation

Assessment criteria	Content – What needs to be covered
	○ limitations ▪ single-use – needs replacement after blowing ▪ not resettable like circuit breakers ▪ may not suit high-power industrial systems ▪ wrong fuse rating can cause issues • Switches, socket-outlets and fused-spurs ○ applications ▪ power ▪ control ▪ isolation ○ advantages ▪ convenient control ▪ safety enhancement ▪ space saving ▪ versatility ▪ durable ○ limitations ▪ manual operation ▪ limited load capacity ▪ fixed location • Earthing protection ○ applications ▪ electrical circuit protection ▪ appliances protection ▪ power distribution systems ○ advantages ▪ safety from electric shock ▪ prevents fire hazards ▪ equipment protection ▪ fault detection ○ limitations ▪ maintenance requirements • PVC flat profile (twin and earth) ○ applications ▪ general domestic wiring ▪ fixed installations ▪ low voltage applications ▪ concealed ○ advantages ▪ ease of installation ▪ cost-effective ▪ durable insulation ○ limitations ▪ temperature limits ▪ limited flexibility ▪ UV degradation

Assessment criteria	Content – What needs to be covered
	▪ not for outdoor use ▪ mechanical damage • Flex including heat resistant (butyl) rubber o applications ▪ portable appliances ▪ heat-generating equipment ▪ flexible connections ▪ lighting fixtures o advantages ▪ high heat resistance ▪ flexibility ▪ durable ▪ moisture resistant ▪ chemical resistance o limitations ▪ higher cost ▪ limited UV resistance ▪ thickness and weight • Central heating controls o applications ▪ timed heating and hot water ▪ control temperatures for heating and hot water ▪ zone control ▪ frost protection o advantages ▪ energy efficient ▪ enhanced comfort ▪ convenience to use ▪ heating zoning – individual/independent control of areas of a property ▪ individual time setting o limitations ▪ initial cost ▪ complex installation ▪ maintenance ▪ compatibility issues with some systems ▪ dependence on power • Immersion heater o applications ▪ water heating ▪ back up in case main heat source failure o advantages ▪ cost effective ▪ compact design ▪ simple operation ▪ independent control

Assessment criteria	Content – What needs to be covered
	○ limitations ▪ slow heating ▪ limited heating capacity ▪ inefficient for large systems ▪ manual control • Shower pump ○ applications ▪ boosting water ▪ power showers ○ advantages ▪ improved water pressure ▪ better performance ▪ compatible with various showers ▪ simple to install ○ limitations ▪ potential noise ▪ increased energy consumption ▪ space requirements • Macerator WC ○ applications ▪ basement toilets ▪ conversion projects ▪ remote locations ▪ renovations ○ advantages ▪ flexible installation ▪ space saving ▪ cost effective ○ limitations ▪ potential noise ▪ blockages ▪ power dependency
61.4 Identify the 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.	• Building Regulations Approved Document P • Electricity at Work Regulations 1989 • BS 7671:2018 (IET Wiring Regulations)

Assessment criteria	Content – What needs to be covered

61.5 Identify 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.	• Verifying job information and documentation
	  ○ review job documentation
	  ○ check revision dates
	  ○ compare with industry standards
	  ○ consult subject matter experts (SMEs)
	  ○ use document control systems
	  ○ confirm compliance with work scope
	• Verifying plant and equipment
	  ○ inspection and pre-use checks
	  ○ maintenance records
	  ○ calibration and certification
	  ○ check safety compliance
	  ○ operator feedback
	• Verifying access equipment (ladders, scaffolds, platforms)
	  ○ pre-use inspections
	  ○ load ratings and certification
	  ○ tagging system
	  ○ compliance with safety regulations
	• Verifying tools and instruments
	  ○ Pre-use functional testing
	  ○ calibration and certification
	  ○ check for damage or wear
	  ○ proper storage and handling
	  ○ pat ensures the safety of electrical appliances, particularly portable tools and equipment
	  ○ identifying appliances for testing
	  ▪ any portable electrical device, including power tools, extension cords and computers
	  ▪ equipment that is frequently moved or used in harsh environments
	  ▪ class I (earthed) and class II (double-insulated) appliances require different testing procedures

Learning outcome 62 – Apply industry standard safe isolation procedures.

Assessment criteria	Content – What needs to be covered

62.1 Identify the correct means of electrical isolation prior to commencing work.	Actions in the following order:
	• Seek permission from the relevant responsible person
	• Identify the point of isolation turn off and lock it off to prevent the system from being energised
	• Place warning labels to warn others that the electrical installation has been isolated
	• Secure the isolation and keep the key to the lock with you at all times
	• Prove that your voltage indicator or test lamp are functioning correctly, on a proving unit or a known live source
	• Prove the system or equipment is dead using an approved voltage indicator or test lamp
	• Test the outgoing side of the means of isolation to ensure it is dead
	• Complete the following tests, depending on the type of supply:
	  ○ single phase installations test to confirm that there is no voltage between:
	  ▪ Earth and line
	  ▪ Earth and Neutral
	  ▪ Neutral and line
	  ○ re-test the voltage indicator on the proving unit
	  ○ once the system/equipment is isolated, only then can you begin work

Who we are

As part of the City & Guilds Group, we believe in a world where people and organisations have the confidence and capabilities to prosper, today and in the future.

As workplaces evolve, so do we. That's why we set the standard for skills that transform lives, industries, and economies.

About City & Guilds

Founded in 1878 to develop the knowledge, skills, and behaviours needed to help businesses thrive, we offer a broad and imaginative range of products and services that help people achieve their potential through work based learning. We believe in a world where people and organisations have the confidence and capabilities to prosper, today and in the future. So we work with like-minded partners to develop the skills that industries demand across the world.

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