

Qualification Specification

DPH-014

BPEC Level 3 Diploma in Plumbing and Domestic Heating

Qualification number – 603/4526/3

Qualification Specification DPH-014

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1. About BPEC

BPEC Certification Ltd was initially established in 1997 to act as an accredited certification body to oversee competence assessment of individuals working in the gas industry. It has extended its coverage and now offers a range of assessment and certification services to meet the needs of operatives working in the Building Services sector.

In 2010 BPEC established a recognised Awarding Organisation (AO), offering a suite of regulated qualifications. These have been developed with the input of industry and learning providers to meet the skills needs of the Building Services Engineering sector.

The Company is committed to high levels of customer service and providing support to organisations who deliver our qualifications, assessments and learning materials, which meet the needs of employers, Learners and training providers on an ongoing basis.

BPEC Certification is a not for profit company and any surplus funds are gift aided to the BPEC Charity. The focus of the Charity is to raise the knowledge and skills of those who work in the UK plumbing and heating industry and support associated projects, grants and awards.

Should you wish to learn more about BPEC (including our Charity work) please contact us at:

BPEC Certification
1-2 Mallard Way
Pride Park
Derby
DE24 8GX
Tel: 01332 376000

Or visit our website at: www.bpec.org.uk

2. Introduction to the Qualification

2.1. Qualification Overview

Qualification title		BPEC Level 3 Diploma in Plumbing and Domestic Heating				
Qualification Number (QN)		603/4526/3				
BPEC Certification code		DPH-014				
Assessment method/s		Practical assessments, Multiple choice questions, written Assignments, Work Based Portfolios				
Entry Requirements		Learners must be aged 16 and over				
1	GLH	1517	TQT	1875	Credits	--
2	GLH	1467	TQT	1825	Credits	--
3	GLH	1467	TQT	1825	Credits	--
4	GLH	1517	TQT	1875	Credits	--
Mandatory Units		13				
Optional Units		0				
Pathway Options		1. Natural Gas Pathway 2. Oil Pathway 3. Solid fuel/Biomass fuel Pathway 4. Environmental Technologies Pathway				
Last Registration Date		30 April 2024				
Last Certification Date		30 April 2028				

2.2. Who is the Qualification for?

This qualification is for those learners currently employed in the plumbing and domestic heating industry as an apprentice plumber/domestic heating engineer. Learners will be required to demonstrate the necessary abilities, skills and knowledge to be able to plan, select, install and commission all aspects of plumbing and heating systems. In addition to this, learners will also demonstrate a knowledge of service, maintenance and fault diagnosis and rectification of plumbing and heating systems.

2.3. The Purpose of the Qualification

For Learners to be able to develop those skills necessary for a career in the plumbing and domestic heating industry.

2.4. Support and accreditation

This qualification is supported by industry and regulated by OFQUAL

2.5. Relationship to other Qualifications

Although there is no direct relationship to other qualifications, learners who have already completed the current BPEC Level 2 NVQ Diploma in Domestic Plumbing and Heating may be able to enter this Level 3 qualification at Phase 3 provided they meet and undertake the requirements detailed in the BPEC RPL document.

It is envisaged that the apprentices will require further college/centre input for the shortfall in learning up to Phase 2 of this qualification to allow the learner to enter at Phase 3.

3. Qualification Structure

3.1. Overview

This qualification consists of 13 mandatory units (core) and 2/3 pathway units depending upon the pathway chosen:

3.2. Mandatory Units

Unit Ref	Unit Title	Level	GLH	TQT
CORE UNITS				
J/617/5976	Health and Safety Systems	2	88	100
L/617/5977	Common Processes and Techniques	2	88	100
R/617/5978	Scientific Principles	2	70	85
Y/617/5979	Planning and Supervision	3	54	60
L/617/5980	Cold Water Systems	3	138	170
R/617/5981	Hot Water Systems	3	138	170
Y/617/5982	Central Heating Systems	3	180	220
D/617/5983	Rainwater Systems	3	30	40
H/617/5984	Sanitation Systems	3	106	130
K/617/5985	Environmental Technology Systems	3	15	20
M/617/5986	Domestic Fuel Systems	3	30	40
T/617/5987	Electrical Work and the Control of Plumbing and Domestic Heating Systems	3	70	80
A/617/5988	Install, Commission, Service and Maintain Domestic Plumbing and Heating Systems	3	60	110
Totals			1067	1325

3.3. Pathway Units

Unit Ref	Unit Title	Level	GLH	TQT
PATHWAY UNITS				
Natural Gas Pathway (to be completed in a Gas ACS registered centre)				
F/617/5989	Specific Domestic Core Safety for Natural Gas	3	190	210
T/617/5990	Install and Maintain Gas Water Heating and Wet Central Heating Appliances	3	260	340
Totals			450	550
Fuel Oil Pathway (to be completed in an OFTEC approved centre or college)				
A/617/5991	Core Principles of Oil Fuel Systems for Dwellings (Safety and Efficiency)	3	170	200
F/617/5992	Install, Commission, Maintain and Service Oil Systems and Appliances in the Work Place	3	230	300
Totals			400	500

Unit Ref	Unit Title	Level	GLH	TQT
PATHWAY UNITS				
Solid fuel/biomass Pathway (to be completed in a HETAS approved centre or college)				
J/617/5993	Safety Principles (Solid Mineral Fuel and Biomass Combustion)	3	170	210
L/617/5994	Plan, Install, Commission, Service and Maintain Solid Mineral Fuel and Biomass Combustion Appliances	3	230	290
Totals			400	500
Environmental Pathway				
R/617/5995	Air Source Heat Pump Systems	3	160	190
Y/617/5996	Rainwater Harvesting and Greywater Reuse Systems	3	160	190
D/617/5997	Solar Thermal Hot Water Systems	3	130	170
Totals			450	550

3.4. Rules of Combination

Learners must complete all mandatory units and one (1) pathway.

3.5. IGEM/IG/1 Supplement 2 requirements for Gas Training

From September 1st, 2022, training in Natural Gas subjects for this qualification must comply with the relevant requirements for the Standards of Training in Gas Work IGEM/IG/1 supplement 2, 2022, a copy of which can be downloaded from [here](#).

New Schemes of Work have been provided on the secure portal for the **GAS PATHWAY** that take into account the requirements of IGEM/IG/1 supplement 2, 2022 and these **must be followed** whenever gas training is taking place to ensure compliance with IGEM/IG/1 supplement 2. Schemes of work are available for gas Units 14 and 15.

4. The Learners

4.1. Qualifications that the Learner must have completed before taking the Qualification

Nonapplicable

4.2. Knowledge, skills or understanding which the Learner is required to have before taking the Qualification

a) Specific

Nonapplicable

b) General

The Centre should:

- Undertake initial assessment of each Learner to ensure that they have the minimum levels of numeracy and literacy to comply with the health and safety aspects of the qualification and the completion of the Learning Outcomes and assessments
- Establish if the Learner has any specific training needs
- Identify any support and guidance the Learner may require when working towards the qualification.

4.3. The Units the Learner must have completed before the Qualification will be awarded

Learners are required to complete all 13 mandatory Units and 1 Pathway before the Qualification will be awarded.

4.4. Any other requirements which a Learner must have satisfied before the Learner will be assessed or before the Qualification is awarded

None identified

5. Delivery requirements

5.1. Centre Recognition

Centres wishing to deliver this qualification will need to gain Centre Recognition and Qualification Approval (see 5.2). For full details of the recognition process please contact:

BPEC Certification

1-2 Mallard Way Pride Park

Derby

DE24 8GX

Tel: 01332 376000

aoadmin@bpec.org.uk

5.2. Qualification Approval

- a) Centres wishing to deliver this Qualification who are already recognised (see 5.1) should complete and submit a Qualification Approval Form to BPEC Certification Ltd
- b) Before submission, centres should ensure that they can meet the delivery requirements
- c) Centres who are approved to deliver this qualification and wish to extend delivery to satellite sites must seek approval for each additional site

5.3. Physical Resources

- a) General – Centres must provide a safe environment for Learners and staff with appropriate policies and procedures in place which are adhered to
- b) Teaching Provision – Centres must provide adequate facilities and equipment to allow the effective teaching of the qualification including any practical provision
- c) Assessments/Exam Provision – Centres must provide facilities and equipment which allow assessments and exams to be conducted in accordance with the assessment criteria/guidance and exam procedures

5.4. Assessor/Trainer Requirements

Assessors must:

- Hold, or be working towards TAQA (A1/A2 – D32/33 updated) standards and continue to practice to these standards and possess CPD evidence of personally maintaining these standards, or
- Have other suitable equivalent assessor qualifications endorsed by BPEC
- ‘Candidate assessors’ who are working towards their assessor qualifications must always be supervised by a qualified assessor. They should have a clear action plan for achieving the assessor qualification(s), (assessor approval will be withdrawn if the assessor qualification/units have not been attained within a period of 18 months).

5.4.1. Assessor occupational competence (Core)

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

- A relevant level 3 plumbing qualification:
 - If older qualifications are held – such as city & guilds craft or advanced craft certificates – the assessor must be able to evidence through CPD activity a thorough knowledge of the qualification standards and requirements
 - If other MES-related NVQ/SVQ qualifications are held – such as domestic gas (wet central heating), heating and ventilation installation (domestic), domestic heating – the assessor must be able to evidence plumbing competence through CPD activity
- An up-to-date CPD record including relevant qualifications
- A verifiable CV of industry experience and current knowledge of industry practice and techniques relevant to the occupational area in which they assess
- A thorough knowledge and understanding of the qualification standards and requirements.

5.4.2. Unit 12 Electrical Work and the Control of Plumbing and Domestic Heating Systems

The person responsible for assessing Unit 12 must be competent in the technical areas of the unit. This means that assessors must have an NVQ in the technical area and/or relevant up-to-date CPD. An assessor without this evidence of competence must engage a qualified electrician to directly observe all the critical safety aspects of the assessment.

5.4.3. Assessor occupational competence (Pathway – Environmental Technologies, Oil and Solid Fuel)

Assessors for the Environmental Technologies, Oil and Solid Fuel pathways must be occupationally competent, experienced and hold relevant NVQs and/or other qualifications/CPD relating to the technical area they are assessing.

Evidence required prior to assessing:

- Qualification in the technical area
- Verifiable CV indicating experience in the technical area
- Current registration with an appropriate professional body to demonstrate competence to act as an assessor for the specific occupational pathway

This is not an exhaustive list – assessors may provide additional evidence.

5.4.4. Assessor occupational competence (Pathway – Natural Gas)

The centre must nominate all assessors to BPEC for approval prior to them conducting any assessments. Assessors may be employed by the centre (centre-based assessors) or be work based (workplace assessors) who may or may not be from the same organisation as the learner.

Assessors must be vocationally and occupationally competent in the areas they are assessing and have a thorough knowledge of the units, within the qualification, being assessed.

In addition to the qualifications listed below, the assessor must be able to provide appropriate documented evidence that demonstrates they have a minimum of five years' proven

occupational experience in the activities they will be assessing. Particular attention should be paid to providing evidence of occupational experience in the gas safety critical areas being assessed.

Where assessors undertake assessments in the workplace, and are not supported by a suitable gas operative, then they or their employer must be a member of an appropriate Gas Registration Body in accordance with the Gas Safety (Installation and Use) Regulations. In these circumstances they should also hold suitable insurance for this activity.

5.4.5. Qualifications

Assessors must be technically qualified in domestic gas installation/maintenance and hold one of the following qualifications:

- Level 3 Diploma in Gas Utilisation
- SQA S/NVQ in Domestic Natural Gas (Level 3) *or*
- Certificate for Service Engineers (Gas) *or*
- Certificate in Gas Installation Studies *or*
- Certificate in Gas Fitting – Final.

This list is not considered exhaustive and other ‘Mechanical Engineering Services’ (MES) or ‘Building Engineering Services’ (BES) qualifications at Level 3/SCQF Level 6 or equivalent may be considered acceptable. Centres must submit requests to confirm the acceptability of other qualifications to their External Quality Assurer. The External Quality Assurer must keep a record of any such decisions.

In addition to the above qualifications, all assessors must hold a current certificate of gas safety competence in the areas of gas work they will be assessing that is not more than five years old (either current ACS Certificates of Gas Safety Competence or an aligned qualification are acceptable). For elective units, assessors must hold a relevant qualification and/or evidence of current competency in the areas they will be assessing.

5.4.6. Assessor continuing professional development

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

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

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

5.4.7. Pathway Direct Observations (Environmental Technologies, Oil, Solid Fuel)

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

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

Where “Workplace Assessors” are used in the assessment process they must be:

- Sector competent individuals who can attest to the learner’s performance in the workplace
- It is not necessary for workplace assessors to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by a workplace assessors
- Evidence from workplace assessors must meet the tests of validity, reliability, authenticity and sufficiency
- Workplace assessors will need to demonstrate:
 - They have had training and mentoring in the assessment methods they will be using
 - They have relevant current knowledge of industry working practices and techniques
 - That they have no conflict of interest in the outcome of their evidence.

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

5.5. IQA occupational competence (Core and Pathway – Environmental Technologies, Oil and Solid Fuel)

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

- A Level 3 NVQ in Plumbing
- A related building services qualification with proven technical expertise
- A related building services qualification with access to plumbing technical expertise when undertaking IQA activities

5.6. IQA occupational competence (Pathway – Natural Gas)

In addition to the qualifications listed below, the Internal Quality Assurers for the Natural Gas pathway must be able to provide appropriate documentary evidence that demonstrates they have a minimum of five years’ proven occupational experience in the activities they will be verifying. Particular attention should be paid to providing evidence of occupational experience in the gas safety critical areas being verified.

Internal Quality Assurers must be technically qualified in domestic gas installation/maintenance and hold one of the following qualifications:

- Level 3 Diploma in Gas Utilisation
- SQA - S/NVQ in Domestic Natural Gas (Level 3) or
- Certificate for Service Engineers (Gas) or
- Certificate in Gas Installation Studies or
- Certificate in Gas Fitting – Final.

This list is not considered exhaustive and other 'Mechanical Engineering Services' (MES) or 'Building Engineering Services' (BES) qualifications at Level 3 / SCQF Level 6 or equivalent may be considered acceptable. Centres must submit requests to confirm the acceptability of other qualifications to their External Quality Assurer. The External Quality Assurer must keep a record of any such decisions.

5.7. External Quality Assurers (EQAs)

EQAs must:

- Hold or be working towards TAQA (V2 or D36 updated)
- Hold a Level 3 NVQ in plumbing or a related building services engineering qualification.

5.8. Expert Witness Roles and Responsibilities

- To observe the Learner's performance undertaking practical assessment tasks in the workplace
- Using the assessment criteria provided, determine whether or not the learner has completed the tasks satisfactorily
- To satisfactorily complete the assessment documentation to reflect the outcomes of the assessment.

5.8.1. Expert Witness Competence Requirements

The Expert witness should:

- Be occupationally competent i.e. having up-to-date knowledge of each industry (for the assessment being undertaken), its settings, legislative and regulatory requirements, codes of practice, guidance, working practices and techniques
- Be familiar with the national occupational standards and be able to interpret current working practices and technologies within the area of work
- Evidence from expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency
- Have no conflict of interest in the outcome of their evidence.

(It is not necessary for expert witnesses to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by an expert witness.)

6. Support Materials

6.1. Qualification Specification

This Qualification Specification provides details of all Units, Learning Outcomes, Assessment Criteria and specific advice regarding the assessment process.

6.2. Textbooks

BPEC Qualification Textbooks are available from www.bpec.org.uk.

6.3. Learner Underpinning Knowledge Packs

Underpinning Knowledge packs are available from BPEC.

6.4. Learner Practical Work Book

Learner practical work books are available from BPEC.

6.5. Learner Practical Guide

Learner practical guides are available from BPEC.

6.6. Schemes of Work

Individual Schemes of Work for all units in all phases are available from BPEC. New Schemes of Work have been provided on the secure portal for the **GAS PATHWAY** that take into account the requirements of IGEM/IG/1 supplement 2, 2022 and these must be used whenever gas training is taking place. Schemes of work are available for all gas Units 14 and 15.

6.7. PowerPoint Presentations

A full complement of PowerPoint Presentations for phases 1 and 2 are available from BPEC. Phases 3 will be released in spring 2020.

7. The Phased Approach to Training and Assessment

7.1. Phases 1 to 4

The Plumbing and Domestic Heating Technician Standard and its associated Assessment Plan indicate a typical duration of 48 months to complete the Qualification and the associated End-point Assessment (EPA).

The qualification is delivered over a 45-month period and is divided into four (4) Phases. Phase 1, 2 and 3 cover the core plumbing units and are delivered over a period of 36 months. At the end of each Phase the candidates will attempt an 'end of Phase' holistic assessment and a multiple-choice question test based on the Learning Outcomes and the Assessment Criteria required for that Phase. The practical assessments are externally set by BPEC and internally assessed by the centre. The multiple-choice examinations are administered online.

Phase 4 covers the candidates chosen fuel Pathway and is delivered over a period of 9 months.

The Pathway options are:

- **Natural Gas Pathway** – this entitles the Candidate to apply for Gas Safe registration in the following Categories:
 - Core Domestic Gas Safety – CCN1 (compulsory), now includes combustion performance analysis
 - Central Heating Boilers and Water Heaters – CENWAT
- **Oil Fuel Pathway** – This entitles the Candidate to apply for OFTEC registration in the following competencies:
 - OFT10-101 - Single stage pressure jet servicing and commissioning
 - OFT10-105E - Installation of oil-fired combustion appliances
 - OFT10-600a - Installation of oil fuel storage and supply systems
- **Mineral Solid Fuel and Biomass Pathway** – This entitles the Candidate to apply for HETAS registration in the following competencies:
 - HETAS Dry Appliance Installer (includes service & maintenance competency)
 - HETAS Wet Appliance Installer (includes service & maintenance competency)
 - HETAS Biomass Installer
 - HETAS System Chimney
- **Environmental Technologies Pathway** – This entitles the Candidate to apply for MCS registration in the following competencies:
 - Air Source Heat Pump Systems
 - Solar thermal hot water heating systems
 - Rainwater harvesting systems.

7.2. End-point Assessment

The candidate will be entitled to enter the 'Gateway' for End Point Assessment (EPA), after successful completion of the Qualification and after the candidate has met the prerequisites as set out in the Plumbing and Domestic Heating Technician Apprenticeship (level 3) Assessment Plan.

During the final 3 months of Phase 4 the candidate will attempt the five (5) assessments as set out in the Plumbing and Domestic Heating Technician Apprenticeship (level 3) Assessment Plan:

- A Multiple Choice Test
- A Design Project
- A Practical Installation Test
- A Practical Application Test
- A Professional Discussion.

At the end of the End Point Assessment, the Candidate will be awarded a grade – distinction, merit, pass, referred.

It **MUST** be the employer's decision to put an apprentice forward for EPA, once they are confident that the candidate is ready and has the necessary competencies for a successful completion. The employer may consult with the candidate and the training provider, centre or college for advice. An independent third party who has not been involved with either the Candidates training, assessment, or their employment will deliver the EPA. The independent third party is required to be an organisation that is registered on the Education and Skills Funding Agency's (ESFA) **Register of End-Point Assessment Organisations** (RoEPAO) for that apprenticeship standard. The third party is known as an End-Point Assessment Organisation, or EPAO. BPEC are recognised as an EPAO and are on the RoEPAO.

Successful completion of all 4 phases and End Point Assessment will entitle the Candidate to further registrations in the following Competent Persons Schemes:

- Unvented Hot Water Storage Systems
- Water Industry Approved Persons Scheme (WIAPS)
- The Candidate may also apply for Engineering Technician, or '**Eng.Tech**' status with the Engineering Council. A small fee is payable.

7.3. Re-sitting of Assessment Policy for Phases 1 to 4

In the event that a Candidate fails to achieve progression at the end of the Phase, they can resit that part of the assessment they have been referred in. The resit **MUST** take place within 14 calendar days from the date of the original assessment.

Should the Candidate be referred at the end of the second attempt, then the candidate must wait 60 days before a third attempt is allowed. During this time the Candidate will be required to undergo further training. A training plan will need to be agreed and documented between the employer, apprentice and training provider.

If the Candidate fails to achieve at the third attempt, the Candidate may again resit the assessment. The resit **MUST** take place within a 14-day period.

Should the Candidate be referred at the end of the fourth and final attempt, the candidate must repeat the training for that phase before taking the assess again. However, it will be the employer's decision with guidance from the training provider whether a further training plan will be offered, agreed and documented.

Phase assessment must be passed fully before attempting the next phase assessments.

8. Unit Overview

8.1. The Units Phase by Phase

Unlike previous Plumbing Qualifications, the L3 Diploma in Plumbing and Domestic Heating qualification is assessed at the **end** of each phase. This means that for the majority of their time within a college or training establishment, the Candidate will be training towards their 'end of phase' assessment. Strict rules regarding assessment must be enforced by the assessor:

1. The work produced, both practical and written, must be the Candidate's own work and strict rules on copying and plagiarism must be enforced
2. Co-operation between the Candidates is not allowed unless the task specifically states otherwise
3. Time limits for the tasks in the assessments should be adhered to
4. Correct Health and Safety must be observed at all times

Not all Units within the qualification are taught in their entirety from the start. Some units, and indeed, LOs and ACs are taught over a number of phases and it is recommended that tutors and assessors become familiar with each of the Phase Units, LOs and ACs content. These are shown in the following tables:

8.2. Phase 1 Learning Outcomes and Assessment Criteria

UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Health and Safety Systems	LO1 Know health and safety legislation that applies to the building services industry	1.1 to 1.5
	LO2 Understand hazardous situations working in the building services industry	2.1 to 2.7
	LO3 Apply personal protection measures	3.1 to 3.5
	LO4 Understand how to respond to accidents	4.1 to 4.5
	LO5 Apply procedures for electrical safety	5.1 to 5.6
	LO6 Understand how to work safely with heat producing equipment	6.1 to 6.7
	LO7 Safely use access equipment	7.1 to 7.4
	LO8 Understand working safely in excavations and confined spaces	8.1 to 8.4
Common Processes and Techniques	LO1 Use hand and power tools in domestic plumbing and heating work	1.1 and 1.2
	LO2 Know types of domestic plumbing and heating pipework and their jointing principles	2.1 to 2.5
	LO3 Understand site preparation techniques for plumbing and heating work	3.1 to 3.4
	LO4 Use clips and brackets to support domestic plumbing and heating pipework and components	4.1 to 4.4
	LO5 Install domestic plumbing and heating pipework	5.1 to 5.6
Scientific Principles	LO1 Understand units of measurement used in the plumbing and heating industry	1.1 to 1.3
	LO2 Understand properties of materials	2.1 to 2.6
	LO5 Understand mechanical principles in the plumbing and heating industry	5.1 to 5.2
Planning and Supervision	LO1 Know the role of the construction team within the plumbing and heating industry	1.1 to 1.3
	LO2 Understand information sources in the building services industry	2.1 to 2.2
	LO3 Know how to communicate with others	3.1 to 3.4

	LO4 Understand responsibilities of relevant people in the building services industry	4.1 to 4.3
Cold Water Systems	LO1 Understand cold water supply route to dwellings	1.1 to 1.7
	LO2 Install cold water systems	2.1
Hot Water Systems	LO1 Install hot water systems	1.1
Central Heating Systems	LO1 Install central heating systems	1.1
Rainwater Systems	LO1 Install rainwater systems	1.1
Sanitation Systems	LO1 Install sanitary appliances and pipework systems	1.1

8.3. Phase 2 Learning Outcomes and Assessment Criteria

UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Cold Water Systems	LO2 Install cold water systems	2.2 to 2.10
	LO3 Decommission cold water systems	3.1 to 3.2
	LO5 Perform a soundness test and commission cold water systems and components	5.1 to 5.6
Hot Water Systems	LO1 Install hot water systems	1.2 to 1.12
	LO2 Decommission hot water systems	2.1 to 2.2
	LO4 Perform a soundness test and commission hot water systems and components	4.1 to 4.6
Rainwater Systems	LO1 Install rainwater systems	1.2 to 1.9
	LO2 Decommission rainwater systems	2.1 to 2.2
	LO4 Perform a soundness test and commission rainwater systems	4.1 to 4.7
Sanitation Systems	LO1 Install sanitary appliances and pipework systems	1.2 to 1.14
	LO2 Decommission sanitary appliances, pipework systems and components	2.1 to 2.2
	LO4 Perform a soundness test and commission sanitary appliances, pipework systems and components	4.1 to 4.6
Central Heating Systems	LO1 Install central heating systems	1.2 to 1.13
Scientific Principles	LO2 Understand properties of materials	2.7
	LO3 Understand the relationship between energy, heat and power	3.1 to 3.6
	LO4 Understand principles of force and pressure and their application in the plumbing and heating industry	4.1 to 4.7
	LO6 Understand principles of electricity in the plumbing and heating industry	6.1 to 6.4

8.4. Phase 3 Learning Outcomes and Assessment Criteria

UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Domestic Fuel Systems	LO1 Understand factors affecting fuel selection	1.1 to 1.6
	LO2 Know combustion processes of fuel supply systems	2.1 to 2.9
	LO3 Know principles of chimney/flue systems.	3.1 to 3.7

Environmental Technology Systems	LO1 Know the basic operating principles of micro-renewable energy and water conservation technologies.	1.1 to 1.3
	LO2 Understand requirements to install micro-renewable energy and water conservation systems to existing systems	2.1 to 2.5
Electrical Work and the Control of Plumbing and Domestic Heating Systems	LO1 Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating	1.1 to 1.10
	LO2 Apply industry standard safe isolation procedures	2.1 to 2.2
	LO3 Carry out the safe installation, testing and decommissioning of electrical systems	3.1 to 3.4
	LO4 Carry out the identification of faults and safe repair of electrical work	4.1
Cold Water Systems	LO4 Size and select cold water systems and components for dwellings	4.1 to 4.7
	LO5 Perform a soundness test and commission cold water systems and components	5.7 to 5.11
	LO6 Perform fault diagnosis and rectification procedures on cold water systems	6.1 to 6.3
	LO7 Carry out service and maintenance of cold water systems	7.1 to 7.5
Hot Water Systems	LO3 Size and select hot water systems and components for dwellings	3.1 to 3.7
	LO4 Perform a soundness test and commission hot water systems and components	4.7 to 4.11
	LO5 Perform fault diagnosis and rectification procedures on hot water systems	5.1 to 5.3
	LO6 Carry out service and maintenance of hot water systems	6.1 to 6.5
Central Heating Systems	LO1 Install central heating systems	1.14
	LO2 Decommission central heating systems	2.1 to 2.2
	LO3 Size and select central heating systems and components for dwellings	3.1 to 3.7
	LO4 Perform a soundness test and commission central heating systems and components	4.1 to 4.11
	LO5 Perform fault diagnosis and rectification procedures on central heating systems	5.1 to 5.3
	LO6 Carry out service and maintenance of central heating systems	6.1 to 6.4
Rainwater Systems	LO3 Size and select rainwater systems components for dwellings	3.1 to 3.6
	LO5 Perform fault diagnosis and rectification procedures on rainwater systems	5.1 to 5.3
Sanitation Systems	LO3 Size and select sanitary appliances pipework system and components for dwellings	3.1 to 3.6
	LO4 Perform a soundness test and commission sanitary appliances, pipework systems and components	4.6
	LO5 Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems	5.1 to 5.3
	LO6 Carry out service and maintenance of sanitary appliances and pipework systems	6.1 to 6.4

8.5. Phase 4 Learning Outcomes and Assessment Criteria and Pathways

UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Planning and Supervision	LO5 Produce risk assessments and method statements for the plumbing and heating industry	5.1 to 5.4
	LO6 Produce a work programme for tasks in the plumbing and heating industry	6.1 to 6.5

GAS PATHWAY		
Specific Domestic Core Safety for Natural Gas	LO1 Know the natural gas supply network and LPG supplies	1.1 to 1.2
	LO2 Know the operation pressure regulators	2.1 to 2.3
	LO3 Know the characteristics of the combustion processes with natural gas	3.1 to 3.10
	LO4 Know the types of burners used with natural gas	4.1 to 4.5
	LO5 Know how to install gas pipework in domestic and small commercial premises	5.1 to 5.14
	LO6 Know how domestic Natural Gas supplies are metered, regulated and controlled	6.1 to 6.10
	LO7 Know how to take pressure readings and gas rates in domestic gas systems and check meter regulators	7.1 to 7.7
	LO8 Understand how to tightness test and purge gas pipework in small natural gas installations	8.1 to 8.13
	LO9 Know how to re-establish gas supplies and relight appliances	9.1 to 9.3
	LO10 Know industry specific legislation and standards	10.1 to 10.2
	LO11 Demonstrate that gas safety controls are operating correctly and the actions required when unsafe or ineffective operation is found	11.1 to 11.5
	LO12 Know the ventilation requirements of gas appliances installed in dwellings	12.1 to 12.10
	LO13 Know the standards of chimneys and flue systems to be used with gas appliances	13.1 to 13.10
	LO14 Carry out chimney performance checks	14.1 to 14.8
	LO15 Use the Gas Industry Unsafe Situations Procedures	15.1 to 15.9
	LO16 Know the gas emergency actions, responsibilities and procedures relevant to the industry	16.1 to 16.2
	LO17 Use of combustion and atmosphere sampling analysers	17.1 to 17.9
	LO18 Install and commission a small domestic gas installation	18.1 to 18.14
Install and Maintain Gas Water Heating and Wet Central Heating Appliances	LO1 Know the uses of gas water heating and wet central heating appliances in dwellings	1.1 to 1.3
	LO2 Know the types of gas water heating and wet central heating appliances and their layout requirements	2.1 to 2.4
	LO3 Plan gas systems for installing domestic gas water heaters and wet central heating appliances	3.1 to 3.9
	LO4 Prepare work activities for installing, maintaining domestic gas water heaters and wet central heating appliance	4.1 to 4.12

	LO5 De-commission domestic gas water heaters and wet central heating appliances	5.1 to 5.2
	LO6 Install, exchange, and remove gas pipework to industry standards	6.1 to 6.8
	LO7 Tightness testing and direct purging of gas systems and components	7.1 to 7.11
	LO8 Install domestic gas water heaters and wet central heating appliances	8.1 to 8.14
	LO9 Maintain domestic water heating and wet central heating appliances	9.1 to 9.19
	LO10 Diagnose and rectify faults on domestic water heating and wet central heating appliances	10.1 to 10.14
	LO11 Commission domestic gas water heaters and wet central heating appliances	11.1 to 11.22

OIL PATHWAY		
Core Principles of Oil Fuel Systems for Dwellings (Safety and Efficiency)	LO1 Know the health and safety risks and safe systems of work associated with oil storage, appliances and heating systems installation work	1.1 to 1.5
	LO2 Demonstrate the procedure to be followed in the case of oil spills	2.1 to 2.2
	LO3 Know the oil supply legislation, regulations and guidance	3.1 to 3.7
	LO4 Understand actual and potential risks relating to oil tanks and associated pipework	4.1 to 4.4
	LO5 Select domestic oil storage tanks and associated fittings to meet installation requirements	5.1 to 5.11
	LO6 Know the requirements for the installation of non-domestic oil storage tanks	6.1 to 6.9
	LO7 Install oil storage tanks	7.1 to 7.8
	LO8 Install oil supply pipelines	8.1 to 8.16
	LO9 Test oil pipework for soundness	9.1 to 9.7
	LO10 Diagnose and rectify faults for oil supply systems	10.1 to 10.4
	LO11 Know how to safely decommission oil storage tanks	11.1
Install, Commission, Maintain and Service Oil Systems and Appliances in the Work Place	LO1 Know the combustion process and the types of burners used in oil fired appliances	1.1 to 1.10
	LO2 Know ventilation requirements of oil fired appliances	2.1 to 2.9
	LO3 Know the standards of chimneys and flue systems to be used with oil fired appliances	3.1 to 3.11
	LO4 Test oil fired appliance flue systems for effective operation	4.1 to 4.3
	LO5 Know how to identify and respond to unsafe situations relating to oil systems and appliances	5.1 to 5.2
	LO6 Know the types of pressure jet oil fired appliances	6.1 to 6.2
	LO7 Know condensate disposal requirements of condensing oil fired appliances	7.1 to 7.3
	LO8 Know energy efficiency legislation applicable to pressure jet oil fired appliances	8.1 to 8.5
	LO9 Size and select pressure jet oil fired appliances to meet customers' needs	9.1 to 9.3

	LO10 Install pressure jet oil fired appliances	10.1 to 10.2
	LO11 Commission pressure jet oil fired appliances	11.1 to 11.11
	LO12 Decommission pressure jet oil fired appliances	12.1 to 12.6
	LO13 Carry out service and maintenance of pressure jet oil fired systems and appliances	13.1 to 13.7
	LO14 Carry out fault diagnosis of pressure jet oil fired appliances	14.1 to 14.9

SOLID FUEL/BIOMASS PATHWAY		
Safety Principles (Solid Mineral Fuel and Biomass Combustion)	LO1 Understand solid mineral fuel and biomass combustion legislation that applies to work in dwellings	1.1 to 1.5
	LO2 Understand the types of solid fuels and the factors affecting fuel selection	2.1 to 2.4
	LO3 Understand the factors that affect the selection of solid fuel appliances	3.1 to 3.4
	LO4 Know the combustion process and the principles of safe combustion of solid fuels	4.1 to 4.8
	LO5 Apply ventilation requirements of solid mineral fuel and biomass combustion appliances installed in dwellings	5.1 to 5.10
	LO6 Understand standards of chimneys and flue systems to be used with solid mineral fuel and biomass combustion appliances in dwellings	6.1 to 6.10
	LO7 Understand methods of diagnosing problems with flue/chimney performance	7.1 to 7.4
	LO8 Understand the requirements for hearths and fireplace surrounds to solid mineral fuel and biomass combustion appliances	8.1 to 8.5
	LO9 Understand how to test solid mineral fuel and biomass combustion appliances and associated flue systems in dwellings for effective operation	9.1 to 9.6
	LO10 Understand how to identify and respond to unsafe situations relating to flue systems and appliances in dwellings	10.1 to 10.2
Plan, Install, Commission, Service and Maintain Solid Mineral Fuel and Biomass Combustion Appliances	LO1 Know types of solid mineral fuel and biomass combustion appliances and their operating principles	1.1 to 1.3
	LO2 Know the energy efficiency legislation applicable to solid mineral fuel and biomass combustion	2.1 to 2.4
	LO3 Select solid mineral fuel and biomass combustion appliances to meet customers' needs	3.1 to 3.3
	LO4 Install solid mineral fuel and biomass combustion appliances	4.1 to 4.3
	LO5 Commission solid mineral fuel and biomass combustion appliances	5.1 to 5.12
	LO6 Decommission solid mineral fuel and biomass combustion appliances	6.1 to 6.10
	LO7 Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances	7.1 to 7.12

ENVIRONMENTAL PATHWAY		
Air Source Heat Pump Systems	LO1 Health and safety risks and legislation associated with air source heat pump systems	1.1 to 1.3
	LO2 Different types of air source heat pump systems	2.1 to 2.6

	L03 Design air source heat pump systems	3.1 to 3.17
	L04 Install air source heat pump systems	4.1 to 4.5
	L05 Service and maintenance of air source heat pump systems	5.1 to 5.4
	L06 Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems	6.1 to 6.6
	L07 Perform a test, commission and handover of air source heat pump systems	7.1 to 7.8
Rainwater Harvesting and Greywater Reuse Systems	L01 Rainwater harvesting and greywater reuse systems	1.1 to 1.7
	L02 Install rainwater harvesting and greywater reuse system components	2.1 to 2.4
	L03 Test, commission and handover rainwater harvesting and greywater reuse systems	3.1 to 3.5
	L04 Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems	4.1 to 4.5
Solar Thermal Hot Water Systems	L01 Health and safety and relevant legislation, regulations and standards	1.1 to 1.3
	L02 Fundamental design principles for solar thermal hot water systems	2.1 to 2.10
	L03 Install solar thermal hot water systems	3.1 to 3.6
	L04 Test, commission and handover of solar thermal hot water systems	4.1 to 4.3
	L05 Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation	5.1 to 5.3

8.6. Core Work Based learning on-site assessment (Does not include WBL for the chosen pathway)

UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Install, Commission, Service and Maintain Domestic Plumbing and Heating Systems	L01 Apply Health and Safety and welfare in the workplace	1.1 to 1.13
	L02 Prepare for the installation of plumbing and heating systems and components	2.1 to 2.5
	L03 Install plumbing and heating systems and components in the workplace	3.1 to 3.7
	L04 Perform fault diagnosis and rectification procedures	4.1 to 4.5
	L05 Commission plumbing and heating systems in the workplace	5.1 to 5.8
Evidence must be gathered across a minimum of four different jobs/site addresses. It is an expectation that candidates will require more than the minimum four jobs to meet the full range required.		

9. Unit Details - Core

9.1. Unit 01: Health and Safety Systems

Unit level	2	<i>This unit provides essential health and safety knowledge required to work safely in the plumbing and domestic heating industries, on new-build construction sites and refurbishment projects in occupied and unoccupied properties.</i>
GLH	88	
Unit	Learning Outcomes	Assessment Criteria
Health and Safety Systems	LO1 Know health and safety legislation that applies to the building services industry	1.1 to 1.5
	LO2 Understand hazardous situations working in the building services industry	2.1 to 2.7
	LO3 Apply personal protection measures	3.1 to 3.5
	LO4 Understand how to respond to accidents	4.1 to 4.5
	LO5 Apply procedures for electrical safety	5.1 to 5.6
	LO6 Understand how to work safely with heat producing equipment	6.1 to 6.7
	LO7 Safely use access equipment	7.1 to 7.4
	LO8 Understand working safely in excavations and confined spaces	8.1 to 8.4

Learning Outcome 1	
Know health and safety legislation that applies to the building services industry	
Assessment Criteria	
1.1	Identify health and safety legislation in protecting the workforce and members of the public <ul style="list-style-type: none"> • General legislation • Construction specific legislation • Building services specific legislation – to include CSCS card
1.2	Define responsibilities of members of the construction team <ul style="list-style-type: none"> • Employers (including employer representatives) • Designers • Main contractors • Sub-contractors • Employees • Self-employed (labour only) • Clients (customers)
1.3	Describe the legal status of health and safety guidance materials <ul style="list-style-type: none"> • Acts of parliament • Regulations • Approved codes of practice • HSE guidance notes
1.4	Identify the role of enforcing authorities <ul style="list-style-type: none"> • Health and Safety Executive • Local Authority

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 1 **continued**

Know health and safety legislation that applies to the building services industry

Assessment Criteria

- 1.5** State the control measures of inspectors
- Improvement notice
 - Prohibition notice
 - Powers of prosecution
 - Role in providing advice and guidance.

Learning Outcome 2

Understand hazardous situations working in the building services industry

Assessment Criteria

- 2.1** Identify types of site hazards that may be encountered while at **work** or by members of the public
- Construction sites (all property types)
 - In industrial commercial premises (occupied and unoccupied refurbishment)
 - In dwellings (occupied and unoccupied refurbishment)
 - Vehicle use (driving time limits, driving duress)
- 2.2** Define **strategies** used to prevent accidents during work activities
- Risk assessments
 - Method statements
 - Permit to work systems
 - Safety notices
 - CSCS card
- 2.3** State how the hazards of some substances and mixtures can be identified from the **labels** on packaging
- Globally Harmonised System (GHS) on the classification and labelling of hazardous substances and mixtures
 - Categorisation and hazard classes:
Physical hazards:
 - Explosives
 - Flammable gases
 - Oxidising liquids
 - Corrosive to metals**Health hazards:**
 - Acute toxicity
 - Skin corrosion/irritation
 - Eye damage/irritation
 - Respiratory/skin sensitisation**Environmental hazards:**
 - Hazardous to the aquatic environment
 - Presentation of information:
 - GHS pictogram
 - Signal word (Danger or Warning)
 - Hazard statement (Causes serious eye damage, Toxic if swallowed, etc.)
 - Precautionary statement (Wear eye protection, Do not eat, drink or smoke when using this product, etc.)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 2 **continued**

Understand hazardous situations working in the building services industry

Assessment Criteria

- 2.4** Describe how to deal with commonly encountered **substances**
- Lead – solid and fume
 - Solvents and lubricants
 - Fluxes
 - Jointing compounds
 - Sealants
 - Gases – LPG, oxy-acetylene and carbon dioxide
 - Petroleum
 - Diesel fuels
 - Cleaning agents
- 2.5** Identify **common building materials and services** components that may contain asbestos
- Flue, soil, rainwater pipes and gutters
 - Tanks and cisterns
 - Artex
 - Small gaskets and seals
 - Bath panels/panelling
 - Floor tiles
- 2.6** Identify **types of asbestos** that may be encountered in the workplace
- White (Chrysotile)
 - Brown or grey (Amosite)
 - Blue (Crocidolite)
 - Asbestos cement-based materials
- 2.7** State **procedures** that must be used to safely work with asbestos cement based materials
- Work activities for licensed and unlicensed work
 - Licensing requirements for asbestos removal organisations
 - Safe disposal requirements
 - Protection of the workforce and members of the public.

Learning Outcome 3

Apply personal protection measures

Assessment Criteria

- 3.1** State the purpose of **personal protective equipment (PPE)**
- Clothing protection including high visibility
 - Eye protection
 - Hand protection
 - Head protection
 - Foot protection
 - Hearing protection
 - Respiratory protection
 - Vibration protection
 - Harnesses

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 3 **continued**

Apply personal protection measures

Assessment Criteria

3.2 Apply and use **personal protective equipment (PPE)**

- Clothing protection including high visibility
- Eye protection
- Hand protection
- Head protection
- Foot protection
- Hearing protection
- Respiratory protection
- Vibration protection
- Harnesses

3.3 Define **procedures** for manual handling

- Assessment of a safe load
- Safe kinetic lifting technique

3.4 Carry out correct manual handling

3.5 Use **mechanical lifting aids**

- Sack trolley.

Learning Outcome 4

Understand how to respond to accidents

Assessment Criteria

4.1 State requirements for first-aid provision in the **workplace**

- In small occupied properties
- On construction sites (new-build and refurbishment)

4.2 Describe actions that should be taken when an accident or emergency is discovered

4.3 Identify procedures for dealing with **minor injuries**

- Cuts
- Minor burns
- Objects in the eye
- Exposure to fumes

4.4 Identify procedures for dealing with **major injuries**

- Bone fractures
- Unconscious co-workers
- Electric shock
- Concussion

4.5 State **recording procedures** for accidents and near misses at work

- Statutory requirements
- Accident books
- Details to be recorded on a simple accident/incident report form.

Learning Outcome 5

Apply procedures for electrical safety

Assessment Criteria

- 5.1** Identify common **electrical dangers** encountered on construction sites and in private dwellings
- Faulty electrical equipment
 - Signs of damaged or worn electrical cables – power tools and property hard wiring system
 - Trailing cables
 - Proximity of cables to services pipework
 - Buried/hidden cables
 - Inadequate over-current protection devices
- 5.2** State methods of safe supply for **electrical tools** and equipment on site
- Battery-powered
 - 110 volt
 - 230 volt
- 5.3** State the procedure that should be applied for tools and equipment that fail safety checks
- Drill bits
 - Cutting blades
- 5.4** Identify safe isolation procedure when replacing **attachments** to power tools
- Drill bits
 - Cutting blades
- 5.5** Conduct **visual inspection** of a power tool for safe condition before use
- Valid PAT test
 - Visual checks for general condition
- 5.6** Use temporary continuity bonding when working on pipework components.

Learning Outcome 6

Understand how to work safely with heat-producing equipment

Assessment Criteria

- 6.1** Identify various **types of gases** used in pipe and sheet jointing processes
- Propane
 - MAPP gas
 - Butane
 - Oxy/acetylene
- 6.2** Describe 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
- Hoses
 - Colours used
 - Thread directions
 - Flashback arrestors
 - Dates
 - Control valves
 - Gauges
 - Blowpipes

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 6 **continued**

Understand how to work safely with heat-producing equipment

Assessment Criteria

- 6.4** Describe how gas heating equipment is **safely assembled** and used
- Bottle location and position
 - Equipment assembly sequence
 - Leak detection procedures
 - Safe purging procedure
 - Safe lighting and extinguishing procedure
 - Actions in the event of leakage
 - Transportation
- 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** Describe the method for **fighting small localised fires** that can occur in the workplace
- Tackling fires to aid escape
 - Types of extinguisher
 - Selection of extinguisher by fire type
 - Method of use
 - Evacuation procedures.

Learning Outcome 7

Safely use access equipment

Assessment Criteria

- 7.1** Identify situations where it may be necessary to work at height
- 7.2** State how to select appropriate **access equipment** to permit work at heights
- Step ladders
 - Ladders
 - Harnesses
 - Roof ladders and crawling boards
 - Mobile tower scaffolds
 - Fixed scaffolds and edge protection
 - Mobile elevated work platforms including scissor lifts and cherry pickers
- 7.3** Define safety checks to be carried out on access equipment
- 7.4** **Use** access equipment
- Step ladders
 - Ladders
 - Mobile tower scaffold.

Learning Outcome 8

Understand working safely in excavations and confined spaces

Assessment Criteria

8.1 Identify situations where it may be necessary to work in **excavations** and **confined spaces**

Excavations

- Drainage systems
- Cold water mains
- Foundations

Confined spaces

- Plant rooms
- Main service duct-rooms
- Tanks, cylinders, boilers or cisterns
- Under suspended timber floors
- Roof spaces

8.2 Identify **safe working** in excavations and confined spaces

- Safe access into the excavation
- Trench support systems

8.3 State **dangers** associated with excavations and confined spaces

- Inadequate ventilation
- Inadequate lighting
- Flooding
- Obstruction of an escape route
- Explosion
- Collapse

8.4 State **safety measures** when working in excavations and confined spaces

- Warning signs
- Safety barriers
- Vehicle stops
- Permit to work.

9.2. Unit 02: Common Processes and Techniques

Unit level	2	<i>This unit covers knowledge of basic pipework required when installing all plumbing and domestic heating systems and provides an introduction to the range of work activities carried out in plumbing and domestic heating, including methods of checking that pipework and components are leak free.</i>
GLH	88	
Unit	Learning Outcomes	Assessment Criteria
Common Processes and Techniques	LO1 Use hand and power tools in domestic plumbing and heating work	1.1 and 1.2
	LO2 Know types of domestic plumbing and heating pipework and their jointing principles	2.1 to 2.5
	LO3 Understand site preparation techniques for plumbing and heating work	3.1 to 3.4
	LO4 Use clips and brackets to support domestic plumbing and heating pipework and components	4.1 to 4.4
	LO5 Install domestic plumbing and heating pipework	5.1 to 5.6

Learning Outcome 1	
Use hand and power tools in domestic plumbing and heating work	
Assessment Criteria	
1.1	<p>Identify the purpose of hand tools and power tools</p> <p>Hand tools</p> <ul style="list-style-type: none"> • Screwdriver • Hammer • Chisel • Grip • Wrench • Spanner • Spirit level • Manual pipe threader • Pipe cutter • Hand saw • Pliers • Bending tool <p>Power tools</p> <ul style="list-style-type: none"> • Power drill • Circular saw • Jig saw • Reciprocating saws • Portable pipe threading machine • Hydraulic machine bender • Hydraulic crimping kit • Portable pipe freezing kit
1.2	Use and maintain hand and power tools

Learning Outcome 2

Know types of domestic plumbing and heating pipework and their jointing principles

Assessment Criteria

- 2.1** Identify **pipework materials and sizes** used in dwellings
- Copper
 - R220 soft coils
 - R250 half hard lengths
 - R290 hard lengths
 - Low carbon steel (LCS)
 - Medium grade
 - Plastic pipework (hot, cold and heating)
 - Polyethylene (MDPE)
 - Polybutylene
 - Plastic pipework (sanitary)
 - PVC-u
 - Polypropylene
 - MUPVC
 - ABS
 - Lead
- 2.2** State methods of jointing new hot and cold water pipe to existing lead pipework
- 2.3** Identify **fitting** types used in dwellings
- Couplers
 - Elbows and bends
 - Equal tees
 - Reducing tees
 - Reducers
 - Tap connectors
 - Flexible connectors
 - Manifolds
 - Tank connectors
- 2.4** Describe methods of **jointing** pipework used in dwellings
- Copper pipe
 - Solder ring and end feed
 - Compression (type A and B)
 - Push-fit
 - Press-fit
 - Low carbon steel (LCS) pipe
 - Threaded
 - Plastic pressure pipe
 - Push-fit
 - Compression
 - Proprietary – copper and MDPE
 - Plastic jointing (sanitary)
 - Ring seal
 - Compression
 - Solvent

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 2 *continued*

Know types of domestic plumbing and heating pipework and their jointing principles

Assessment Criteria

2.5 Describe methods of **bending** pipework used in dwellings

- Copper machine bending
 - 90° bends
 - Sets and offset bends
 - Passover bends
- Copper spring bend
 - 90° bends
 - Sets and offset bends
- LCS hydraulic machine bending
 - 90° bends
 - Sets and offset bends
 - Passover bends
- Plastic pressure pipe
 - Spring bend
 - Cabling technique
 - Cold forming bend

Learning Outcome 3

Understand site preparation techniques for plumbing and heating work

Assessment Criteria

3.1 State **work methods** for preparing and protecting the building for installation work

- Holes in masonry surfaces – hammer and chisel, large power drill
- Making good to masonry surfaces
- Lifting and replacing timber flooring materials
- Notching timber floor joists
- Drilling holes – timber floor joists
- Cutting chases – wall and floor surfaces
- Walking boards
- Dust sheets
- Removal of personal property

3.2 Identify the pre-existing damage checks to the building fabric or customer property before the work commences

3.3 Describe the methods of safe storing of tools, equipment and materials

3.4 Identify **sources of information** for carrying out preparatory work

- Regulations
- Industry standards
- Manufacturers' technical instructions
- Building plans
- Specifications.

Learning Outcome 4

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

Assessment Criteria

- 4.1** Describe how to measure and mark out for fixings to pipework and plumbing and heating components
- 4.2** Identify types of **fixing devices**
- Nails
 - For timber
 - For masonry
 - Screws
 - Slotted head
 - Phillips head
 - Pozidrive
 - Plastic plugs
 - Heavy-duty fixings
 - Coach bolts
 - Rawlbolts
 - Cavity fixings
 - Drive in fixings
 - Chemical fixings
 - Channel fixings
- 4.3** Identify **clip and bracket types**
- Munsen rings
 - School board clips
 - Copper pipework
 - LCS pipework
 - Plastic pipework
- 4.4** Select and fix clips and brackets appropriate to the **system pipework** and the industry recommended spacing
- Hot water
 - Cold water
 - Central heating.

Learning Outcome 5

Install domestic plumbing and heating pipework

Assessment Criteria

- 5.1** Identify pipework installation **requirements**
- Prefabrication of pipework
 - Installing pipework in-situ
 - Use of sleeves
 - Fire stopping to pipework
 - Timber joist notching
 - First and second fix
 - Pipework protection
- 5.2** Select pipework materials and fittings from instructions

LEARNING OUTCOME CONTINUED ON NEXT PAGE

5.3 Measure, mark and cut pipework **materials** for **installation**

Materials

- Copper pipework – hot, cold and central heating
- LCS pipework – central heating
- Plastic pipework – hot, cold, central heating and sanitation pipework

Installation

- Hot water
- Cold water
- Central heating
- Sanitation

5.4 Fabricate pipework **bends** to clear obstacles

- Copper machine bending
 - 90° bends
 - Sets and offset bends
 - Passover bends
- LCS hydraulic machine bending
 - 90° bends
 - Sets and offset bends
 - Passover bends
- Plastic (hot, cold and heating)
- Cabling technique

5.5 Select, position and fix pipework materials to specifications

5.6 **Joint** pipework to specifications

- Copper pipe
 - Solder ring and end feed
 - Compression (type A and B)
 - Push-fit
 - Press-fit
- Low carbon steel (LCS) pipe
 - Threaded
- Plastic pipe (hot, cold and heating)
 - Push-fit
 - Compression
 - Proprietary – copper and MDPE
- Plastic jointing (sanitary)
 - Ring seal
 - Compression.

9.3. Unit 03: Scientific Principles

Unit level	2	<i>This unit covers essential scientific principles that underpin the installation, commissioning and maintenance requirements of systems and components in the plumbing and domestic heating industries, including a range of basic calculation methodologies.</i>
GLH	70	
Unit	Learning Outcomes	Assessment Criteria
Scientific Principles	LO1 Understand units of measurement used in the plumbing and heating industry	1.1 to 1.3
	LO2 Understand properties of materials	2.1 to 2.7
	LO3 Understand the relationship between energy, heat and power	3.1 to 3.6
	LO4 Understand principles of force and pressure and their application in the plumbing and heating industry	4.1 to 4.7
	LO5 Understand mechanical principles in the plumbing and heating industry	5.1 to 5.2
	LO6 Understand principles of electricity in the plumbing and heating industry	6.1 to 6.4

Learning Outcome 1

Understand units of measurement used in the plumbing and heating industry

Assessment Criteria

1.1 Identify internationally recognised (SI) **units of measurement**

- Metre (length) m
- Kilogram (mass) kg
- Second (time) s
- Kelvin (temperature) K
- Pascals Pa
- Bar

1.2 State the application and use of **SI derived units**

- Area (m²)
- Volume (m³)
- Litres (l)
- Density (kg/m³)
- Velocity (m/s)

1.3 Describe the use of conversion tables for non-SI units.

Learning Outcome 2

Understand properties of materials

Assessment Criteria

2.1 Compare **relative densities** of common materials

- To air
- To water

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 2 **continued**

Understand properties of materials

Assessment Criteria

- 2.2** Identify properties and applications of **solid materials**
- Pure metals
 - Ferrous metals
 - Alloys including solders
 - Thermoplastics
 - Thermo-setting plastics
 - Fireclays/ceramics
- 2.3** Explain **reasons** why solid materials breakdown
- Atmospheric corrosion
 - Oxidisation of metals
 - UV damage to plastics
 - Heat damage to plastics
 - Electrolytic corrosion
 - Electromotive series
 - Dissimilar metals in the presence of an electrolyte (water)
 - Erosion corrosion
- 2.4** Outline methods of preventing corrosion
- 2.5** Identify applications of **liquids** and **gases**
- Liquids**
- Water
 - Refrigerants
 - Anti-freeze/glycol mixes
 - Fuel oils
 - Lubricants/greases
- Gases**
- Air and steam
 - LPG
 - Natural gas
 - Carbon dioxide
 - Refrigerant gases
- 2.6** Describe basic **properties of liquids**
- Water
 - Boiling/freezing point
 - Change of state and molecular changes
 - Volume and pressure increases
 - Density at differing temperatures
 - Steam/super-heated steam
 - Capillarity
 - Acidity/alkalinity (ph value)
 - Water hardness
 - Soft, Temporary hard and Permanently hard

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 2 **continued**

Understand properties of materials

Assessment Criteria

- 2.7** Describe basic **properties of gases**
- Natural gas, LPG and air
 - Pressure
 - Volume
 - Temperature of gases found within the industry
 - Charles's law
 - Boyle's law.

Learning Outcome 3

Understand the relationship between energy, heat and power

Assessment Criteria

- 3.1** Identify the relationship between the Celsius and kelvin temperature scales
- 3.2** Describe the principles associated with a **change of state**
- Melting
 - Freezing
 - Boiling
 - Evaporating
 - Condensing
- 3.3** Identify the terms latent and sensible heat as they apply to liquids and gases
- 3.4** Define methods of **heat transfer**
- Conduction
 - Convection
 - Radiation
- 3.5** Distinguish how **units** of energy and heat are related and derived
- Energy – joules (J)
 - Specific heat capacity (kJ/kg/°C)
 - Power – watts (W)
 - Maximum density
 - Coefficient of linear expansion
- 3.6** Carry out heat, energy and power **calculations**
- Heat energy required to raise the temperature of a substance
 - Power required to heat a substance.

Learning Outcome 4

Understand principles of force and pressure and their application in the plumbing and heating industry

Assessment Criteria

- 4.1** State how **units of force and pressure** are derived from SI units
- Acceleration (m/s^2)
 - Force due to gravity
 - Force - Newton (N)
 - Pressure (N/m^2)
 - Atmospheric pressure (bar)
 - Flow rate (m^3/s)
- 4.2** Identify **pressure and flow rate** units of measurements
- Pressure
 - bar/millibar
 - kPa
 - psi
 - metre head
 - Flow rate
 - m^3/s
 - l/s
 - kg/s
- 4.3** Describe the application of pressure and flow rate measurements
- 4.4** Carry out simple **force and pressure** calculations
- Force calculations
 - Pressure head
 - Pressure calculations
 - Static pressure
 - Dynamic pressure
 - Draught
 - Forced draught
- 4.5** Explain the relationship between **velocity, pressure and flow rate** in systems
- Effects of increasing/reducing pressure
 - Effects of increasing/reducing pipe size
- 4.6** Identify how **restrictions** in the pipework affects the flow of liquids and gases
- Changes of direction, bends and tees
 - Pipe size
 - Pipe reductions
 - Roughness of material surface
 - Constrictions such as valves
- 4.7** Describe the principles of a siphon.

Learning Outcome 5

Understand mechanical principles in the plumbing and heating industry

Assessment Criteria

5.1 Outline principles of **simple machines**

- Levers
- Pulleys
- Archimedes screws

5.2 Outline principles of **basic mechanics**

- Theory of moments
- Action and reaction
- Centre of gravity
- Equilibrium
- Velocity and ratio
- Mechanical advantage.

Learning Outcome 6

Understand principles of electricity in the plumbing and heating industry

Assessment Criteria

6.1 Identify **basic principles** of electron flow theory

- Measurements of electrical flow
- Material conductivity and resistance
- Direct and alternating current

6.2 Describe the purpose and application of simple **units** of electrical measurement

- Current (amps)
- Voltage (volts)
- Resistance (ohms)
- Power (watts)

6.3 Carry out simple **electrical calculations**

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

6.4 Identify the requirements for earthing of electrical circuits.

9.4. Unit 04: Planning and Supervision

Unit level	2	<i>This unit covers the key points necessary to develop and maintain effective relationships when working with others on new-build construction sites and refurbishment projects for contract and private customers</i>
GLH	88	
Unit	Learning Outcomes	Assessment Criteria
Planning and Supervision	LO1 Know the role of the construction team within the plumbing and heating industry	1.1 to 1.3
	LO2 Understand information sources in the building services industry	2.1 to 2.2
	LO3 Know how to communicate with others	3.1 to 3.4
	LO4 Understand responsibilities of relevant people in the building services industry	4.1 to 4.2
	LO5 Produce risk assessments and method statements for the plumbing and heating industry	5.1 to 5.4
	LO6 Produce a work programme for tasks in the plumbing and heating industry	6.1 to 6.5

Learning outcome 1	
Know the role of the construction team within the plumbing and heating industry	
Assessment criteria	
1.1	Identify key roles of the site management team <ul style="list-style-type: none"> • Architect • Project manager • Clerk of works • Structural engineer • Surveyor • Building services engineer • Quantity surveyor • Buyer • Estimator • Contracts manager • Site manager • Health and safety manager
1.2	Identify key roles of the site operatives <ul style="list-style-type: none"> • Sub-contractors • Site supervisor • Trade supervisor • Bricklayer • Joiner • Plasterer • Tiler • Electrician • H&V fitter • Gas fitter • Decorator • Groundworkers

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Know the role of the construction team within the plumbing and heating industry

Assessment criteria

1.3 Identify common **site visitors**

- Inspectors
 - Building control
 - Water
 - HSE
 - Electrical services
- Members of the public
- Delivery drivers.

Learning Outcome 2

Understand information sources in the building services industry

Assessment Criteria

2.1 Interpret **workplace information**

- Statutory legislation
- Building regulations
- Job specifications
- Plans/drawings
- Work programmes
- Variation order
- Delivery notes
- Time sheets
- Policy documentation – health and safety, environmental, customer service
- Manufacturer guidance
- Installation instructions
- Service and maintenance instructions
- User instructions
- Customer information
 - Quotations
 - Estimates
 - Invoices/statements
 - Statutory cancellation rights
 - Handover information

2.2 State the importance of complying with **company policies and procedures**

- Company working policies/procedures
 - Behaviour
 - Timekeeping
 - Dress code
 - Contract of employment
 - Limits to personal authority
- Organisation/reporting structures
- Relevant qualifications and training.

Learning outcome 3

Know how to communicate with others

Assessment criteria

3.1 Identify methods for effective communication with **individual's needs**

- Disabilities
- Learning difficulties
- Language differences
 - Dialects
 - Accents
 - Foreign and second language issues

3.2 Identify suitable **communication methods**

- Oral communication
- Written communication
- Email
- Fax
- Letter
- Text
- Social media

3.3 Identify **appropriate actions** to deal with conflicting parties

- Mediation
- Negotiating
- Compromising
- Escalation

3.4 Explain the effects of poor communication with **individuals**

- Operatives
- Management
- Customers.

Learning outcome 4

Understand responsibilities of relevant people in the building services industry

Assessment criteria

4.1 Identify different types of **client**

- Private customer
 - Direct communication
 - Through customer representatives/managing agents
- Contracting customer
- Internal customer – within same company

4.2 Identify what may be communicated to the client through the progress of a job

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Understand responsibilities of relevant people in the building services industry

Assessment criteria

4.3 Define **duties** and **methods** for supervising staff

Duties

- Competence of operatives to undertake work
- Direct supervision or detailed direction is required
- Specific health and safety issues
- Responsibility for planning safe working for subordinates
- How to adjust work schedules when health and safety problems delay work

Methods

- Motivation
- Monitoring timesheets
- Direct supervision
- Monitoring outputs
- Work programmes.

Learning outcome 5

Produce risk assessments and method statements for the plumbing and heating industry

Assessment criteria

5.1 Identify different hazards

5.2 Identify levels of risk

5.3 Produce a risk assessment for a task

5.4 Produce a method statement for a task.

Learning outcome 6

Produce a work programme for tasks in the plumbing and heating industry

Assessment criteria

6.1 Identify types of **projects**

Projects

- Private installation work
- Private service/maintenance work
- New-build installation contract work
- Service/maintenance contract work

6.2 State **factors** to consider when planning activities to job specifications

Factors

- The scope, purpose and requirements of the work
- Identification of work responsibilities
- External factors that affect timeframe

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Produce a work programme for tasks in the plumbing and heating industry

Assessment criteria

- 6.3** Describe the impact when materials are not delivered on time against the **work programme**
- Work programme**
- Work in private properties
 - Work on new-build housing
 - Work on commercial contracts
 - Avoiding loss of materials on site (theft)
- 6.4** Identify **factors** which affect working time allocation to work activities
- Factors**
- Labour resources
 - Planning work with other trades
 - Material deliveries
- 6.5** Produce **simple** work programmes
- Simple**
- Bar (progress) charts.

9.5. Unit 05: Cold Water Systems

Unit level	3	<i>This unit covers the installation, maintenance, decommissioning and soundness testing of a range of cold water system/component types in domestic dwellings/light commercial properties. The scope of the system is from the boundary stop valve into the property feeding the water outlets.</i>
GLH	138	
Unit	Learning Outcomes	Assessment Criteria
Cold Water Systems	LO1 Understand cold water supply route to dwellings	1.1 to 1.7
	LO2 Install cold water systems	2.1 to 2.10
	LO3 Decommission cold water systems	3.1 to 3.2
	LO4 Size and select cold water systems and components for dwellings	4.1 to 4.7
	LO5 Perform a soundness test and commission cold water systems and components	5.1 to 5.11
	LO6 Perform fault diagnosis and rectification procedures on cold water systems	6.1 to 6.3
	LO7 Carry out service and maintenance of cold water systems	7.1 to 7.5

Learning outcome 1	
Understand cold water supply route to dwellings	
Assessment criteria	
1.1	State the key stages in the rainwater cycle
1.2	Identify the various sources of water and the typical properties of water from those sources <ul style="list-style-type: none"> • Surface sources <ul style="list-style-type: none"> – Lakes – Reservoirs – Rivers – Streams • Underground sources <ul style="list-style-type: none"> – Deep and shallow wells – Artesian wells – Bore-holes – Springs
1.3	Describe the two main types of water supply to dwellings and how these are regulated <ul style="list-style-type: none"> • Mains • Private
1.4	Identify fluid categories of water and uses of water supplied to dwellings <ul style="list-style-type: none"> • 1 to 5
1.5	Describe the mains water treatment process and typical mains water distribution system from treatment works to property

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Understand cold water supply route to dwellings

Assessment criteria

- 1.6** Identify mains water **service to the property** and isolation points
- Connection methods to the main
 - Communication pipe detail
 - Service pipe detail
 - Main external stop valve location and meter housings
 - Installation requirements
 - Methods of entry of the service pipework to a property
- 1.7** Define the requirements to provide water whilst preventing waste, undue consumption, misuse or contamination.

Learning outcome 2

Install cold water systems

Assessment criteria

- 2.1** Identify types and layout features of **cold water systems**
- Direct cold water system
 - Indirect cold water system
 - Borehole
 - Boosted
 - Direct boosted
 - Direct boosted to a water header or cistern
 - Indirect boosted to a cistern
 - Indirect boosted with pressure vessel
- 2.2** State advantages and disadvantages of cold water systems
- 2.3** Identify types and typical pipe sizes used in cold water systems within dwellings
- 2.4** Describe working principles of cold water systems, positioning, fixing, connection and operation of **components**
- Appliances
 - Baths
 - WCs
 - Over the rim bidets
 - Wash hand basins
 - Sinks
 - Urinals
 - Refrigerators
 - Washing machines
 - Dishwashers

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Install cold water systems

Assessment criteria

- 2.4**
Cont.
- Taps, outlets and valves
 - Mixer taps
 - Outside taps
 - Pillar taps
 - Bib taps
 - Bi-flow mixer taps
 - Ceramic disc taps
 - Stop valves
 - Servicing valves
 - Full-way gate valves
 - Spherical plug valves
 - Drain valves
 - Float operated valves (part 1–4)
 - Water meters
 - Showers
 - Gravity
 - Instantaneous electric
 - Digital shower valves
 - Bath shower mixer
 - Pumped (single and twin impeller)
 - Mixer valve
 - Water treatment
 - Water softeners
 - Water filters
 - Water conditioners
 - Cisterns
 - Cold water storage cisterns
 - Cold water feed cisterns
 - Combined feed and expansion cisterns
 - WC/urinal flushing cisterns
 - Break cisterns
 - Sectional (1000 litre+)
 - Boosted system components
 - Float switch
 - Pressure switch
 - Accumulator/pressure vessel
 - Booster pump sets
 - Pressure relief valve
 - Pressure gauge
 - Drinking water header

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Install cold water systems

Assessment criteria

- 2.5** Describe **layout and installation requirements** for protected plastic storage cisterns
- Typical cistern sizes for small dwellings
 - Warning pipe (overflow) arrangements
 - Inlet/ outlet position
 - Position of float operated valve
 - Position of cistern vent
 - Position of open vent pipe connection
 - Requirement for a rigid close fitting lid
 - Service valve requirements
 - Insect screens
 - Insulation
 - Support
 - Drilling requirement
 - Maintenance and access requirements
 - Prevention of stagnation
 - Linking multiple cisterns
- 2.6** Describe insulation requirements, system frost protection and prevention of undue warming of cold water systems
- 2.7** Identify the positioning and fixing of pipework within the **building fabric**
- Building fabric**
- Suspended timber floors
 - Solid floors
 - Embedded in walls
 - Areas subject to frost
 - Weight distribution of cisterns and heavy components
- 2.8** Identify **sources of information** required when undertaking work on cold water systems
- Sources of information**
- Statutory regulations
 - Building regulations – to include water efficiency calculator
 - Industry standards
 - Manufacturers' technical instructions

LEARNING OUTCOME CONTINUED ON NEXT PAGE

2.9 Explain **backflow** risk and required **methods** of prevention

Backflow

- Back siphonage
- Back pressure

Methods

- Air gaps
 - AA
 - AB
 - AD
 - AG
 - AUK1
 - AUK2
 - AUK3
 - DC
- Mechanical
 - BA
 - CA
 - DB
 - EA/EB
 - EC/ED
 - HA
 - HUK1
 - HC

2.10 **Install** cold water systems

Install

- Cistern
- Bath
- WHB
- WC
- Booster set
- Shower
- Pipework
 - Plastic
 - Copper.

Learning Outcome 3

Decommission cold water systems

Assessment Criteria

- 3.1** Explain **procedures** for **decommissioning** systems
- Procedures**
- Notify relevant person
 - Isolate fuel/electricity supply to the system as appropriate
 - Isolate water supply
 - Apply warning notices and signs
 - Drain system to a suitable location
 - Appropriately dispose of contents and any additives
 - Continuity bonding as required
 - Temporary capping of pipework sections as required
 - Notify building users
 - Alternative supplies as required
- Decommissioning**
- Permanent
 - Temporary
- 3.2** Carry out decommissioning **procedures**
- Notify relevant person
 - Isolate fuel/electricity supply to the system as appropriate
 - Isolate water supply
 - Apply warning notices and signs
 - Drain system to a suitable location
 - Appropriately dispose of contents and any additives
 - Continuity bonding as required
 - Temporary capping of pipework sections as required
 - Notify building users
 - Alternative supplies as required.

Learning Outcome 4

Size and select cold water systems and components for dwellings

Assessment Criteria

- 4.1** Explain **factors** which affect the selection of cold water systems for dwellings
- Factors**
- Customer needs
 - Building layout and features
 - Energy efficiency
 - Environmental impact
 - Occupancy and purpose
 - Appliance location
 - Cost
 - Storage type/location
 - Legislation

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 4 **continued**

Size and select cold water systems and components for dwellings

Assessment Criteria

- 4.2** Identify **information sources** required to size and select cold water systems and components
- Information sources**
- Statutory regulations
 - Industry standards
 - Manufacturers' technical instructions
 - Verbal and written feedback from the customer
 - Plans and drawings
 - Specifications
 - Pre-determined data
- 4.3** Identify recommended **design temperatures** within cold water systems
- Design temperatures**
- Condensation consideration
 - Storage (frost protection and undue warming)
 - Appliance outlet
- 4.4** Calculate cold water **system requirements** used in dwellings
- System requirements**
- Storage requirements
 - Pipe size
 - Outlet size and type
- 4.5** Select cold water **components** in accordance with calculations from predetermined data
- Components**
- Storage requirements
 - Pipe size
 - Accumulator
 - Safety device
 - Booster pump
- 4.6** Interpret information to complete a detailed **materials list**
- Materials list**
- Quantities and grades
 - Pipework
 - Consumables
 - Fittings
 - Components
 - Appliances
- 4.7** Present calculations and information in a suitable format for quotation and tender.

Learning Outcome 5

Perform a soundness test and commission cold water systems and components

Assessment Criteria

- 5.1** Identify information sources required to complete testing and commissioning
- 5.2** Describe how to fill and vent cold water systems
- 5.3** Describe a visual inspection of a cold water system to confirm that it is ready to be soundness tested
- 5.4** Describe a **soundness test** to industry requirements on cold water systems **pipework** and components
- | | |
|---|---|
| Soundness test | Pipework |
| <ul style="list-style-type: none">• Visual inspection• Notify• Initial fill• Stabilisation• Test to required pressure• Check for leaks• Check pressures after test period• Complete documentation and notify as required | <ul style="list-style-type: none">• Metal• Plastic |
- 5.5** State the **flushing requirements** including the use of **system additives** for new and existing cold water systems
- Flushing requirements**
- Cold
 - Disinfection
- System additives**
- Neutralisers
 - Cleanser
 - Water softener (salt)
- 5.6** Carry out a soundness test
- 5.7** Describe **operational checks** required during commissioning
- Operational checks**
- Temperature
 - Flow rate
 - Pressures
 - Controls
- 5.8** Identify the range of information that would be detailed on commissioning documentation
- 5.9** Identify actions that must be taken when commissioning reveals defects
- 5.10** Describe the procedure for handing over to the end user
- 5.11** Carry out **commissioning procedures**
- Commissioning procedure**
- Visual inspection
 - Fill and vent
 - Soundness test
 - Flush
 - Operational checks
 - Commissioning documentation
 - Handover procedure.

Learning Outcome 6

Perform fault diagnosis and rectification procedures on cold water systems

Assessment Criteria

6.1 Describe methods of obtaining **information** on system **faults**

Information

- End user
- Manufacturer instruction
- Fault diagnosis flow chart
- Service history

Faults

- Incorrect pressures
- Accumulator expansion vessel failure
- Blockages
- System debris
- Pump failure
- Control failure
- Pressure relief valve
- Incorrect support to system pipework and storage cisterns
- Excessive noise in pipework systems
- Cistern failure
- Leakage from below ground cold water service pipework
- Leakage or ineffective operation of
 - terminal fittings
 - float operated valves
 - stop and service valves

6.2 Carry out diagnostic checks for a range of faults

Faults

- Incorrect pressures
- Accumulator expansion vessel failure
- Blockages
- System debris
- Pump failure
- Control failure
- Pressure relief valve
- Incorrect support to system pipework and storage cisterns
- Excessive noise in pipework systems
- Cistern failure
- Leakage from below ground cold water service pipework
- Leakage or ineffective operation of
 - terminal fittings
 - float operated valves
 - stop and service valves

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 6 **continued**

Perform fault diagnosis and rectification procedures on cold water systems

Assessment Criteria

6.3 Carry out repair and rectification **procedures** to deal with a range of faults

Procedure

- Diagnose
- Notify client
- Safely isolate
- Decommission
- Rectify
- Re-commission
- Handover.

Learning Outcome 7

Carry out service and maintenance of cold water systems

Assessment Criteria

7.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components

7.2 Describe **routine checks** required on cold water system components and pipework as part of a periodic maintenance programme

Routine checks

- 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

7.3 Identify types of information to be provided on a maintenance record for cold water systems

7.4 Identify requirements for Legionella and bacterial growth control measures

7.5 Carry out routine checks of cold water systems.

9.6. Unit 06: Hot Water Systems

Unit level	3	<i>This unit covers the installation, maintenance, decommissioning and soundness testing of a range of hot water system/component types in domestic dwellings/light commercial properties.</i>
GLH	138	
UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Hot Water Systems	LO1 Install hot water systems	1.1 to 1.12
	LO2 Decommission hot water systems	2.1 to 2.2
	LO3 Size and select hot water systems and components for dwellings.	3.1 to 3.7
	LO4 Perform a soundness test and commission hot water systems and components	4.1 to 4.11
	LO5 Perform fault diagnosis and rectification procedures on hot water systems	5.1 to 5.3
	LO6 Carry out service and maintenance of hot water systems	6.1 to 6.5

Learning Outcome 1	
Install hot water systems	
Assessment Criteria	
1.1	Identify types and layout features of hot water systems Hot water systems (vented and unvented systems) <ul style="list-style-type: none"> • Direct <ul style="list-style-type: none"> – Boiler – Immersion • Indirect • Thermal store • Instantaneous hot water heaters • Single point (point of use) heaters • Multipoint heaters • Combination boilers
1.2	State advantages and disadvantages of hot water systems
1.3	Identify types and typical pipe sizes used in hot water systems within dwellings

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 1 **continued**

Install hot water systems

Assessment Criteria

1.4 Describe working principles of hot water systems, positioning, fixing, connection and operation of **components**

- Cylinders (vented and unvented)
 - Various grades available
 - Sizes available
 - Direct
 - Indirect
 - Primatic
 - Quick recovery
 - Dual coil
 - Combination
 - Thermal store
- Appliances
 - Baths
 - WCs
 - Over the rim bidets
 - Wash hand basins
 - Sinks
 - Washing machines
 - Dishwashers
- Taps, outlets and valves
 - Mixer taps
 - Outside taps
 - Pillar taps
 - Bib taps
 - Mixer taps
 - Bi-flow mixer taps
 - Ceramic disc taps
 - Infra-red operated taps
 - Concussive taps
 - Flow limiting taps and valves
 - Stop valves
 - Spray taps
 - Servicing valves
 - Full way gate valves
 - Spherical plug valves
 - Thermostatic mixing valve
 - Drain valves
 - Float-operated valves (part 1–4)
- Water meters
- Showers
 - Gravity
 - Digital shower valves
 - Bath shower mixer
 - Pumped (single and twin impeller)
 - Mixer valve
- Secondary pump
- Cisterns

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 1 **continued**

Install hot water systems

Assessment Criteria

- 1.5** Describe insulation requirements and system frost protection
- 1.6** Identify the positioning and fixing of pipework within the **building fabric**
- Suspended timber floors
 - Solid floors
 - Embedded in walls
 - Areas subject to frost
 - Weight distribution of cisterns and cylinders
- 1.7** Explain expansion and contraction in hot water systems and negative effects
- 1.8** Identify location and function of **unvented system components**
- Unvented system components**
- Cylinder
 - Isolation valve
 - Strainer
 - Expansion vessel
 - Pressure reducing valve
 - Expansion (pressure) relief valve
 - Temperature relief valve
 - Balanced cold connection
 - Check valve
 - D1, D2 discharge pipework requirements
 - Composite valve
 - Tundish
 - Control thermostat
 - Overheat thermostat (thermal cut-out)
- 1.9** Describe secondary circulation and how trace heating can be used
- 1.10** Identify **sources of information** required when undertaking work on hot water systems
- Sources of information**
- Regulations
 - Industry standards
 - Manufacturers' technical instructions

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 1 **continued**

Install hot water systems

Assessment Criteria

1.11 Explain **backflow** risk and required **methods** of prevention

Backflow

- Back siphonage
- Back pressure

Methods

- Air gaps
 - AA
 - AB
 - AD
 - AG
 - AUK1
 - AUK2
 - AUK3
 - DC
- Mechanical
 - BA
 - CA
 - DB
 - EA/EB
 - EC/ED
 - HA
 - HUK1
 - HC

1.12 **Install** hot water systems

Install

- Cylinder (open vented)
- Cylinder (unvented)
- Bath
- WHB
- Shower
- Pipework
 - Plastic
 - Copper.

Learning Outcome 2

Decommission hot water systems

Assessment Criteria

2.1 Explain **procedures** for **decommissioning systems**

Procedures

- Notify relevant person
- Isolate the fuel/electricity supply to the system as appropriate
- Isolate water supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents and any additives
- Continuity bonding as required
- Temporary capping of pipework sections as required
- Notify building users
- Alternative supplies as required

Decommissioning

- Permanent
- Temporary

2.2 Carry out decommissioning **procedures**

- Notify relevant person
- Isolate the fuel/electricity supply to the system as appropriate
- Isolate water supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents and any additives
- Continuity bonding as required
- Temporary capping of pipework sections as required
- Notify building users
- Alternative supplies as required.

Learning Outcome 3

Size and select hot water systems and components for dwellings

Assessment Criteria

3.1 Explain **factors** which affect the selection of hot water systems for dwellings

Factors

- Customer needs
- Building layout and features
- Energy efficiency
- Environmental impact
- Occupancy and purpose
- Appliance location
- Cost
- Storage type/location
- Legislation

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 3 **continued**

Size and select hot water systems and components for dwellings

Assessment Criteria

- 3.2** Identify **information sources** required to size and select hot water systems and components
- Information sources**
- Regulations
 - Industry standards
 - Manufacturers' technical instructions
 - Verbal and written feedback from the customer
 - Plans and drawings
 - Specifications
 - Pre-determined data
- 3.3** Identify recommended **design temperatures** within hot water systems
- Design temperatures**
- Pipework
 - Secondary circulation
 - Storage
 - Appliance outlet
- 3.4** Calculate hot water **system requirements** used in dwellings
- System requirements**
- Storage
 - Pipe size
- 3.5** Select hot water **components** in accordance with calculations from predetermined data
- Components**
- Storage vessel
 - Pipe
 - Pump
 - Expansion vessel
 - Safety device
- 3.6** Interpret information to complete a detailed **materials list**
- Materials list**
- Quantities and grades
 - Pipework
 - Consumables
 - Fittings
 - Components
 - Appliances
- 3.7** Present calculations and information in a suitable format for quotation and tender.

Learning outcome 4

Perform a soundness test and commission hot water systems and components

Assessment criteria

- 4.1** Identify information sources required to complete testing and commissioning
- 4.2** Describe how to fill and vent hot water systems
- 4.3** Describe a visual inspection of a hot water system to confirm that it is ready to be soundness tested
- 4.4** Describe a **soundness test** to industry requirements on hot water systems **pipework** and components
- Soundness test**
- Visual inspection
 - Notify
 - Initial fill
 - Stabilisation
 - Test to required pressure
 - Check for leaks
 - Check pressures after test period
 - Complete documentation and notify as required
- Pipework**
- Metal
 - Plastic
- 4.5** State the **flushing requirements** including the use of **system additives** for new and existing hot water systems
- Flushing requirements**
- Cold
 - Hot
 - Disinfection
- System additives**
- Neutralisers
 - Cleanser
 - Water softener (salt)
- 4.6** Carry out a soundness test
- 4.7** Describe **operational checks** required during commissioning
- Operational checks**
- Temperature
 - Flow rate
 - Pressure
 - Controls
- 4.8** Identify the range of information that would be detailed on commissioning documentation
- 4.9** Identify actions that must be taken when commissioning reveals defects
- 4.10** Describe the procedure for handing over to the end user

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 4 **continued**

Perform a soundness test and commission hot water systems and components

Assessment Criteria

4.11 Carry out **commissioning procedures** for **hot water systems**

Commissioning procedure

- Visual inspection
- Fill and vent
- Soundness test
- Flush
- Operational checks
- Commissioning documentation
- Handover

Hot water systems

- Vented
- Unvented.

Learning outcome 5

Perform fault diagnosis and rectification procedures on hot water systems

Assessment criteria

5.1 Describe methods of obtaining **information** on system **faults**

Information

- End user
- Manufacturers' instruction
- Fault diagnosis flow chart
- Service history

Faults

- Motorised valves not operating
- Incorrect pressures
- Expansion vessel failure
- Heat exchanger
- Blockages
- System debris
- Pump failure
- Thermostat
- Programmer
- Expansion valve
- Pressure relief valve
- Stratification of cylinders
- Incorrect support to hot water system pipework and storage cisterns
- Excessive noise in pipework systems
- Cistern failure
- Hot water storage cylinder/ heater failure
- Leakage or ineffective operation of
 - Terminal fittings
 - Float operated valves
 - Stop and service valves
 - Mixer showers
 - Thermostatic mixing valves

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning Outcome 5 **continued**

Perform fault diagnosis and rectification procedures on hot water systems

Assessment Criteria

5.2 Carry out diagnostic checks for a range of faults

5.3 Carry out repair and rectification **procedures** to deal with a range of faults

Procedure

- Diagnose
- Notify client
- Safely isolate
- Decommission
- Rectify
- Re-commission
- Handover.

Learning outcome 6

Carry out service and maintenance of hot water systems

Assessment criteria

6.1 Identify how to use manufacturer's instructions and job maintenance schedules to establish the periodic servicing requirements of system components

6.2 Describe **routine checks** required on hot water components and pipework as part of a periodic maintenance programme

Routine checks

- Visual inspection of pipework for leakage, adequate support and insulation
- Effective operation of terminal fittings
- Effective operation of float operated valves
- Effective operation of service valves
- Condition of hot water cylinder
- Condition of storage cisterns
- Unvented cylinder and controls
- Effective operation of thermostatic control devices
- Temperature and pressure relief valve
- Expansion vessel
- Composite valve
- Pumps

6.3 Identify types of information to be provided on a maintenance record for hot water systems

6.4 Identify requirements for legionella and bacterial growth control measures

6.5 Carry out **service and maintenance** of systems

Service and maintenance

- Unvented cylinder
- Controls.

9.7. Unit 07: Central Heating Systems

Unit level	3	<i>This unit covers the installation, maintenance, decommissioning and soundness testing of a range of wet central heating system/component types in domestic dwellings/light commercial properties</i>
GLH	180	
UNIT	LEARNING OUTCOME	ASSESSMENT CRITERIA
Central Heating Systems	LO1 Install central heating systems	1.1 to 1.14
	LO2 Decommission central heating systems	2.1 to 2.2
	LO3 Size and select central heating systems and components for dwellings	3.1 to 3.7
	LO4 Perform a soundness test and commission central heating systems and components	4.1 to 4.11
	LO5 Perform fault diagnosis and rectification procedures on central heating systems	5.1 to 5.3
	LO6 Carry out service and maintenance of central heating systems	6.1 to 6.4

Learning outcome 1	
Install central heating systems	
Assessment criteria	
1.1	<p>Identify types and layout features of heating systems</p> <p>Types</p> <ul style="list-style-type: none"> • Pumped heating gravity hot water • Fully pumped, 2 x two port valves (S plan) • Fully pumped, 3 x two port valves (S plan+) • Fully pumped, 3 port valve (mid position/diverting) (Y/W plans) • Combination boiler • System boiler <p>Layout</p> <ul style="list-style-type: none"> • One pipe • Two pipe • Manifold (micro and minibore) • Underfloor heating <p>Heating systems</p> <ul style="list-style-type: none"> • Wet central heating • Warm air • Storage heaters • District heating
1.2	State advantages and disadvantages of types and layout features of heating systems
1.3	Identify typical pipe sizes used in central heating systems types within dwellings

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Install central heating systems

Assessment criteria

- 1.4** Describe working principles of types of central heating systems, positioning, fixing, connection and operation of **components**
- Radiator valves – thermostatic and manual valves
 - Automatic air vents
 - Filling loop
 - Pressure gauge
 - Feed and expansion cisterns
 - Circulating pumps
 - Thermo-mechanical cylinder control valves
 - Anti-gravity valves
 - Drain valves
 - Additives
 - Low loss headers
 - Buffers
 - Pressure relief valves
 - Expansion joints
 - Corrosion filters
 - Zone valves (2 port, 3 port, mid position and diverter)
 - Low loss headers for multiple boiler installation
 - Multiple heat producing appliances installation
 - Programmer
 - Timer
 - Thermostats
 - Programmable room stat
 - Optimizer
 - Frost stat
 - Wiring centre
 - Cylinder stat
 - Expansion vessel
 - Automatic by-pass
 - Bespoke heat emitters
 - Panel radiators
 - Column radiators
 - Low surface temperature radiators
 - Fan convectors
 - Plinth heaters
 - Towel warmers
 - Underfloor heating components
 - Manifolds
 - Pump control unit
 - Insulation
 - Pipework
 - Manifold isolation ball valves
 - Supports
 - Controls
- 1.5** Explain the importance of pump positioning

LEARNING OUTCOME CONTINUED ON NEXT PAG

Learning outcome 1 **continued**

Install central heating systems

Assessment criteria

- 1.6** Identify **operating principles** for system control
- Time
 - Temperature weather compensation
 - Delayed start
 - Optimum start
 - Home automation systems
 - Smart control systems and associated equipment correct connection to home Wi-Fi networks
 - Internet of things (IoT)
 - Multiple boiler controls
 - Zoning requirements
- 1.7** Define zoning and control requirements of central heating systems in accordance with statutory legislation
- 1.8** Describe insulation requirements and system frost protection
- 1.9** Identify the positioning and fixing of pipework within the **building fabric**
- Suspended timber floors
 - Solid floors
 - Embedded in walls
 - Areas subject to frost
 - Weight distribution of boilers
- 1.10** Explain expansion and contraction in central heating systems and negative effects
- 1.11** Identify **sources of information** required when undertaking work on central heating systems
- Regulations
 - Industry standards
 - Manufacturers' technical instructions
- 1.12** Describe procedures for filling and venting system types
- 1.13** State the operating principles of **heat-producing appliances**
- Traditional boilers
 - Condensing boilers
 - Combination boilers
 - Freestanding boilers
 - Wall mounted boilers
- 1.14** **Install** central heating systems
- Install**
- Boiler/jig
 - Pump
 - Motorised valve
 - Expansion vessel
 - Radiator
 - Radiator valves
 - Underfloor heating
 - Controls
 - Valves
 - Pipework
 - Copper
 - LCS
 - Plastic.

Learning outcome 2	
Decommission central heating systems	
Assessment criteria	
2.1	<p>Explain procedures for decommissioning systems</p> <p>Procedures</p> <ul style="list-style-type: none"> • Notify relevant person • Isolate fuel/electricity supply to the system as appropriate • Isolate water supply • Apply warning notices and signs • Drain system to a suitable location • Appropriately dispose of contents and any additives • Continuity bonding as required • Temporary capping of pipework sections as required • Notify building users • Alternative source of heat or supplies as required <p>Decommissioning</p> <ul style="list-style-type: none"> • Permanent • Temporary
2.2	Carry out decommissioning procedures.

Learning outcome 3	
Size and select central heating systems and components for dwellings	
Assessment criteria	
3.1	<p>Explain factors which affect the selection of central heating systems for dwellings</p> <p>Factors</p> <ul style="list-style-type: none"> • Customer needs • Building layout and features • Energy efficiency • Environmental impact • Occupancy and purpose • Appliance location • Cost • Storage type/location • Legislation
3.2	<p>Identify information sources required to size and select central heating systems and components</p> <p>Information sources</p> <ul style="list-style-type: none"> • Regulations • Industry standards • Manufacturers' technical instructions • Verbal and written feedback from the customer • Plans and drawings • Specifications • Pre-determined data

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Size and select central heating systems and components for dwellings

Assessment criteria

3.3 Describe the principles of **heat loss and gain** and how this affects heating requirements

Heat loss and gain

- Electrical equipment
- Occupancy
- Solar
- Building fabric
- Ventilation
- Internal and external design temperatures
- Pipework

3.4 Calculate central heating **system requirements** used in dwellings

System requirements

- Total heat load
- Emitter load
- Hot water allowance
- Pipe size
- Pump size
- Emitter size
- Expansion

3.5 Select central heating system **components** in accordance with calculations from predetermined data

Components

- Emitter
- Boiler
- Pipe
- Pump
- Expansion vessel

3.6 Interpret information to complete a detailed **materials list**

Materials list

- Quantities and grades
 - Pipework
 - Consumables
 - Fittings
 - Components
 - Appliances

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

Learning outcome 4

Perform a soundness test and commission central heating systems and components

Assessment criteria

- 4.1** Identify information sources required to complete testing and commissioning
- 4.2** Describe how to fill and vent central heating systems
- 4.3** Describe a visual inspection of a central heating system to confirm that it is ready to be soundness tested
- 4.4** Describe a **soundness test** to industry requirements on central heating system **pipework** and components
- Soundness test**
- Visual inspection
 - Notify
 - Initial fill
 - Stabilisation
 - Test to required pressure
 - Check for leaks
 - Check pressures after test period
 - Complete documentation and notify as required
- Pipework**
- Metal
 - Plastic
- 4.5** State the **flushing requirements** including the use of **system additives** for new and existing central heating systems
- Flushing requirements**
- Cold
 - Hot
 - Cleansing
- System additives**
- Neutralisers
 - Cleanser
 - Inhibitor
 - Descaler
- 4.6** Carry out a soundness test
- 4.7** Describe **operational checks** required during commissioning
- Operational checks**
- Temperature
 - Flow rate
 - Pressure
 - Controls
- 4.8** Identify the range of information that would be detailed on commissioning documentation
- 4.9** Identify actions that must be taken when commissioning reveals defects
- 4.10** Describe the procedure for handing over to the end user
- 4.11** Carry out **commissioning procedures** for central heating systems
- Commissioning procedure**
- Visual inspection
 - Fill and vent
 - Soundness test
 - Flush
 - Operational checks
 - Commissioning documentation
 - Handover procedure.

Learning outcome 5

Perform fault diagnosis and rectification procedures on central heating systems

Assessment criteria

- 5.1** Describe methods of obtaining **information** on system **faults**
- Information**
- End user
 - Manufacturers' instruction
 - Fault diagnosis flow chart
 - Service history
- Faults**
- Pumping over
 - Persistent venting
 - Emitter cold spots
 - Stuck TRVs
 - Motorised valves not operating
 - Incorrect pressures
 - Expansion vessel failure
 - Heat exchanger
 - Blockages
 - Pump failure
 - Thermostat
 - Programmer
 - Pressure relief valve
 - Incorrect support to system pipework and components
 - Excessive noise in pipework systems
 - Feed and expansion cistern failure
 - Leakage or ineffective operation of:
 - Terminal fittings
 - Stop and service valves
 - Pipework
- 5.2** Carry out diagnostic checks for a range of faults
- 5.3** Carry out repair and rectification **procedures** to deal with a range of faults
- Procedure**
- Diagnose
 - Notify client
 - Safely isolate
 - Decommission
 - Rectify
 - Re-commission
 - Handover.

Learning outcome 6

Carry out service and maintenance of central heating systems

Assessment criteria

- 6.1** Identify how to use manufacturer's instructions and job maintenance schedules to establish the periodic servicing requirements of system components
- 6.2** Describe **routine checks** required on central heating components and pipework as part of a periodic maintenance programme
- Routine checks**
- Visual inspection of pipework for leakage, adequate support and insulation
 - Effective operation of terminal fittings
 - Effective operation of float operated valves
 - Effective operation of valves
 - Condition of cisterns
 - Effective operation of thermostatic control devices
 - Temperature and pressure relief valve
 - Expansion vessel
 - Pumps
 - Heat emitter
 - Performance checks
- 6.3** Identify types of information to be provided on a maintenance record for central heating systems
- 6.4** Carry out service and maintenance of systems and controls.

9.8. Unit 08: Rainwater Systems

Unit level	3	<i>This unit covers the installation, decommissioning, commissioning and maintenance of rainwater systems on domestic dwellings/light commercial properties.</i>	
GLH	30		
Unit	Learning Outcomes		Assessment Criteria
Rainwater Systems	LO1 Install rainwater systems		1.1 to 1.9
	LO2 Decommission rainwater systems		2.1 to 2.2
	LO3 Size and select rainwater systems components for dwellings		3.1 to 3.6
	LO4 Perform a soundness test and commission rainwater systems		4.1 to 4.7
	LO5 Perform fault diagnosis and rectification procedures on rainwater systems		5.1 to 5.3

Learning outcome 1	
Install rainwater systems	
Assessment criteria	
1.1	<p>Identify types and layout features of rainwater systems: pipe (RWP) and gutter</p> <ul style="list-style-type: none"> • Pipe (RWP) <ul style="list-style-type: none"> – Round section – Square section • Gutter <ul style="list-style-type: none"> – Half round – Square – Ogee – High capacity
1.2	<p>State advantages and disadvantages of rainwater systems: pipe (RWP) and gutter</p> <ul style="list-style-type: none"> • Pipe (RWP) <ul style="list-style-type: none"> – Round section – Square section • Gutter <ul style="list-style-type: none"> – Half round – Square – Ogee – High capacity

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Install rainwater systems

Assessment criteria

- 1.3** Identify typical sizes and **materials** used in rainwater systems: **pipe (RWP)** and **gutter**
- Rainwater systems**
- Pipe (RWP)
 - Round section
 - Square section
 - Gutter
 - Half round
 - Square
 - Ogee
 - High capacity
- Materials**
- PVC-U
 - Extruded aluminium
 - Cast iron
 - Specialist
 - Copper
 - Lead
 - Fusion welded
- 1.4** Describe working principles of rainwater systems (positioning, fixing, connection and operation of **components**)
- Components**
- Pipe (RWP)
 - Offsets
 - Angles
 - Branches
 - Hopper heads
 - Shoes
 - Specialist connectors to the drainage system
 - Gutter
 - Running outlets
 - Gutter angles
 - Gutter unions
 - Stop ends
 - Specialist unions between different gutter materials
 - Syphonic outlet
- 1.5** Explain expansion and contraction in rainwater systems and negative effects
- 1.6** Explain **factors** affecting gutter bracket selection and fixing for buildings
- Factors**
- Fascia boards
 - Exposed rafters
 - No fascia board or exposed rafters
 - Gutter and rainwater material selection
- 1.7** Identify **sources of information** required when undertaking work on rainwater systems
- 1.8** Explain working principles of rainwater recycling systems

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Install rainwater systems

Assessment criteria

1.9 Install rainwater systems

Install

- Pipe (RWP)
 - Offsets
 - Shoes
 - Clips
- Gutter
 - Running outlets
 - Gutter angles
 - Gutter unions
 - Stop ends
 - Brackets.

Learning outcome 2

Decommission rainwater systems

Assessment criteria

2.1 Explain **procedures** for decommissioning systems

Procedures

- Notify relevant person
- Checks for hazardous materials
- Appropriate access equipment
- Apply warning notices and signs
- Removal of components
- Appropriately dispose of materials

2.2 Carry out decommissioning **procedures**

Procedures

- Notify relevant person
- Checks for hazardous materials
- Appropriate access equipment
- Apply warning notices and signs
- Removal of components
- Appropriately dispose of materials.

Learning outcome 3

Size and select rainwater systems components for dwellings

Assessment criteria

3.1 plain **factors** which affect the selection of rainwater systems for dwellings

Factors

- Customer needs
- Building layout and features
- Energy efficiency
- Environmental impact
- Cost
- Legislation
- Rainfall intensity
- Roof area
- Roof pitch
- Running outlet position
- Gutter fall
- Changes of direction in the gutter run

3.2 Identify **information sources** required to size and select rainwater systems components

Information sources

- Regulations
- Industry standards
- Manufacturers' technical instructions
- Verbal and written feedback from the customer
- Plans
- Drawings and specifications
- Pre-determined data

3.3 Calculate rainwater systems requirements for dwellings

3.4 Select rainwater systems components in accordance with calculations from predetermined data

3.5 Interpret information to complete a detailed **materials list**

Materials list

- quantities and grades
 - Pipe (RWP)
 - Consumables
 - Fittings
 - Components
 - Appliances
 - Gutter

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

Learning outcome 4

Perform a soundness test and commission rainwater systems

Assessment criteria

- 4.1** Identify information sources required to complete testing and commissioning
- 4.2** Describe a **visual inspection** of a rainwater system to confirm that it is ready to be soundness tested
- Visual inspection**
- Checks
 - Leakage
 - Adequate support
 - Damage
 - Gutters are clear of debris
 - Signs of damp on the building surface
- 4.3** Describe a **soundness test** to industry requirements on rainwater, gutter systems pipework and components
- Soundness test**
- Visual inspection
 - Notify
 - Initial fill
 - Wet test
 - Check for leaks
 - Complete documentation and notify as required
- 4.4** Describe **operational checks** required during commissioning
- Operational checks**
- Correct fall
 - No spill over
 - No leaks
- 4.5** Identify actions that must be taken when commissioning reveals defects
- 4.6** Describe the procedure for handing over to the end user
- 4.7** Carry out soundness testing and **commissioning procedures**
- Commissioning procedure**
- Visual inspection
 - Soundness test
 - Operational checks
 - Commissioning documentation
 - Handover

Learning outcome 5

Perform fault diagnosis and rectification procedures on rainwater systems

Assessment criteria

- 5.1** Describe methods of obtaining **information** on system **faults**
- Information**
- End user
 - Manufacturers' instructions
 - Visual inspection
- Faults**
- Leaks
 - Blockages/debris
 - Inadequate or broken support
 - Broken gutter/pipe (RWP)
 - Incomplete systems
 - Incorrect fall
 - Lack of provision for expansion and contraction
- 5.2** Carry out diagnostic checks for a range of faults
- 5.3** Carry out repair and rectification **procedures** to deal with a range of faults
- Procedure**
- Diagnose
 - Notify client
 - Decommission
 - Rectify
 - Re-commission
 - Handover.

9.9. Unit 09: Sanitation Systems

Unit level	3	<i>This unit covers the installation, maintenance, decommissioning and soundness testing of a range of sanitary appliances and connecting sanitary pipework systems in domestic dwellings/light commercial properties.</i>
GLH	106	
Unit	Learning Outcomes	Assessment Criteria
Sanitation Systems	LO1 Install sanitary appliances and pipework systems	1.1 to 1.9
	LO2 Decommission sanitary appliances, pipework systems and components	2.1 to 2.2
	LO3 Size and select sanitary appliances pipework systems and components for dwellings	3.1 to 3.6
	LO4 Perform a soundness test and commission sanitary appliances, pipework systems and components	4.1 to 4.6
	LO5 Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems	5.1 to 5.3
	LO6 Carry out service and maintenance of sanitary appliances and pipework systems	6.1 to 6.4

Learning outcome 1

Install sanitary appliances and pipework systems

Assessment criteria

- 1.1** Identify types and **layout** features of sanitary appliances pipework **systems**
- Layout**
- Discharge stacks
 - Soil stack sizes based on WC outlet size
 - Waste stack sizes serving waste appliances only
 - Use and types of bends
 - Proximity of low level connections
 - Branch discharge
 - Layout of unventilated and ventilated branch discharge pipework
 - Maximum pipework lengths and gradients
 - Sizes of branch discharge pipework for soil and waste appliances
 - Use of traps and self-sealing valves
 - Methods of ventilating branch discharge pipework
 - Methods of connecting multiple waste appliances to branch discharge pipework
 - Methods of connecting branch discharge pipework into the main stack
 - Stack ventilation
 - Proximity of vent outlet to openable windows
 - Use of air admittance valves
 - Systems and appliances
 - Waste appliance connections to gullies
 - Waste appliance connections direct to drain
 - WC connection direct to drain

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Install sanitary appliances and pipework systems

Assessment criteria

1.1 cont.	Systems <ul style="list-style-type: none">• Primary ventilated stack system• Secondary ventilated stack system• Ventilated branch discharge system• Stub stack system
1.2	State advantages and disadvantages of sanitary appliances pipework systems
1.3	Identify typical pipe sizes and maximum distances permitted in sanitary appliances pipework systems within dwellings
1.4	<p>Describe working principles of sanitary appliances pipework systems, positioning, fixing, connection and operation of components</p> <p>Components</p> <ul style="list-style-type: none">• Bend 92.5 degree• Bend 135 degree• Bend (male-female)• Access bend• Offset bend• Branch tee• Boss• Boss socket• Vent terminal• Waste manifold• Pan connectors• Traps• Waterless trap• Air admittance valve• Clips/brackets• Coupler• Socket plug• Socket rodding access• Floor gullies
1.5	<p>Identify the positioning and fixing of pipework within the building fabric</p> <p>Building fabric</p> <ul style="list-style-type: none">• Suspended timber floors• Solid floors• Embedded in walls• Areas subject to frost• Underground
1.6	Explain expansion and contraction in sanitary appliances pipework systems and negative effects
1.7	<p>Identify sources of information required when undertaking work on sanitary appliances pipework systems</p> <p>Sources of information</p> <ul style="list-style-type: none">• Regulations• Industry standards• Manufacturers' technical instructions

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Install sanitary appliances and pipework systems

Assessment criteria

- 1.8** Identify different types of **sanitary appliances** and components used in dwellings
- Sanitary appliances**
- Conventional WC
 - Flushing cisterns (automatic and manual)
 - Waste disposal units
 - Baths
 - Bidets
 - Wash hand basins
 - Shower tray
 - Bath/shower screens and cubicles
 - Sinks
 - Urinals
 - WC macerators
 - Waste water lifters used in domestic dwellings
 - Sink waste disposals
- 1.9** Identify factors that lead to trap seal loss in sanitary pipework systems
- 1.10** Outline the suitability of **below ground drainage systems** to receive **waste water**
- Below ground drainage systems**
- Combined drainage systems
 - Separate drainage systems
 - Partially separate drainage systems
 - Soakaway
 - Cesspit
 - Septic tanks
- Waste water**
- Foul
 - Soil
 - Waste
 - Condensate water
- 1.11** Installation requirements of sanitary facilities and equipment in dwellings for the disabled including wet rooms
- 1.12** Identify **jointing methods** used in sanitary appliances pipework systems
- Jointing methods**
- Ring seal joints
 - Solvent weld joints
 - Compression joints
 - Fusion welded
- 1.13** Explain working principles of greywater recycling systems
- 1.14** **Install** sanitary appliances, pipework systems and components
- Install**
- Bath
 - WHB
 - WC
 - Primary ventilated stack.

Learning outcome 2

Decommission sanitary appliances, pipework systems and components

Assessment criteria

2.1 Explain **procedures** for **decommissioning systems**

Procedures

- Notify relevant person
- Isolate the fuel/electricity supply to the system as appropriate
- Isolate water supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents
- Temporary capping of pipework sections as required
- Notify building users
- Alternative sources of facilities or supplies as required

Decommissioning

- Permanent
- Temporary

2.2 Carry out decommissioning **procedures**

Procedures

- Notify relevant person
- Isolate the fuel/electricity supply to the system as appropriate
- Isolate water supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents
- Temporary capping of pipework sections as required
- Notify building users
- Alternative sources of facilities or supplies as required.

Learning outcome 3

Size and select sanitary appliances pipework systems and components for dwellings

Assessment criteria

3.1 Explain **factors** which affect the selection of sanitary appliances pipework systems for dwellings

Factors

- Customer needs
- Building layout and features
- Energy efficiency
- Environmental impact
- Cost
- Legislation
- Appliance type
- Drainage system type
- Pipework routes
- Access requirements

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Size and select sanitary appliances pipework systems and components for dwellings

Assessment criteria

- 3.2** Identify **information sources** required to size and select sanitary appliances pipework system
- Information sources**
- Regulations
 - Industry standards
 - Manufacturers' technical instructions
 - Verbal and written feedback from the customer
 - Plans
 - Drawings and specifications
 - Pre-determined data
- 3.3** **Calculate** sanitary appliances pipework system requirements for dwellings
- Calculate**
- Gradient
 - Diameter
 - Length
 - Material
 - System type
- 3.4** Select sanitary system components in accordance with calculations from predetermined data
- 3.5** Interpret information to complete a detailed **materials list**
- Materials list**
- Quantities and grades
 - Pipework
 - Consumables
 - Fittings
 - Components
 - Appliances
- 3.6** Present calculations and information in a suitable format for quotation and tender.

Learning outcome 4

Perform a soundness test and commission sanitary appliances, pipework systems and components

Assessment criteria

- 4.1** Describe a **visual inspection** of sanitary appliances and pipework systems to confirm that it is ready to be soundness tested
- Visual inspection**
- Checks
 - Leakage
 - Adequate support
 - Damage
 - Signs of damp on the building surface

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Perform a soundness test and commission sanitary appliances, pipework systems and components

Assessment criteria

- 4.2** Describe a **soundness** test to industry requirements on sanitary appliances, pipework systems and components
- Soundness test**
- Visual inspection
 - Notify
 - Air test
 - Initial fill
 - Wet test
 - Check for leaks
 - Complete documentation and notify as required
- 4.3** Describe **operational checks** required during commissioning
- Operational checks**
- Correct fall
 - No trap seal loss
 - No leaks
 - Adequate support
 - Waste removed satisfactory
- 4.4** Identify actions that must be taken when commissioning reveals defects
- 4.5** Describe the procedure for handing over to the end user
- 4.6** Carry out soundness testing and **commissioning procedures**
- Commissioning procedure**
- Visual inspection
 - Soundness test
 - Operational checks
 - Commissioning documentation
 - Handover.

Learning outcome 5

Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems

Assessment criteria

5.1 Describe methods of obtaining **information** on system **faults**

Information

- End user
- Manufacturers' instructions
- Visual inspection

Faults

- Leaks
- Blockages
- Inadequate or broken support
- Trap seal loss
- Debris
- Expansion and contraction
- Cistern faults
- Appliance faults
- WC macerators
- Waste water lifters
- Sink waste disposal units
- Air admittance valves
- Pipework
- Condensing boiler condensate

5.2 Carry out diagnostic checks for a range of faults

5.3 Carry out repair and rectification **procedures** to deal with a range of faults

Procedure

- Diagnose
- Notify client
- Decommission
- Rectify
- Re-commission
- Handover.

Learning outcome 6

Carry out service and maintenance of sanitary appliances and pipework systems

Assessment criteria

- 6.1** Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
- 6.2** Describe **routine checks** required on sanitary appliances and pipework systems as part of a periodic maintenance programme
- Routine checks**
- Visual inspection of pipework for leakage, adequate support
 - Effective operation of terminal fittings
 - Effective operation of float-operated valves
 - Effective operation of valves
 - Condition of cisterns
 - Operation of flushing cisterns/mechanisms
 - Fitting of effective waste outlet plugs
 - Effective operation of appliance traps/self-sealing valves
 - Pumps
 - Performance checks
 - Appliance support
- 6.3** Identify types of information to be provided on a maintenance record for sanitary appliances and pipework
- 6.4** Carry out routine checks of sanitary appliances and pipework systems.

9.10. Unit 10: Environmental Technology Systems

Unit level	3	<i>This unit provides an introduction to micro-renewable energy and water conservation and the installation of environmental technologies.</i>	
GLH	15		
Unit	Learning Outcomes		Assessment Criteria
Environmental Technology Systems	LO1 Know the basic operating principles of micro-renewable energy and water conservation technologies		1.1 to 1.3
	LO2 Understand requirements to install micro-renewable energy and water conservation systems to existing systems		2.1 to 2.5

Learning outcome 1	
Know the basic operating principles of micro-renewable energy and water conservation technologies	
Assessment criteria	
1.1	Describe the basic operating principles of heat producing micro-renewable energy technologies Micro-renewable energy <ul style="list-style-type: none"> • Solar thermal (hot water) • Ground source heat pump • Air source heat pump • Biomass
1.2	Describe the basic operating principles of heat-led micro-combined heat and power
1.3	Describe the basic operating principles of water conservation technologies Water conservation <ul style="list-style-type: none"> • Rainwater harvesting • Greywater re-use.

Learning outcome 2	
Understand requirements to install micro-renewable energy and water conservation systems to existing systems	
Assessment criteria	
2.1	Explain the suitability of building location and features when installing micro-renewable energy and water conservation systems Building location and features <ul style="list-style-type: none"> • Structural • Orientation • Listed buildings • Environmental conditions • Adjacent structures and obstructions • Geographical

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Understand requirements to install micro-renewable energy and water conservation systems to existing systems

Assessment criteria

- 2.2** Identify **regulations** affecting installation of micro-renewable energy and water conservation systems
- Building Regulations
 - Part A
 - Part E
 - Part G
 - Part H
 - Part L
 - Town and country planning regulations
- 2.3** Describe what would be typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of **technologies**
- Technologies**
- Solar thermal (hot water)
 - Ground source heat pump
 - Air source heat pump
 - Biomass
- 2.4** State which parts of the regulations apply in relation to the installation of **environmental technologies**
- Environmental technologies**
- Solar thermal (hot water)
 - Ground source heat pump
 - Air source heat pump
 - Biomass
 - Micro-combined heat and power (heat-led)
 - Rainwater harvesting
 - Greywater re-use
- 2.5** State typical advantages and disadvantages associated with environmental technologies.

9.11. Unit 11: Domestic Fuel Systems

Unit Level	3	<i>This unit covers factors affecting fuel selection, the combustion processes of fuel supply systems and the operating principles of chimney/flue systems.</i>
GLH	30	
Unit	Learning Outcomes	Assessment Criteria
Domestic Fuel Systems	LO1 Understand factors affecting fuel selection	1.1 to 1.6
	LO2 Know combustion processes of fuel supply systems	2.1 to 2.9
	LO3 Know principles of chimney/flue systems	3.1 to 3.7

Learning outcome 1	
Understand factors affecting fuel selection	
Assessment criteria	
1.1	Identify the types of fuels used in appliances Fuels <ul style="list-style-type: none"> • Natural gas • LPG • Oil • Solid fuel • Sustainable sources
1.2	Describe the factors which affect the selection of fuels Factors <ul style="list-style-type: none"> • Client preference • Availability • Appliance type • Fuel storage requirements • Environmental considerations • Smoke control legislation • Cost
1.3	State sources of information for fuel supply installation Sources of information <ul style="list-style-type: none"> • British Standards • Regulations • Manufacturers' instructions • Guidance notes
1.4	Define the regulatory type bodies which govern the installation of various fuel types Regulatory type bodies <ul style="list-style-type: none"> • Gas Safe • OFTEC • HETAS
1.5	Specify the storage requirements for fuels

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Understand factors affecting fuel selection

Assessment criteria

1.6 Compare **factors** which could affect storage requirements for fuels

Factors

- Space
- Delivery requirements
- Safety
- Weather conditions
- Distribution
- Proximity to dwelling.

Learning outcome 2

Know combustion processes of fuel supply systems

Assessment criteria

2.1 Describe the combustion process

2.2 Identify the main constituents of complete and incomplete combustion

2.3 Identify **causes** of incomplete combustion

Causes

- Lack of oxygen
- Too much fuel
- Vitiated air
- Flame impingement

2.4 Identify **signs** of incomplete combustion

Signs

- Yellow flame
- Floppy flame
- Sooting
- Staining

2.5 Describe the symptoms of CO poisoning

2.6 Describe the purpose of CO detectors

2.7 Explain the **requirements** for ventilation

Requirements

- Combustion air
- Cooling air

2.8 Identify the different **types** of ventilation

Types

- Natural
- Mechanical

2.9 Explain **installation practices** for ventilation

Installation practices

- Adequately sized
- Continuous size
- Sleeved
- Permanently open
- Fly screen removed
- Correctly positioned.

Learning outcome 3

Know principles of chimney/flue systems

Assessment criteria

- 3.1** Explain the **operating principles** of chimney/flue systems
Operating principles
- Remove combustion products
 - Draw in combustion air
- 3.2** Identify **types** of chimney/flue systems
Types
- Open flued
 - Room sealed
- 3.3** Identify the **components** within chimney/flue systems
Components
- Primary flue
 - Draught diverter
 - Secondary flue
 - Terminal
- 3.4** Explain the **effects** of layout on chimney/flue systems
Effects
- Equivalent height
 - Internal temperature
 - External temperature
 - Air quality
 - Humidity
 - Route
 - Bends
 - Termination
- 3.5** State the layout and features of **chimney and flue construction**
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)
- 3.6** Reference termination requirements for chimney/flue systems from relevant **documents**
Documents
- British Standards
 - Manufacturers' instructions
- 3.7** List basic **inspection and testing** procedures for chimney/flue systems
Inspection and testing
- Visual inspection
 - Flue flow
 - Spillage
 - Flue gas analysis.

9.12. Unit 12: Electrical Work and the Control of Plumbing and Domestic Heating Systems

Unit Level	3	<i>This unit is for plumbing and domestic heating technicians, carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems.</i>
GLH	70	
Unit	Learning Outcomes	Assessment Criteria
Electrical Work and the Control of Plumbing and Domestic Heating Systems	LO1 Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems	1.1 to 1.10
	LO2 Apply industry standard safe isolation procedures	2.1 to 2.2
	LO3 Carry out the safe installation, testing and decommissioning of electrical systems	3.1 to 3.4
	LO4 Carry out the identification of faults and safe repair of electrical work	4.1

Unit guidance

This unit is for plumbing and domestic heating technicians, carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems which:

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

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

This work must be in accordance with the current versions of the appropriate industry standards and regulations, the specification, industry recognised working practices, the working and natural environment. It will not involve the testing and commissioning of the fixed electrical installation and its constituent parts. They must know and understand the types, applications and limitations of electrical supplies, isolation and control equipment, earthing and overcurrent protection, cables and wiring associated with plumbing and domestic heating system.

Learning outcome 1

Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems

Assessment criteria

- 1.1** State the limitations of your responsibility when carrying out work on electrical supplies and/or circuits for the control of plumbing and domestic heating systems
- 1.2** Identify the applications, advantages and limitations of **electrical supplies**
- Electrical supplies**
- Extra low voltage and/or low voltage single and/or multi-phase provision for:
 - Control
 - Communication
 - Heating
 - Lighting
 - Power
- 1.3** Identify the applications, advantages and limitations of different **electrical equipment, cables/wiring** and **components** in relation to the **working environment**
- Electrical equipment**
- Isolators
 - Circuit breakers
 - Fuses
 - Switches
 - Socket-outlets/fused-spurs
 - Earthing protection
 - Motor control equipment
 - Control panels – environmental control
 - Control devices – electrical, electronic, electro-mechanical
- Cables/wiring**
- PVC flat profile (twin and earth)
 - Flex including heat resistant (butyl) rubber etc.
- Components**
- Boiler
 - Central heating controls
 - Zone valves (2 port, 3 port, mid position and diverter)
 - Programmer
 - Timer
 - Thermostats
 - Programmable room stat
 - Optimizer
 - Frost stat
 - Wiring centre
 - Cylinder stat
 - Wi-fi routers
 - Wi-fi range extenders
 - Wiring centres
 - Immersion heater
 - Instantaneous shower
 - Shower pump
 - Jacuzzi bath/hot tub
 - Macerator WC
 - Heat-producing or cooling appliances
 - Pumps
 - Fans

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems

Assessment criteria

1.3 Working environment (internal and/or external)

cont.

- Commercial
- Industrial
- Domestic
- Agricultural
- Horticultural
- Leisure and entertainment residential
- Medical and care facilities public services establishments
- Pre-1919 traditional/historic buildings

1.4 State 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

1.5 State 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

Plant

- Generators
- Transformers for low-voltage hand tools
- Lifting equipment
- Access equipment

1.6 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

1.7 Apply and use **personal protective equipment (PPE)**

Personal protective equipment (PPE)

- Clothing protection including high visibility
- Eye protection
- Hand protection
- Head protection
- Foot protection
- Hearing protection
- Respiratory protection
- Vibration protection
- Harnesses

1.8 Confirm the **status** of the electrical supply

Status

- Live
- Dead

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

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

- a) Of the right type and size
- b) Fit for purpose in accordance with the plumbing and domestic heating system's design.

Learning outcome 2

Apply industry standard safe isolation procedures

Assessment criteria

2.1 Identify the correct means of electrical isolation prior to commencing **work**

Work

- Disconnection
- Installation
- Connection

2.2 Carry out the safe-isolation of **electrical equipment** and **components** associated with the **electrical supply** of the plumbing and domestic heating system

Electrical equipment

- Isolators
- Circuit breakers
- Fuses
- Switches
- Socket-outlets/fused-spurs
- Earthing protection
- Motor control equipment
- Control panels – environmental control
- Control devices – electrical, electronic, electro-mechanical

Components

- Boiler
- Central heating controls
 - Zone valves (2 port, 3 port, mid position and diverter)
 - Programmer
 - Timer
 - Thermostats
 - Programmable room stat
 - Optimizer
 - Frost stat
- Wiring centre
- Cylinder stat
- Wi-fi routers
- Wi-fi range extenders
- Wiring centres
- Immersion heater
- Instantaneous shower
- Shower pump
- Jacuzzi bath/hot tub
- Macerator WC
- Heat producing or cooling appliances
- Pumps
- Fans

Electrical supply

Extra low voltage and/or low voltage single-phase provision for:

- Control
- Communication
- Heating
- Lighting
- Power.

Learning outcome 3

Carry out the safe installation, testing and decommissioning of electrical systems

Assessment criteria

- 3.1** Carry out **work** on **electrical equipment, cables/wiring** and **components** associated with the **electrical supply** and control of the plumbing and domestic heating system in accordance with the requirements of:
- Industry recognised methods and procedures
 - Manufacturers' instructions
- Work**
- Disconnection
 - Installation
 - Connection
- Electrical equipment**
- Isolators
 - Circuit breakers
 - Fuses
 - Switches
 - Socket-outlets/fused-spurs
 - Earthing protection
 - Motor control equipment
 - Control panels – environmental control
 - Control devices – electrical, electronic, electro-mechanical
- Cables/wiring**
- PVC flat profile (twin and earth)
 - Flex including heat resistant (butyl) rubber etc.
- Components**
- Boiler
 - Central heating controls
 - Zone valves (2 port, 3 port, mid position and diverter)
 - Programmer
 - Timer
 - Thermostats
 - Programmable room stat
 - Optimizer
 - Frost stat
 - Wiring centre
 - Cylinder stat
 - Wi-fi routers
 - Wi-fi range extenders
 - Wiring centres
 - Immersion heater
 - Instantaneous shower
 - Shower pump
 - Jacuzzi bath/hot tub
 - Macerator WC
 - Heat producing or cooling appliances

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Carry out the safe installation, testing and decommissioning of electrical systems

Assessment criteria

- 3.1 cont.**
- Pumps
 - Fans
- Electrical supply**
Extra low voltage and/or low voltage single-phase provision for:
- Control
 - Communication
 - Heating
 - Lighting
 - Power
- 3.2** Identify that the electrical equipment, cables/wiring and components are in accordance with the requirements of the plumbing and domestic heating system
- 3.3** Check that the electrical equipment, cables/wiring and components are of proper **construction** in accordance with the requirements of the plumbing and domestic heating system
- Construction**
- Insulation
 - Mechanical strength
 - Protection
- 3.4** 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.

Learning outcome 4

Carry out the identification of faults and safe repair of electrical work

- 4.1** 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
- Faults and deficiencies**
- Appliance components
 - Micro switches
 - Relays
 - Pressure switches
 - Printed circuit boards
 - Pumps
 - Fans
 - Control components
 - Thermostats
 - Programmers/timers
 - Electrically operated control valves
 - Wiring centres
 - Deficiencies
 - Inadequate earthing provision
 - Effective cable routing
 - Effective termination
 - Incorrect polarity
 - Provision of inadequate circuit protection device.

9.13. Unit 13: Install, Commission, Service and Maintain Domestic Plumbing and Heating Systems

Unit Level	3	<i>This performance unit is to demonstrate the correct selection of system types and components, the installation of domestic plumbing and heating systems, the commissioning, diagnosis of faults and the rectification of those faults. The correct preparation of the working area for all such work must also be demonstrated.</i>
GLH	60	

Upon completion of the unit the learner will:

- Apply health and safety and welfare in the workplace
- Prepare for the installation of plumbing and heating systems and components
- Install plumbing and heating systems and components in the workplace
- Perform fault diagnosis and rectification procedures
- Commission plumbing and heating systems in the workplace

Unit guidance

Evidence requirements

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

Candidates must be assessed on **cold and hot water systems** as these systems are mandatory, and then **one** from the remaining three:

- Central heating systems
- Sanitation systems
- Gravity rainwater systems

The following groups can be used for guidance:

Group 1 systems:

- Cold and hot water systems
- Central heating systems

Group 2 systems:

- Cold and hot water systems
- Sanitation systems

Group 3 systems:

- Cold and hot water systems
- Gravity rainwater systems

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

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

Observation 1 First fix installation of a significant amount of pipework and associated fixings and fittings from the required range, picking up the requirements for health and safety holistically as part of the visit.

Observation 2 First fix installation of a significant amount of pipework and associated fixings and fittings from the required range, picking up the requirements for health and safety holistically as part of the visit.

Observation 3 Second fix complete installation of **two** major components from the required range in group A and associated pipework fixings and fittings picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required component installations.

Observation 4 Second fix complete installation of **two** major components from the required range in group A and associated pipework fixings and fittings picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required component installations.

Observation 5 Complete commissioning of **two** of the system types from the required range picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required system types.

Observation 6 Complete commissioning of **two** of the system types from the required range picking up the requirements for health and safety holistically as part of the visit. More than one visit to site may be required to capture both of the required system types.

Important Note: The Candidate **MUST** cover all Learning Outcomes and all Assessment Criteria at least once. This does not mean that the Candidate must cover all Assessment Criteria on every job. They do not. Provided the assessment criteria for the Learning Outcome is covered across the range of addresses/jobs listed for the system being installed, then the criteria for the qualification is satisfied.

Learning outcome 1	
Apply health and safety and welfare in the workplace	
Assessment criteria	
1.1	Use personal protective equipment
1.2	<p>Ensure appropriate provision for first aid and fire safety is in place</p> <p>First aid</p> <ul style="list-style-type: none"> • First-aid kit • Accident book • Nominated person <p>Fire safety</p> <ul style="list-style-type: none"> • Fire extinguisher • Evacuation procedure • Muster points
1.3	Comply with information, warning, mandatory instruction and prohibition notices
1.4	Perform manual handling techniques
1.5	Ensure appropriate facilities are in place for welfare and personal hygiene
1.6	Transport and store tools and equipment
1.7	<p>Verify appropriate access and exit routes to and from the work location</p> <p>Access and exit routes – Candidates must be assessed on three of the following:</p> <ul style="list-style-type: none"> • Adequate lighting • Routes free from obstruction • Follow safety signs and notices • Emergency exit routes in place • Appropriate barriers
1.8	Demonstrate appropriate procedures are in place for reporting hazards
1.9	Carry out procedures for reporting hazards
1.10	Carry out procedures for the disposal of waste materials and products
1.11	Demonstrate safe working practices when joining pipework
1.12	Produce a risk assessment and method statement in accordance with organisational procedures
1.13	<p>Use access equipment in the workplace</p> <p>Candidates must be assessed on two of the following:</p> <ul style="list-style-type: none"> • Ladder • Tower scaffold • Stepladder • Platform (MEWP).

Learning outcome 2	
Prepare for the installation of plumbing and heating systems and components	
Assessment criteria	
2.1	Check that all necessary job information is available
2.2	Liaise with other persons to confirm the detail of the installation work to be carried out
2.3	<p>Comply with health and safety requirements</p> <p>Health and safety requirements – Candidates must be assessed on two of the following:</p> <ul style="list-style-type: none"> • Risk assessment • Method statements • Work permits
2.4	<p>Carry out preparatory work</p> <p>Candidates must be assessed on all of the following:</p> <ul style="list-style-type: none"> • Safe and unobstructed access to work areas • Safe storage of materials tools and equipment • Reporting pre-existing damage • Protecting the building fabric <p>Candidates must also be assessed on:</p> <ul style="list-style-type: none"> • Drilling walls or floors • Cutting holes and notches in timber floor joists • Cutting chases in wall or floor surfaces
2.5	<p>Comply with organisational procedures for completing documentation that is required during work operations</p> <p>Documentation – Candidates must be assessed on three of the following:</p> <ul style="list-style-type: none"> • Variation order • Timesheets • Work programme • Requisitions • Delivery note.

Learning outcome 3	
Install plumbing and heating systems and components in the workplace	
Assessment criteria	
3.1	Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed
3.2	Plan the installation and pipe work routes using relevant job information

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

3.3	<p>Complete installation work on a range of plumbing and heating systems</p> <p>Systems – Candidates must be assessed on cold and hot water systems and then one from the remaining three:</p> <ul style="list-style-type: none"> • Cold water systems • Hot water systems • Central heating systems • Sanitation systems • Gravity rainwater systems 				
3.4	<p>Position and fix pipework and components</p> <p>Pipework – Candidates must be assessed on <u>three</u> of the following:</p> <ul style="list-style-type: none"> • Copper • Plastic pressure pipe • Steel (screwed or pressed) • Stainless steel • Plastic (sanitary) • Rainwater <p>Components – Candidates must be assessed on <u>six components from Group A</u> with at least three on more than one occasion and <u>three unique components from Group B</u>:</p> <table> <tr> <th>Group A</th><th>Group B</th></tr> <tr> <td> <ul style="list-style-type: none"> • Bath • WC • Wash hand basin • Sink • Shower and tray • Cylinder • Boiler (connections) • Soil stack system • Rain water/guttering system • F&E/CWSC Cistern • Pump • Motorised valves • Radiator • Water conditioners/filters </td><td> <ul style="list-style-type: none"> • Urinal • Bidet • Booster pump • Water meter • Fan convector • Low loss header • Macerator • Waste water lifter • Cesspit • Septic tank • Refrigerator cold connection • Washing machine/dishwasher • Water softeners • Underfloor heating circuit and underfloor manifold </td></tr> </table>	Group A	Group B	<ul style="list-style-type: none"> • Bath • WC • Wash hand basin • Sink • Shower and tray • Cylinder • Boiler (connections) • Soil stack system • Rain water/guttering system • F&E/CWSC Cistern • Pump • Motorised valves • Radiator • Water conditioners/filters 	<ul style="list-style-type: none"> • Urinal • Bidet • Booster pump • Water meter • Fan convector • Low loss header • Macerator • Waste water lifter • Cesspit • Septic tank • Refrigerator cold connection • Washing machine/dishwasher • Water softeners • Underfloor heating circuit and underfloor manifold
Group A	Group B				
<ul style="list-style-type: none"> • Bath • WC • Wash hand basin • Sink • Shower and tray • Cylinder • Boiler (connections) • Soil stack system • Rain water/guttering system • F&E/CWSC Cistern • Pump • Motorised valves • Radiator • Water conditioners/filters 	<ul style="list-style-type: none"> • Urinal • Bidet • Booster pump • Water meter • Fan convector • Low loss header • Macerator • Waste water lifter • Cesspit • Septic tank • Refrigerator cold connection • Washing machine/dishwasher • Water softeners • Underfloor heating circuit and underfloor manifold 				
3.5	<p>Connect pipework to system controls and main components</p>				

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Install plumbing and heating systems and components in the workplace

Assessment criteria

3.6 Complete a range of **jointing methods** during pipework installation

Jointing methods – Candidates must be assessed on **four** of the following

- Compression
- Push fit plastic pressure
- Push fit waste
- Threaded/screwed
- Soft soldered
- Crimped
- Glues/adhesives
- Fusion welded

3.7 Carry out a **soundness test** to industry requirements on systems pipework and components

Components – Soundness test

- Visual inspection
- Notify
- Initial fill
- Stabilisation
- Test to required pressure
- Check for leaks
- Check pressures after test period
- Complete documentation and notify as required.

Learning outcome 4

Perform fault diagnosis and rectification procedures

Assessment criteria

4.1 Obtain **information** on system **faults**

Information

- End user
- Manufacturers' instruction
- Fault diagnosis flow chart
- Service history

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

4.2 Carry out diagnostic checks for a range of **faults**

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

Group A

- System debris
- Pump failure
- Leakage
- Trap seal loss
- Expansion and contraction
- Cistern failure
- Pumping over/persistent venting
- Emitter cold spots
- TRV/ valve
- Tap/ valve failure

Group B

- Accumulator expansion vessel failure
- Motorised valves not operating
- Heat exchanger failure
- Expansion valve
- WC macerators/waste water lifter
- Sink waste disposal units
- Control failure
- Pressure relief valve
- Thermostat
- Programmer
- Air admittance valves
- Condensing boiler condensate
- Component failure

4.3 Carry out **decommissioning procedures**

Procedures

- Notify relevant person
- Isolate fuel/electricity supply to the system as appropriate
- Isolate water supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents and any additives
- Continuity bonding as required
- Temporary capping of pipework sections as required
- Notify building users
- Alternative supplies as required

4.4 Carry out fault repair or replace system component

4.5 Re-commission and handover to the client.

Learning outcome 5	
Commission plumbing and heating systems in the workplace	
Assessment criteria	
5.1	Carry out a visual inspection of the system
5.2	<p>Charge the system to normal operating pressure and check for leakage</p> <p>System – Candidates must be assessed on two of the following systems on two occasions:</p> <ul style="list-style-type: none"> • Hot and cold water systems • Central heating systems • Sanitation and drainage systems
5.3	Perform a soundness test to industry requirements
5.4	Flush the system with cold water on completion of soundness testing
5.5	Operate the system and take performance readings in order to compare them to the design specifications
5.6	Adjust system controls to establish that the system operates to its design specifications
5.7	Prepare commissioning records for completed systems
5.8	Instruct the customer in the efficient and effective operation of the system.

10. Unit Details - Pathway

10.1. Natural Gas Pathway

10.2. Oil Pathway

10.3. Solid fuel/Biomass fuel Pathway

10.4. Environmental Technologies Pathway

Unit details follow on the next pages

10.1. Natural Gas Pathway

10.1.1. Unit 14 Specific Domestic Core Safety for Natural Gas

Unit Level	3	<i>The unit covers the core gas safety requirements that apply when working in the domestic gas industry, providing the learner with the knowledge, understanding and practical skills required to achieve Gas Safe recognition for CCN1.</i>
GLH	190	
Unit	Learning Outcomes	Assessment Criteria
Specific Domestic Core Safety for Natural Gas	LO1 Know the natural gas supply network and LPG supplies	1.1 to 1.2
	LO2 Know the operation pressure regulators	2.1 to 2.3
	LO3 Know the characteristics, combustion process with natural gas	3.1 to 3.10
	LO4 Know the types of burners used with natural gas	4.1 to 4.5
	LO5 Know how to install gas pipework in domestic and small commercial premises	5.1 to 5.14
	LO6 Know how domestic Natural Gas supplies are metered, regulated and controlled	6.1 to 6.10
	LO7 Know how to take pressure readings and gas rates in domestic gas systems and check meter regulators	7.1 to 7.7
	LO8 Tightness test and purge gas pipework in small natural gas installations	8.1 to 8.13
	LO9 Know how to re-establish gas supplies and relight appliances	9.1 to 9.3
	LO10 Know industry specific legislation and standards	10.1 to 10.2
	LO11 Demonstrate that gas safety controls are operating correctly, and the actions required when unsafe or ineffective operation is found	11.1 to 11.7
	LO12 Know the ventilation requirements of gas appliances installed in dwellings	12.1 to 12.10
	LO13 Know the standards of chimneys and flue systems to be used with gas appliances	13.1 to 13.10
	LO14 Carry out chimney performance checks	14.1 to 14.8
	LO15 Use the Gas Industry Unsafe Situations Procedures	15.1 to 15.9
	LO16 Know the gas emergency actions, responsibilities and procedures relevant to the industry	16.1 to 16.2
	LO17 Use of combustion and atmosphere sampling analysers	17.1 to 17.10
	LO18 Install and commission a small domestic gas installation	18.1 to 18.14

Learning outcome 1	
Know the natural gas supply network and LPG supplies	
Assessment criteria	
1.1	Describe the key features of a natural gas network Network <ul style="list-style-type: none"> • Gas terminals • Pipe materials and sizes • Compressors • Pressure regulation • Storage • Gas quality
1.2	State the operating pressure ranges Ranges <ul style="list-style-type: none"> • Low pressure • Medium pressure • Intermediate pressure • High pressure.

Learning outcome 2	
Know the operation pressure regulators	
Assessment criteria	
2.1	Explain the need for, purpose and application of pressure regulators
2.2	State the different types of pressure regulators
2.3	Describe the construction and operation of a compensated constant pressure regulator.

Learning outcome 3	
Know the characteristics, combustion process with natural gas	
Assessment criteria	
3.1	Define the different types of gases used to supply appliances in domestic dwellings Types of gases <ul style="list-style-type: none"> • Chemical symbols <ul style="list-style-type: none"> - Methane (CH₄) - Propane (C₃H₈) - Butane (C₄H₁₀) • Gas characteristics • Viscosity • Families of gas <ul style="list-style-type: none"> - 1st, 2nd and 3rd families • Relative density of gases compared to air • Explosive mixtures

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Know the characteristics, combustion process with natural gas

Assessment criteria

3.2 Identify the **combustion process** with gases used in dwellings

Combustion process

- The combustion equation
- Air requirements for combustion
- Main constituents of complete combustion
- Main constituents of incomplete combustion
 - Carbon Monoxide
 - Soot deposits
- Flammability limits of gases
- Causes of incomplete combustion
- Causes of appliance incomplete combustion at the:
 - burner
 - combustion space
 - heat exchanger
 - flue
- Calorific Values of gases
 - Gross; Net
 - British thermal units (BTU's)
 - Kilowatts (kW)
 - Use of conversion charts
- Wobbe number of gases

3.3 Identify the potential **effects of Carbon Monoxide** when incomplete combustion takes place

Effects of Carbon Monoxide

- Effects of exposure to Carbon Monoxide on the human body
- Symptoms of CO poisoning
- Advice to give to a person who describes symptoms of being affected by products of combustion
- Advice to be given when a CO detector has activated
- Ambient levels of CO in atmosphere
- Levels of CO within dwellings and effect on electronic detectors
- Causes of activation of CO detectors and indicators
- Movement of products of combustion within properties and its effect

3.4 State typical ambient levels of carbon dioxide and identify critical levels and the potential effects on the gas combustion process

3.5 Specify the **measures** necessary to ensure that exposure to carbon monoxide does not take place/ is minimised

Measures

- Primary measures – correct appliance installation and maintenance
- Secondary measures – use of carbon monoxide detectors
- Types of CO detectors available and standards of manufacture
- The positioning requirements for carbon monoxide detectors
- The associated maintenance requirements of CO detectors
- Other sources of carbon monoxide and carbon dioxide in dwellings
- Causes of activation of CO detectors & indicators

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Know the characteristics, combustion process with natural gas

Assessment criteria

- 3.6 Identify incomplete combustion** in an open flue appliance
Identify incomplete combustion
- Around appliance location
 - In appliance
- 3.7** Identify the regional differences in Building Regulations regarding CO detection when installing new or replacement fixed combustion appliances
- 3.8** Identify CO detectors and indicators
- 3.9** Identify CO detectors and indicator installation and location requirements
- 3.10** Commission and maintain **detectors**
Detectors
- Audible
 - Readable
 - Visual.

Learning outcome 4

Know the types of burners used with natural gas

Assessment criteria

- 4.1** Define the layout features and operating principles of gas appliance **burners**
Burners
- Pre and post aerated burners
 - Premix burners
 - Forced draught burners
 - Radiant burners
- 4.2** Define the key **terms** related to gas appliance burners
Terms
- Flame speed
 - Ignition temperature
 - Venturi
 - Burner head
 - Burner (flame) retention
- 4.3** Identify how to diagnose **faults** in gas appliance burners
Faults
- Flame picture
 - Sooting
 - Discolouration
 - Flame Chilling
 - Linting
 - Condition of the burner
 - Air supply faults
 - Condition and size of injectors

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Know the types of burners used with natural gas

Assessment criteria

4.4 Clarify the **reasons for burner faults** that result in incomplete combustion

Reasons for burner faults

- Gas rate / pressure settings
- Effects of excessive pressure at the appliance (flame lift)
- Aeration
- Vitiation
- Light back
- Flame chilling

4.5 Inspect the flame picture of **burners** visually and identify complete and incomplete combustion

Burners

- Pre and post aerated burners
- Premix burners
- Forced draught burners
- Radiant burners.

Learning outcome 5

Know how to install gas pipework in domestic and small commercial premises

Assessment criteria

5.1 Clarify the materials suitable for **gas pipework** and fittings

Gas pipework

- Up to 35mm/1½" diameter
- Standards for pipework and fittings
- Materials used
 - Copper
 - Low carbon steel
 - Steel semi-rigid
- Actions to take with existing lead pipe

5.2 Identify the acceptable **jointing methods** for pipework used for domestic gas supplies

Jointing methods

- Cleansing agents
- Jointing methods
 - Copper to copper
 - Mild steel to mild steel
 - Copper to mild steel
 - Press end connections
 - Steel semi-rigid pipework and termination

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Know how to install gas pipework in domestic and small commercial premises

Assessment criteria

- 5.3** Explain the industry **practices and methods of bending pipe** materials suitable for carrying gas
Practices and methods of bending pipe
- Bending methods of copper pipe
 - To set measured distances to include; double sets/offset bends, 90 degree bends, crank sets/passover bends
 - Corrugated stainless steel tube (CSST)
 - Stainless steel flexible pipe (anacondas)
- 5.4** Explain how to confirm that the gas supply and earthing system requirements are adequate for the installation of the new gas system and components or, for extending the system or adding components to system
- 5.5** Describe how to measure and record installation and site details for prefabrication purposes
- 5.6** Calculate gas **pipe sizes** for domestic NG supply systems
Pipe sizes
- Supply from meter to appliance branches
 - Supply from main branch connection to appliance termination
- 5.7** Clarify the circumstances in which polyethylene pipework may be used for domestic gas supply pipework
- 5.8** Specify the correct **positioning, support and fixing** requirements for gas supply pipework
Positioning, support and fixing
- Copper pipework
 - Mild steel pipework
 - Steel semi-rigid pipework
 - Requirements for sleeving pipework:
 - Through building features such as walls and into meter boxes
 - External surface mounted installation pipework
 - Ventilation size requirements for pipework installed within ducts
 - Ventilation requirements for protected shafts and voids
 - Accommodation for thermal movement of pipework
- 5.9** Specify the **installation requirements** for gas supply pipework
Installation requirements
- Route
 - Protection of buildings
 - Appearance
 - Positioning requirements for gas controls/isolation valves
 - Exterior pipework
 - Minimum depth of pipework buried below ground
 - Pipework installed under the base of a wall or foundations
 - Pipework installed between joists in suspended floors or roof spaces:
 - Solid timber
 - Metal web
 - Timber engineered
 - Installed across solid timber joists fitted with flooring

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Know how to install gas pipework in domestic and small commercial premises

Assessment criteria

5.9

Cont.

- Installed in floors or walls
 - Sheathing requirements
 - Buried in concrete floors/walls
 - Installed behind dry lined walls
 - Installed within stud partition walls
 - Installed under the base of a wall or foundation
- Pipework
 - in voids
 - in ducts/shafts
 - in roof spaces
 - laid in joisted floors
 - notching and drilling solid timber floor joists
 - passing through cavity walls
 - within timber/light steel frame walls
- Entry to dwellings from medium pressure meter installations
- Pipework passing through a timber frame/masonry wall - accommodating movement
- Pipework within timber constructed walls
- Fixing installation pipework when connected to a meter not securely restrained

5.10

Specify the provision of **safety and control measures** to gas supply pipework

Safety and control measures

- Positioning requirements adjacent to other services
- Corrosion protection
- Gas pipe identification
- Methods of accommodating movement of pipework in buildings
- Main equipotential bonding (minimum cross sectional area)
- Disconnection of pipes and fittings – use of temporary continuity bond

5.11

Specify the requirements for **pipework to multi-occupancy dwellings**

Pipework to multi-occupancy dwellings

- Safety requirements for fire stopping in buildings containing flats or maisonettes
- Safety requirements for pipework inside a protected shaft or other fire escape route

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Know how to install gas pipework in domestic and small commercial premises

Assessment criteria

5.12 Produce a plan showing the **positioning, protection and fixing methods**

Positioning, protection and fixing methods

For gas pipework, valves, systems and components

- In:
 - Floors
 - Ducts
 - Through walls
 - Buried in walls
 - Multi-occupancy buildings
 - Protected shafts containing stair
 - Lifts or other protected fire escape routes
- To comply with :
 - Industry standards
 - Gas Safety (Installation & Use) Regulations
 - British Standards
 - Building Regulations

i.e. sleeving, purposed designed channels, fire stops, purposed designed shafts

5.13 State the precautions to be taken when making **new connections** into an existing gas pipework system

New connections

- Breaking gas connections to an appliance
- Fixing requirements for installation pipework when connected to a meter not securely restrained
- Use of temporary continuity bonds

5.14 State the precautions to be taken when using an exposed flame for soldering joints on existing gas pipework systems.

Learning outcome 6

Know how domestic Natural Gas supplies are metered, regulated and controlled

Assessment criteria

6.1 Describe the installation, operation and positioning requirements for **Emergency Control Valves (ECV)**

Emergency Control Valves

- Natural gas/LPG meter installations
- Remote meter installations
- Multiple occupancy meter installations
 - External risers
 - Internal risers
- Additional Emergency Control Valves (**AECV**)
- Meter Inlet Valves (**MIV**)

6.2 Explain the installation, operation and positioning requirements for appliance isolation valves (**AIV**)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Know how domestic Natural Gas supplies are metered, regulated and controlled

Assessment criteria

- 6.3** Describe the associated labels required for **Emergency Control Valves (ECV)**
- Emergency Control Valves**
- Natural gas/LPG meter installations
 - Remote meter installations
 - Multiple occupancy meter installations
 - External risers
 - Internal risers
 - Additional Emergency Control Valves (**AECV**)
 - Meter Inlet Valves (**MIV**)
- 6.4** Define the methods of **entry and layout features** of natural gas service pipework to domestic dwellings
- Entry and layout features**
- Minimum depth of service pipework
 - Types of domestic gas meter housings and compartments
 - Surface mounted meter boxes
 - Semi-concealed meter boxes
 - Built-in meter boxes
 - Purpose built meter housings
 - Medium pressure installations
 - Multi-occupancy installation - remote meters
 - Primary meter installations
 - Use of secondary meters
 - Use of pre-payment meters
 - Use of meter labels – secondary and primary meters
 - Internal/external meter positions
- 6.5** State the operation and accuracy of gas positive displacement meters
- 6.6** Identify correctly and incorrectly positioned ECV/AECV/MIV
- 6.7** Demonstrate dealing with incorrectly positioned ECV/AECV/MIV
- 6.8** Identify the procedure to take when a fault is diagnosed on an emergency control valve
- 6.9** Define the characteristics of **meters** used in domestic dwellings
- Meters**
- U6
 - E6
 - Semi-concealed
 - Inferential
 - Rotary
 - Positive displacement

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Know how domestic Natural Gas supplies are metered, regulated and controlled

Assessment criteria

6.10 Define the operating principles of **domestic regulators and governors**

Domestic regulators and governors

- The construction of a regulator
- The operation of a gas meter regulator
- Identification of medium pressure meter and regulator installation
- Maintaining correct installation operating pressures
- Checking and/or setting correct installation operating pressures.

Learning outcome 7

Know how to take pressure readings and gas rates in domestic gas systems and check meter regulators

Assessment criteria

7.1 Specify the procedures for taking **pressure readings** in domestic gas supply systems

Pressure readings

- Measurement of pressure
- Types of pressure gauges
- Use of pressure gauges
- Procedures for taking pressure readings
 - Static pressure at the meter
 - Working pressure at the meter
 - Working pressure at appliances

7.2 Identify the methods of determining and/or setting **gas appliance working pressures**

Gas appliance working pressures

- Fixed rated appliances
- Range rated appliances

7.3 Identify the methods of **determining gas rates at appliances**

Determining gas rates at appliances

- Use of manufacturer data (appliance input)
- Use of meter test dial/index for calculation of gas consumption rate

7.4 Identify reasons for excessive pressure loss across the installation and at the appliances

7.5 Identify the **factors** which can affect the pressure readings at meter regulators

Factors

- Factors affecting pressure loss
- Effects of low flow rates & high flow rates on regulator outlet pressures (19 – 23 mbar)
- Effects of pressure absorption across the primary meter installation

7.6 Describe the process for setting **regulators**

Regulators

- Meter regulators low and medium pressure

7.7 State the procedures to take when incorrect pressure readings are encountered in gas supply systems.

Learning outcome 8	
Tightness test and purge gas pipework in small natural gas installations	
Assessment criteria	
8.1	Define the acronyms and symbols used within the industry standards for tightness testing
8.2	State the types of pressure gauge suitable for carrying out a tightness test and identify the requirements for the accuracy of reading
8.3	Identify the points when tightness testing of an installation should be carried out Tightness testing of an installation <ul style="list-style-type: none"> • Before work commences on existing systems • On completion of work on new and existing gas systems • Following the report of a gas escape
8.4	Describe how to measure, calculate and record gas system installation volumes for tightness testing and direct purging activities
8.5	Clarify how differing system types and configurations impacts on the tightness testing procedure System types and configurations <ul style="list-style-type: none"> • Maximum installation volume for individual tightness tests (0.035m³) <ul style="list-style-type: none"> - Calculating pipe volume; Fittings volume; Meter volume • Pipe diameter up to (35mm) • Inlet pressure exceeds 75 mbar without meter inlet valve • Different meter types <ul style="list-style-type: none"> - Diaphragm U6/G4/U16/G10; Ultrasonic E6; Single dwellings; Multiple dwellings with emergency control valves only • Anti-tamper devices
8.6	Identify medium pressure regulator sets where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, whether a meter inlet valve (MIV) is fitted
8.7	Determine the tightness testing procedures for gas supply systems Tightness testing procedures <ul style="list-style-type: none"> • Testing new installation pipework (no meter connected) • Testing new installations (meter connected) with or without appliances connected • Testing existing installations (meter connected) with or without appliances connected to ensure the installation doesn't exceed the maximum permissible pressure drop • Testing existing medium pressure fed installations where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, where a meter inlet valve (MIV) is fitted or, no meter inlet valve is fitted • Medium pressure system without a meter inlet valve (MIV)
8.8	Specify the actions to take to investigate and repair suspected leakage from gas supplies and components Investigate and repair <ul style="list-style-type: none"> • Use of gas detection equipment • Use of leak detection fluid
8.9	State the industry practices and procedures for tracing and repairing gas escapes

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 8 **continued**

Tightness test and purge gas pipework in small natural gas installations

Assessment criteria

- 8.10** Specify the **actions to be taken** when a smell of gas persists following a gas tightness test
- Actions to be taken**
- When the emergency control valve / additional emergency control valve / meter inlet valve is turned off
 - When a leaking installation cannot be repaired
- 8.11** Explain the process and procedures, equipment and legislative requirements for applying direct purging of gas systems, appliances and components
- 8.12** State the routines and sequences for direct purging of gas systems, appliances and components
- 8.13** Describe the requirements to issue gas testing and purging certificates.

Learning outcome 9

Know how to re-establish gas supplies and relight appliances

Assessment criteria

- 9.1** State the correct action to be taken when a non-commissioned appliance is identified
- 9.2** State the actions to be taken if pipework and appliances are not commissioned when the gas supply to the property is re-established
- 9.3** Identify the procedures for re-establishing gas supplies and relighting appliances.

Learning outcome 10

Know industry specific legislation and standards

Assessment criteria

- 10.1** State the key points of gas **industry legislation**
- Industry legislation**
- Application of Gas Safety (Installation & Use) Regulations to work activities
 - Application of Relevant Building Regulations & Standards
 - Precautionary Actions Required to Prevent use of Unsafe Installations
- 10.2** Describe the Gas Safety (Installation & Use) **Regulations**
- Regulations**
- To include:
- Reg.2 General interpretation and application 2 (1),(2),(3),(4),(5) c (iii),(6),(7) & (8)
 - Reg.3 Qualification and supervision 3 (1),(2),(3),(5),(6),(7) & (8)
 - Reg.4 Duty on employer
 - Reg.5 Materials and workmanship 5 (1) to (3)
 - Reg.6 General safety precautions 6 (1) to (6)
 - Reg.7 Protection against damage 7 (1) to (3)
 - Reg.8 Existing gas fittings 8 (1) to (3)
 - Reg.9 Emergency controls (1) to (4)
 - Reg.10 Maintaining electrical continuity
 - Reg.14 Regulators 14(1), (5), (6), (7)
 - Reg.18 Safe use of pipes 18 (1) and (2)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 10 **continued**

Know industry specific legislation and standards

Assessment criteria

- 10.2 cont.**
- Reg.19 Enclosed pipes 19 (1) to (6)
 - Reg.20 Protection of buildings
 - Reg.22 Testing and purging of pipes 22 (1) to (3)
 - Reg.23 Marking of pipes 23 (1) and (2)
 - Reg.25 Interpretation of Part E
 - Reg.26 Gas appliances – safety precautions 26 (1) to (10)
 - Reg.27 Flues (1) to (4)
 - Reg.30 Room-sealed appliances (1) to (3)
 - Reg.32 Flue dampers (2) and (3)
 - Reg.33 Testing of appliances 33(1) to (3)
 - Reg.34 Use of appliances 34 (1) to (3)
 - Reg.35 Duties of employers and self-employed persons
 - Reg.36 Duties of Landlords 36 (1) to (12)
 - Reg.37 Escape of gas 37 (1) to (4).

Learning outcome 11

Demonstrate that gas safety controls are operating correctly, and the actions required when unsafe or ineffective operation is found

Assessment criteria

- 11.1** Identify appliance data critical for correct spare part identification of gas safety control/devices
- 11.2** Define the types of **gas control devices** used for gas appliances and their operating principles
- Gas control devices**
- Pressure regulators
 - Low pressure cut-off valves
 - Thermal cut-off valves
 - Gas cocks/valves
 - Cooker hotplate lid control valves
 - Electric solenoid valves
 - Excess flow valves
- 11.3** Define the types and operating principles of **flame protection devices** used in gas appliances
- Flame protection devices**
- Vapour pressure devices
 - Thermoelectric valves
 - Flame conduction & rectification systems
 - Interrupter devices
 - Atmosphere sensing devices
 - Spillage detection devices
 - Multifunctional control valves

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 11 **continued**

Demonstrate that gas safety controls are operating correctly, and the actions required when unsafe or ineffective operation is found

Assessment criteria

- 11.4** Define the types and operating principles of **thermostats** used to control heat emitted from gas appliances
- Thermostats**
- Bimetallic
 - Liquid expansion
 - Vapour pressure
 - Electrical control
 - Electrical overheat/limit
 - Thermistors
- 11.5** Explain sequence of operation of control/devices
- 11.6** Safely diagnose correct, unsafe or ineffective operation of **gas control devices, flame protection devices** and **thermostats**
- Gas control devices**
- Pressure regulators
 - Low pressure cut-off valves
 - Thermal cut-off valves
 - Gas cocks/valves
 - Cooker hotplate lid control valves
 - Electric solenoid valves
 - Excess flow valves
- Flame protection devices**
- Vapour pressure devices
 - Thermoelectric valves
 - Flame conduction & rectification systems
 - Interrupter devices
 - Atmosphere sensing devices
 - Spillage detection devices
 - Multifunctional control valves
- Thermostats**
- Bimetallic
 - Liquid expansion
 - Vapour pressure
 - Electrical control
 - Electrical overheat/limit
 - Thermistors
- 11.7** Demonstrate **actions** to be taken when defective or unsafe control operation is identified
- Actions**
- Isolate gas and electricity supplies, where necessary
 - Repair or replace faulty gas safety control/devices
 - Repair or replace faulty gas safety control/devices
 - Check work carried out is gas tight
 - Confirm correct operation of repaired/ replaced gas safety controls/devices to MIs
 - Explain safe operation of gas safety controls/devices.

Learning outcome 12

Know the ventilation requirements of gas appliances installed in dwellings

Assessment criteria

12.1 Calculate the **ventilation requirements** for open flued and flueless gas appliances

Ventilation requirements

- Adventitious air supplies
- Gross and net calorific values of appliances
- For multiple appliance installations in the same room/space
 - Multiple open flued and flueless appliances
 - Open flued and flueless appliances

12.2 Calculate the **ventilation required** for appliances located in compartments

Ventilation required

- Open flued appliances
- Room sealed appliances

12.3 Identify the types of labels and notices available for ventilation

12.4 Identify the types of **grilles and vents** available for ventilation

- Types of grilles and vents
- Sizing of grilles and vents (free area availability)
- In tumescent air vents

12.5 Calculate the free area of unmarked grilles and vents

12.6 Specify the **acceptable locations** for ventilation to appliances

Acceptable locations

- Restrictions to ventilator/grille locations
- Installation of vents through walls (including cavity walls)
- Ventilation paths via other rooms
- Ventilation paths to compartments including ducts
- Ventilation for internal kitchens
- Siting of ventilation
 - Wall
 - Window
 - Floor/ceiling (ducted and un-ducted)

12.7 Clarify the effect that other **heat producing appliances and other types of extraction** have on the requirement for ventilation of gas appliances

Heat producing appliances and other types of extraction

- Oil or solid fuel appliances and flue systems
- Passive stack ventilation
- Extractor fans
- Cooker hoods
- Tumble dryers
- Effects of double glazing/cavity insulation/draught proofing

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 12 **continued**

Know the ventilation requirements of gas appliances installed in dwellings

Assessment criteria

12.8 Specify the ventilation requirements of open flued and flueless **decorative fuel effect space heaters**

Decorative fuel effect space heaters (DFE)

- Single appliances
- DFEs in adjoining rooms
- In rooms with multiple appliances
- Oil and solid fuel appliances

12.9 Measure existing vents and grilles to ensure that they are the correct type and provide the correct supply of air

12.10 Specify ventilation vents/grilles and methods.

Learning outcome 13

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment criteria

13.1 Interpret the **legislation** that applies to chimneys and flues that serve gas appliances

Legislation

- Gas safety legislation
- Exchange of information & planning requirements for chimneys

13.2 State how gas appliances are classified according to the **type of chimney or flue** used

Type of chimney or flue

- Flueless
- Open flued
 - Natural draught
 - Forced (fanned) draught
- Room sealed
 - Natural draught
 - Forced (fanned) draught
 - Vertex type appliances

13.3 Identify the **working principles** of flue systems serving gas appliances

Working principles

- Open flued chimneys
- Room sealed – natural draught
- Room sealed – fanned draught
- Vertex type flues

13.4 State the types and general layout features of **chimney and flue construction**

Chimney and flue construction

- Rigid chimney types
 - Brick / masonry
 - Pre-cast flue blocks
 - Metallic (single & double wall flues)
- Flexible metallic liner installation
- Use of flue box systems
- Shared (common) chimney systems - SE & U Ducts

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 13 **continued**

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment criteria

13.5 Specify the requirements for new and existing chimney and flue **installation**

Installation

- Requirements of designer, builder, provider or installer when installing gas chimneys
- Chimney certificates
- Existing solid fuel chimneys:
 - Suitability - checks required
 - Minimum size of unlined chimney used for gas fire before terminal is required
 - Minimum size of side openings for slabbed over chimneys
 - Minimum cross sectional area of new chimney installations – gas fires
 - Operation of dampers and restrictor plates
 - Effects of other fuels on chimneys and need for cleaning
 - Minimum void dimensions below appliance connections
 - Catchment spaces and standard dimensions/volumes
 - Types of flue liners – during construction (salt glazed clay etc.):
 - Poured/pumped concrete flue liners
 - Pre-cast flue blocks
 - Flexible flue liners
 - Restrictions on use of poured concrete liners
 - Sealing and support for flexible flue liners in chimneys
 - Inspection of chimneys through loft spaces
 - Chimney height/appliance types where liners are required
 - Sealing chimney voids
 - Fitting bird guards to chimneys
 - Suitable and unsuitable terminals for space heaters including radiant, inset and DFE
- Pre-cast flue design:
 - Flue design, standards, operation, routing, connection, termination
 - Minimum cross sectional area of new gas flue blocks
 - Minimum requirement of vertical flue blocks before off sets
 - Jointing material for pre-cast flue blocks
 - Minimum flue size diameter for connecting pre-cast transfer blocks to termination point
 - Effects of temperature on installation requirements for pre-cast flues
 - Classification of gas appliances - flueless, open flue, room sealed
- Chimneys for individual open flue natural draught appliances:
 - Construction and operation of chimney
 - Types of chimney material – cement based, and metallic
 - Methods of jointing chimney components
 - Termination positions for chimney outlets
 - Ridge terminal positions
 - Effects on terminal positions by:
 - adjacent structures
 - basement areas
 - light wells
 - retaining walls
 - Dealing with downdraught on steeply pitched roofs
 - Restrictions to siting and lengths of chimney run to avoid condensation
 - Minimum up-stand for chimneys passing through tiled or slated roofs

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 13 continued

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment criteria**13.5****cont.**

- Clearances when passing through combustible material
- Chimneys passing adjacent to combustible material or through other dwellings
- Terminals and/or guards – protection against wildlife
- Pre-fabricated metal starter box for space heaters
- Passive stack ventilation systems in houses, where open flue natural draught appliances are fitted
- Types of chimney material – cement based, and metallic
- Fan draught chimneys for open flue appliances:
 - Requirements prior to installing fans in secondary flues
 - Additional requirements when fans are installed in secondary flues
 - Fan dilution and shared open flue, fanned draught systems in domestic dwellings
- Shared open flue chimneys for natural draught appliances
 - Two or more appliances connected to same flue
 - Appliances with a common flue in same room
 - Labelling appliances on shared flues installed on different floors
 - Maintenance of shared flue systems
- Room sealed natural draught chimney configurations for appliances:
 - Balanced flue construction
 - Outlet position:
 - horizontal to an opening, relating to appliance net input
 - below an opening, relating to appliance net input
 - above an opening, relating to appliance net input
 - below gutters, soil pipes, drain pipes and eaves
 - in car ports
 - Balanced flue terminal guards
- Room sealed fanned draught chimney configurations for appliances:
 - Restrictions on lengths, bends etc. for fanned draught room sealed appliances
 - Restrictions for outlet positions inc. horizontal and vertical configurations
 - Enclosing chimneys
 - Proximity of flue duct outlets to boundaries
 - Identify unsafe situation of room sealed fanned flue system enclosed without sufficient inspection facility
- Balanced compartments for open flue appliances:
 - Ducted air positioning
 - Cross sectional areas of air inlet ducts
 - Compartment construction

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 13 **continued**

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment criteria

13.5

cont.

- Room sealed appliances for shared chimneys (SE-ducts, U-ducts and CFS):
 - Construction and operation of SE-ducts, U-ducts and CFS
 - Categories of appliances suitable for installation
 - Chimney outlet positions for roof terminals
 - Labelling air inlet ducts
 - Labelling replacement appliances
 - Maintenance of shared flue systems
 - Requirements for replacement appliances
 - NRV requirements for appliance/exhaust ducts for CFS
- Condensing flues:
 - Condensate disposal position termination for appliances of heat input ≤ 4 Kw
 - Plume management kits
 - Differing air inlet duct and terminal positions
 - Terminal guards for plume kit air inlets
- Chimneys for vertex appliances:
 - Construction and operation of vertex chimney
 - Minimum height of appliance draught break above roof insulation
- Room sealed positive pressure combustion chamber appliances
 - Types
 - Causes of leakage of products of combustion
 - Checks prior to fitting case, to include:
 - back plate inspection
 - appliance case
 - screws
 - case seals
 - Installation and spillage testing new or used appliances when MIs are not available
 - Alternative methods of compliance when inspection hatches are not available for flues in voids
 - Actions required where fumes, smells or spillage have been reported/encountered
- Open, balanced and fan assisted chimneys:
 - Insulation for chimneys for open flue appliances
 - Condensing appliance chimneys
 - Chimney maintenance
 - Guards for balanced flue terminals
 - Effects and hazards of inadequately sealed flue liners
 - Incorrect applications of flue liners
 - Identify difference of vertex systems to vertical room sealed chimney configurations

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 13 **continued**

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment criteria

13.6 Define the **design requirements** of chimney and flue systems used with gas appliances

Design requirements

- Requirements of designer, builder, provider or installer when installing gas chimneys
- Requirements for chimney/hearth certificates
- Chimney system design:
 - Distance requirements when passing through combustible material
 - Special requirements for chimneys passing adjacent to combustible material or through other dwellings
- Temperature effects and condensation problems caused by flue pipe runs
- Requirements for the catchment space to open flued space heaters
- Open flued chimney system
 - Parts of an open flue chimney system
- Room-sealed chimney system
 - Parts of a room sealed flue chimney system
 - Natural and fanned draught

13.7 Specify the requirements for the provision of hearths to gas appliances

13.8 Specify the requirements for the **termination** of flue systems serving gas appliances

Termination

- Room sealed flue positions
- Condensing appliances
- Terminal guard requirements
- Open flue terminal positions
 - Flue/chimney outlet locations/terminal positions - before 2001
 - Flue/chimney outlet locations/terminal positions - after 2001
 - Methods of dealing with down-draught on steeply pitched roofs

13.9 Specify the requirements for installing **chimney fans** to open flues and chimney systems

Chimney fans

- Requirements prior to installing fans in secondary flues
- Additional safety requirements when fans are installed in secondary flues
- Requirements for fan dilution and shared open flue, fanned draught systems in domestic dwellings

13.10 Specify the flueing requirements for **balanced compartments** used with open flued appliances

Balanced compartments

- Compartment construction
- Ducted air positioning
- Cross sectional areas of air inlet ducts.

Learning outcome 14

Carry out chimney performance checks

Assessment criteria

- 14.1** Specify the key points to be checked in the **visual inspection** of a flue system prior to undertaking commissioning of the gas appliance and chimney/flue system
- Visual inspection**
- Open flue systems
 - Room sealed flue systems – natural draught & fan assisted
 - Vertex type appliances
- 14.2** State the factors that can affect **flue system performance**
- Flue system performance**
- Downdraught conditions
 - Wind effects at the appliance termination
 - Passive stack ventilation
 - Extraction fans sited in the vicinity of open flued appliances
- 14.3** Carry out the **testing procedures** to check the correct operation of an existing chimney flue/ gas appliance
- Testing procedures**
- Flue flow test
 - Spillage test
 - Flue testing procedures with appliances sited in the vicinity of extraction fans
 - Testing fanned draught open-flue systems and associated safety controls
- 14.4** Carry out the testing procedures for **room sealed fanned draught** flue installations
- Room sealed fanned draught**
- Checking case seals/case integrity
 - Checking flue pipe/air inlet connections for leakage
 - Checking/testing of positive pressure case appliances
- 14.5** Carry out **checks** on **open chimney systems**
- Checks** (as appropriate)
- Visual checks throughout the length
 - Confirmation of correct type
 - Fitness for intended appliance
 - Serves only one room or appliance
 - Terminal position meets current legal requirements
 - Joint between terminal and chimney system is weather tight
 - Adequate support
 - Clearance from obstructions
 - No corrosion or cracking
 - Use of bends meets current requirements
 - Appliance draught diverter correctly installed and in good condition
 - Secondary flue correctly positioned and in good condition
 - Starter block correctly sized and positioned
 - Catchment space correct and free from debris
 - Joints correctly made
 - No visual signs of spillage of combustion products
 - Correct space between flue and combustible material
 - Flexible flue liner correctly sealed at base and terminal position

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 14 **continued**

Carry out chimney performance checks

Assessment criteria

- 14.5 cont.**
- Connection into a pre-lined chimney (clay) is correct
 - Seals on balanced natural and fan flues in good condition and correctly installed
 - Balanced flue appliance seals in good condition and correctly installed

Open chimney systems

- Natural draught chimneys
- Metallic flexible flue liners
- Plastic flue pipe systems

- 14.6** Identify correct and incorrect **open chimney installations**

Open flue chimney installations

- Cement based and metallic rigid
 - jointing
 - adapters
 - bends
 - supports
 - spacing between chimney and combustible material
 - ridge terminals and ridge tile adaptor
 - flueing into a pre-lined chimney (clay lined)
- Flexible flue liners
 - joining at base and at chimney outlet using appropriate adaptors
 - clamping at chimney outlet position
 - sealing annular space between liner and chimney
 - sealing voids at chimney base – pipework etc.
 - plastic flue pipe – flue pipe jointing

- 14.7** Carry out **checks** on **room sealed chimney systems**

Checks (as appropriate)

- Visual checks throughout the length
- Confirmation of correct type
- Fitness for intended appliance
- Serves only one room or appliance
- Terminal position meets current legal requirements
- Joint between terminal and chimney system is weather tight
- Adequate support
- Clearance from obstructions
- No corrosion or cracking
- Use of bends meets current requirements
- Appliance draught diverter correctly installed and in good condition
- Secondary flue correctly positioned and in good condition
- Starter block correctly sized and positioned
- Catchment space correct and free from debris
- Joints correctly made
- No visual signs of spillage of combustion products
- Correct space between flue and combustible material
- Flexible flue liner correctly sealed at base and terminal position
- Connection into a pre-lined chimney (clay) is correct
- Seals on balanced natural and fan flues in good condition and correctly installed
- Balanced flue appliance seals in good condition and correctly installed

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 14 **continued**

Carry out chimney performance checks

Assessment criteria

14.7 Room sealed chimney systems

cont.

- Natural draught
- Fan assisted
- Vertex flue appliances
- Balanced compartments for open flue appliances
- SE-ducts, U-ducts and CFS
- Condensing flues

14.8 Identify correct and incorrect room sealed chimney installations

Room sealed chimney installations

- Natural draught
 - Flue duct cuts
 - Assemble, adjust and seal to MIs
 - Flue terminal guards against balanced flue terminal
- Fan assisted
 - Number of bends within flue duct length is to MIs
 - Calculate ventilation for a vertex system.

Learning outcome 15

Use the Gas Industry Unsafe Situations Procedures

Assessment criteria

15.1 Explain the purpose and scope of the unsafe situations procedure

15.2 Explain the criteria for dealing with each of the **unsafe situations categories**

Unsafe situations

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- Situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

15.3 Explain how the **unsafe situations procedure is applied**

Unsafe situations

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- Situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 15 **continued**

Use the Gas Industry Unsafe Situations Procedures

Assessment criteria

15.4 Identify **unsafe situations**

Unsafe situations

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- Situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

15.5 Classify **unsafe situations**

Unsafe situations

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- Situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

15.6 Explain the purpose and use of the associated warning **notices** and labels

Notices

- MP gas supply
- Warning notice forms
- Advisory notices:
 - Appliance use
 - Appliance shut off
 - Work in progress
 - Electrical bonding
 - Landlord / Home Owner Gas Safety Record
 - Gas Safety Inspection Form
 - Benchmark Maintenance Report
 - Service / Maintenance Checklist(s)
 - Chimney / Hearth Notice Plate
- Issuing to appropriate persons
- Un-commissioned Appliance Label
- Balanced Compartment Label

15.7 Demonstrate the procedure for each **unsafe situation**

Unsafe situations

- ID installations/appliances
- AR installations/appliances
- AR installations/appliances when turning off does not remove the risk
- Situations that do not meet current standards but are not unsafe
- RIDDOR Reportable

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 15 **continued**

Use the Gas Industry Unsafe Situations Procedures

Assessment criteria

15.8 Select and issue appropriate warning/advisory **notices**

Notices

- MP gas supply
- Warning notice forms
- Advisory notices:
 - Appliance use
 - Appliance shut off
 - Work in progress
 - Electrical bonding
 - Landlord / Home Owner Gas Safety Record
 - Gas Safety Inspection Form
 - Benchmark Maintenance Report
 - Service / Maintenance Checklist(s)
 - Chimney / Hearth Notice Plate
- Issuing to appropriate persons
- Un-commissioned Appliance Label
- Balanced Compartment Label

15.9 State the types of RIDDOR reportable work/incidents.

Learning outcome 16

Know the gas emergency actions, responsibilities and procedures relevant to the industry

Assessment criteria

16.1 State the **responsibilities and appropriate actions** to be taken in the event of a gas emergency

Responsibilities and appropriate actions

- Reporting gas escapes
- Responsibilities of the gas user
- Responsibilities of the gas operative to give gas users advice and safety information
- Responsibilities of the gas engineer
- Turning off at emergency controls
- Elimination of ignition sources
- Reduction of gas concentrations via ventilation
- Action by the gas transporter
- Action by the LPG Supplier
- Action if gas continues to escape after turning off supply
- Action to stop a gas escape downstream of ECV/AECV

16.2 State the Gas Emergency **Priorities**

Priorities

- Protect life
- Protect Property
- Secure the escape
- Leave the site safe.

Learning outcome 17	
Use of combustion and atmosphere sampling analysers	
Assessment criteria	
17.1	State when appliance testing must be carried out
17.2	Identify types of portable combustion analysers
17.3	Specify the testing procedures for gas appliances that require commissioning by analysis of the flue combustion products Analysis of the flue combustion products <ul style="list-style-type: none"> • Flue gas samples to be taken during the commissioning process • Sources of information required to determine correct flue gas products and ratios
17.4	State the action levels for gas appliances
17.5	Explain the actions if CO/CO ₂ ratio remains above suitable performance levels after adjustment
17.6	Identify the unsafe situation category for flued /flueless appliance that fails test
17.7	Identify unsafe situation of combustion products that could enter premises
17.8	Demonstrate the correct use of a Combustion Performance Analysers & Atmosphere Sampling Analysers interpreting readings Interpreting readings <ul style="list-style-type: none"> • CO, CO₂, O₂ readings, CO/CO₂ Ratios in a flueway • CO, CO₂, O₂ readings in the atmosphere
17.9	Visually and by the use of combustion performance analysis identify complete and incomplete combustion for Type 'A', 'B' & 'C' gas appliances
17.10	Complete the required checks using a combustion/atmosphere analyser in the event of "carbon monoxide detector" activation.

Learning outcome 18	
Install and commission a small domestic gas installation	
Assessment criteria	
18.1	Install a domestic gas meter, pipework and domestic appliance Install <ul style="list-style-type: none"> • Selecting correct materials and fittings (copper, mild steel and CSST) • Demonstrate the correct method of jointing materials and fittings • Demonstrate the correct method of installing securing and supporting domestic meters and regulators • Demonstrate the correct method of installing a domestic appliance
18.2	Identify installation pipework safety defects Pipework defects (Add specific requirements from MoGS Disc - practical provisions into practical assessment (not to be published in delivery packs))

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 18 **continued**

Install and commission a small domestic gas installation

Assessment criteria

18.3 Demonstrate **tightness testing, purging** and commissioning procedures

Tightness testing, purging

- Testing new installation pipework (no meter connected)
- Testing new installations (meter connected) with or without appliances connected
- Testing existing installations (meter connected) with or without appliances connected to ensure the installation doesn't exceed the maximum permissible pressure drop
- Testing existing medium pressure fed installations where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, where a meter inlet valve (MIV) is fitted or, no meter inlet valve is fitted

18.4 Demonstrate the **procedures** for taking pressure readings in domestic gas supply systems

Procedures

- Use of pressure gauges
- Procedures for taking pressure readings:
 - Standing pressure at the meter
 - Operating pressure at the meter
- Type of appliance being used:
 - Boiler - at full rate
 - Space heater - at full rate
 - Cooker - three hotplates at full rate
 - Other appliances - at full rate
- Operating pressure at appliances

18.5 State the procedure for notifying the Gas Transporter for pressures outside of the acceptable range

18.6 Demonstrate the procedure for resetting and sealing a regulator

18.7 Trace and repair a gas leak

18.8 **Calculate the gas consumption** rates for gas appliances and confirm they comply with manufacturers' instructions

Calculate the gas consumption

- Imperial rated meters
- Metric rated meters
- Smart meters

18.9 Identify and rectify **faults** discovered during testing

Faults

- Excessive pressure loss at the appliance
- Incorrect gas consumption rates at appliances
- Effects of meter pressure absorption under full load conditions

18.10 Demonstrate the correct **method of removal** of domestic meters and regulators

Method of removal

- Permanent removal
- Temporary removal
- Temporary continuity bonds

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 18 **continued**

Install and commission a small domestic gas installation

Assessment criteria

- 18.11** Demonstrate the procedures for **re-establishing gas supplies and relighting appliances**
Re-establishing gas supplies and relighting appliances
- Purge system and appliances of air
 - Apply any protective coating to pipework (as applicable)
 - Re-light appliance(s)
 - Confirm satisfactory operation of user controls
 - Visually inspect appliance installation(s) for unsafe situations
- 18.12** Describe what action is required when an un-commissioned appliance is identified
- 18.13** Identify correct and incorrect methods of connecting the main equipotential bonding
- 18.14** Demonstrate action to meet the **main equipotential bonding requirements** for both permanent and temporary meter removal
Main equipotential bonding requirements
- Method of bonding connection
 - Positioning of bond
 - Sizing of bond.

10.1.2. Unit 15 Install and Maintain Gas Water Heating and Wet Central Heating Appliances

Unit Level	3	<i>This unit covers the requirements to install and maintain gas water heating and wet central heating appliances that apply when working in the domestic gas industry, providing the knowledge, understanding and practical skills required to achieve Gas Safe recognition for CENWAT.</i>	
GLH	260		
Unit	Learning Outcomes		Assessment Criteria
Install and Maintain Gas Water Heating and Wet Central Heating Appliances	LO1 Know the uses of gas water heating and wet central heating appliances in dwellings		1.1 to 1.3
	LO2 Know the types of gas water heating and wet central heating appliances and their layout requirements		2.1 to 2.4
	LO3 Plan gas systems for installing domestic gas water heaters and wet central heating appliances		3.1 to 3.9
	LO4 Prepare work activities for installing, maintaining domestic gas water heaters and wet central heating appliances		4.1 to 4.12
	LO5 De-commission domestic gas water heaters and wet central heating appliances		5.1 to 5.2
	LO6 Install, exchange, and remove gas pipework to industry standards		6.1 to 6.8
	LO7 Tightness testing and direct purging of gas systems and components		7.1 to 7.11
	LO8 Install domestic gas water heaters and wet central heating appliances		8.1 to 8.14
	LO9 Maintain domestic water heating and wet central heating appliances		9.1 to 9.19
	LO10 Diagnose and rectify faults on domestic water heating and wet central heating appliances		10.1 to 10.14
	LO11 Commission domestic gas water heaters and wet central heating appliances		11.1 to 11.22

Learning outcome 1

Know the uses of gas water heating and wet central heating appliances in dwellings

Assessment criteria

1.1 State the purpose of gas water heating and wet central heating appliances used in dwellings

1.2 Identify the different types of **wet central heating appliances** used in dwellings

Wet central heating appliances

- System boiler
- Heat only boiler
- Combi boiler

1.3 Identify the different types of **gas water heating appliances** used in dwellings

Gas water heating appliances

- Multi point
- Circulator
- Single point.

Learning outcome 2

Know the types of gas water heating and wet central heating appliances and their layout requirements

Assessment criteria

2.1 Identify the **working principles of wet central heating** appliances

Working principles of wet central heating

- System boiler
- Heat only boiler
- Combi boiler

2.2 Identify the **working principles of water heating** appliances

Working principles of water heating

- Multi point
- Circulator
- Single point

2.3 State the general operating principles of **gas fired heat producing appliances** systems in dwellings

Gas fired heat producing appliances

- Open flued appliances
- Room sealed appliances
- Freestanding appliances
- Wall mounted appliances
- Fan assisted appliances
- Flueless water heaters.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Know the types of gas water heating and wet central heating appliances and their layout requirements

Assessment criteria

2.4 State the operating principles of wet central heating and hot water appliance **control components**

Control components

- Chimney and flue systems
 - Air pressure switches
 - Horizontal and vertical systems
 - Extended flue runs
- Fans
 - Combustion
 - Flueing
- Safety controls
- Burners
- Automatic air vents
- Circulating pumps
- Automatic bypass valves
- Diverter valves
- PCB's
- Condensate requirements
- Internal/external user controls
 - Timing devices – clocks and programmers
 - Room thermostats
 - Hot water thermostats
 - “Smart” controls
- Frost thermostats.

Learning outcome 3

Plan gas systems for installing domestic gas water heaters and wet central heating appliances

Assessment criteria

3.1 State the **positioning and fixing requirements** of gas water heating and wet central heating appliances

Positioning and fixing requirements

- Installation pipework
 - Gas / water
- Chimney and flue systems
 - Horizontal and vertical systems
 - Extended flue runs
 - Plume kits
- Ventilation requirements
- Condensate requirements
- Pressure release valve pipework

3.2 Identify and record the customer's job **requirements**

Requirements

- Location
- Siting
- Clearances

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Plan gas systems for installing domestic gas water heaters and wet central heating appliances

Assessment criteria

- 3.3** Compare the customer's job **requirements** with statutory and industry requirements and identify any conflicting issues
Requirements
- Location
 - Siting
 - Clearances
- 3.4** **Survey** the work site
Survey
- Key structural features that could affect the installation
 - Record details
- 3.5** Check that the proposed positioning of the appliance meets the manufacturers' and industry standards' **requirements**
Requirements
- Location
 - Siting
 - Clearances
- 3.6** Check that the availability of input services meets the appliance manufacturers' and industry standards' **requirements for the appliance installation**
Requirements for the appliance installation
- Gas supply
 - Electricity supply
 - Chimney suitability
 - The provision of ventilation
- 3.7** Apply changes to customer job **requirements** and obtain customer agreement to those changes
Requirements
- Location
 - Siting
 - Clearances
- 3.8** Check and ensure the design of the proposed installation is **compliant**
Compliant
- Appliance manufacturer's instructions
 - Industry standards
- 3.9** Check proposed location of condensate disposal is **compliant**
Compliant
- Appliance manufacturer's instructions
 - Industry standards.

Learning outcome 4

Prepare work activities for installing, maintaining domestic gas water heaters and wet central heating appliances

Assessment criteria

4.1	<p>Carry out a risk assessment</p> <p>Risk assessment</p> <p>Incorporating;</p> <ul style="list-style-type: none">• Safety provisions• Access at the work site• Movement of people on site• Movement and safe storage of installation materials, tools and equipment
4.2	<p>Survey the work site recording details of any features that may affect the activity</p> <p>Recording details</p> <ul style="list-style-type: none">• Any pre-installation damage• Any pre-maintenance damage• Defects to existing building features
4.3	<p>Advise the property occupier of any defects found</p>
4.4	<p>Protect the work site and the building fabric against possible damage being caused during the activity</p> <p>Activity</p> <ul style="list-style-type: none">• Tightness testing process• Direct purging process• De-commissioning• Installation• Maintenance• Commissioning
4.5	<p>Obtain confirmation from the customer before the job starts to ensure that they agree the planned work</p>
4.6	<p>Check and confirm all materials, tools and equipment necessary for the activity are available and are fit for purpose</p> <p>Activity</p> <ul style="list-style-type: none">• Tightness testing process• Direct purging process• De-commissioning• Installation• Maintenance• Commissioning
4.7	<p>Carry out all necessary checks and tests to confirm the installation meets the manufacturers' and industry requirements</p> <p>Installation</p> <ul style="list-style-type: none">• Gas supply• Electricity supply• The chimney system• The provision of ventilation
4.8	<p>Confirm that the siting of the gas supply meets industry standards' requirements in relation to other services</p> <p>Other services</p> <ul style="list-style-type: none">• Electricity• Water supply

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Prepare work activities for installing, maintaining domestic gas water heaters and wet central heating appliances

Assessment criteria

- 4.9** Confirm the suitability of the proposed location of condensate disposal as required
- 4.10** Check the existing installation for any unsafe appliances and system components and apply the gas industry unsafe situations procedures as required
- 4.11** Carry out preparatory work to meet the **activity** requirements
- Activity**
- Tightness testing process
 - Direct purging process
 - De-commissioning
 - Installation
 - Maintenance
 - Commissioning
- 4.12** Select and use the correct tools and equipment for the planned **activity**
- Activity**
- Tightness testing process
 - Direct purging process
 - De-commissioning
 - Installation
 - Maintenance
 - Commissioning.

Learning outcome 5

De-commission domestic gas water heaters and wet central heating appliances

Assessment criteria

- 5.1** Explain **procedures** for **decommissioning systems**
- | | |
|---|---|
| <p>Procedures</p> <ul style="list-style-type: none">• Notify relevant person• Isolate electricity supply• Isolate water supply• Isolate gas supply• Apply warning notices and signs• Drain system to a suitable location• Appropriately dispose of contents and any additives• Continuity bonding as required• Temporary capping of pipework sections as required• Notify building users• Alternative source of heat or supplies as required | <p>Decommissioning systems</p> <ul style="list-style-type: none">• Permanent• Temporary |
|---|---|

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

De-commission domestic gas water heaters and wet central heating appliances

Assessment criteria

5.2 Carry out decommissioning **procedures**

Procedures

- Notify relevant person
- Isolate electricity supply
- Isolate water supply
- Isolate gas supply
- Apply warning notices and signs
- Drain system to a suitable location
- Appropriately dispose of contents and any additives
- Continuity bonding as required
- Temporary capping of pipework sections as required
- Notify building users
- Alternative source of heat or supplies as required.

Decommissioning systems

- Permanent
- Temporary.

Learning outcome 6

Install, exchange, and remove gas pipework to industry standards

Assessment criteria

6.1 Explain the **industry practices and work standards** for fabricating and installing gas pipework, valves, systems and components to ensure they comply

Industry practices and work standards

- Manufacturers' specification
- Industry standards
- Gas Safety (Installation & Use) Regulations
- British Standards

6.2 Carry out the **installation processes** minimising damage to customer property and building features

Installation processes

- Assessments must be carried out as documented in this table.
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the learner's portfolio and be assessed as meeting the minimum documented requirements.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Install, exchange, and remove gas pipework to industry standards

Assessment criteria

6.2 cont.

Install gas pipework (≤ 35 mm)

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Install gas pipework

Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
<p>Install gas pipework</p> <p>Primary Range:</p> <ul style="list-style-type: none"> • Copper Tube • Steel Tube • Corrugated Stainless Steel Tube (CSST) • Polyethylene Tube (PE) <p>Secondary Range:</p> <ul style="list-style-type: none"> • Through Walls • Under Wooden Floors • Surface Mounted • Capillary Joints • Compression Joints • CSST Joints • Screwed Joints • Formed Bends 	<p>One Successful Assessment</p>	<p>One Successful Assessment</p>	<p>Evidence of experience undertaking the satisfactory tightness testing and purging is required across the documented ranges.</p> <p>At least 5¹ separate installation occasions must occur with the Learner demonstrating experience across the Assessment Criteria (but not necessarily all the criteria) on each occasion.</p> <p>At least 3¹ of the installation occasions must be from the workplace.</p>

Table Notes:

¹ The documented numbers required to be evidenced do include the assessment occasions.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 continued	
Install, exchange, and remove gas pipework to industry standards	
Assessment criteria	
6.3	Fabricate gas system, fittings and components as required by the installation plan
6.4	Position the pipework and confirm it meets the location, siting and clearances required by the manufacturers' and industry standards' specification
6.5	Provide the required ventilation for new or replacement pipework installations and systems
6.6	Provide adequate support(s) for pipework installation to conform with industry standards' specification
6.7	Ensure existing gas systems are clean and free of debris
6.8	Fix and connect gas pipework, valves, fittings and components to the supply.

Learning outcome 7	
Tightness testing and direct purging of gas systems and components	
Assessment criteria	
7.1	Confirm the complete pipework installation complies with the manufacturers' specification and industry standards
7.2	Check that conditions within the gas system will permit safe tightness testing and direct purging
7.3	Measure, calculate and record gas system installation volumes for tightness testing and direct purging activities
7.4	Ensure ventilation for tightness testing and direct purging activities meets industry standards' requirements
7.5	Remove existing gas components as necessary
7.6	Carry out the tightness testing and direct purging process , minimising damage to customer property and building features

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Tightness testing and direct purging of gas systems and components

Assessment criteria

Gas tightness testing and direct purging (IGEM/UP/1B)**Assessment requirements:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Tightness testing and purging gas installations

Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
<p>Primary Range:</p> <ul style="list-style-type: none"> • Natural Gas Installations <p>Secondary Range:</p> <ul style="list-style-type: none"> • Purge Natural Gas Installation with Volume $\leq 0.02\text{m}^3$ • Purge Natural Gas Installation with Volume $> 0.02\text{ m}^3 \leq 0.035\text{m}^3$ • Including a Meter • New Installation • Existing Installation 	One Successful Assessment	One Successful Assessment ²	<p>Evidence of experience undertaking the satisfactory tightness testing and purging is required across the documented ranges.</p> <p>At least 5¹ separate installation occasions must occur with the Learner demonstrating experience across the Assessment Criteria (but not necessarily all the criteria) on each occasion.</p> <p>At least 3¹ of the installation occasions must be from the workplace.</p>

Table Notes:

¹ The documented numbers required to be evidenced do include the assessment occasions.

² The assessment must be of a different 'Primary Range' type than that the one utilised as part of the RWE Assessment.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 7 **continued**

Tightness testing and direct purging of gas systems and components

Assessment criteria

- 7.7** Use tightness testing procedures to confirm the integrity of the newly installed gas system, new and or existing appliances
- 7.8** Use tightness testing procedures to confirm the integrity of the existing gas system, new and existing appliances to ensure the installation doesn't exceed the maximum permissible pressure drop
- 7.9** Use tightness testing procedures to confirm the integrity of the **medium pressure** gas system
- Medium pressure**
- Maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2 bar
 - No meter inlet valve is fitted
- 7.10** Where the **installation fails** the tightness test follow industry procedures and apply the gas industry unsafe situations procedure as required
- Installation fails**
- Trace and repair the escape and retest installation
 - Isolate unsafe gas appliances, gas system and components
- 7.11** Use purging procedures to confirm the safe supply of gas to the installed gas system and appliances.

Learning outcome 8

Install domestic gas water heaters and wet central heating appliances

Assessment criteria

8.1

Carry out the installation processes

Install gas water heating and wet central heating appliances

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Installation of a gas fired boiler

Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
<p>Primary Range:</p> <ul style="list-style-type: none">• Traditional Boiler ¹• System Boiler ²• Combination Boiler ³ <p>Secondary Range:</p> <ul style="list-style-type: none">• Room Sealed Fanned Draught Appliance (Horizontal Chimney) (<i>Appliance Type C12 or C13</i>)• Room Sealed Fanned Draught Appliance (Vertical Chimney) (<i>Appliance Type C32 or C33</i>)• Condensing Appliance• New Installation• Installation Exchange	One Successful Assessment	One Successful Assessment⁵	<p>Evidence of experience undertaking the satisfactory installation of gas fired boilers is required across the documented ranges.</p> <p>At least 5⁴ separate installation occasions must occur with the Learner demonstrating experience across the Assessment Criteria (but not necessarily all the criteria) on each occasion.</p> <p>At least 3⁴ of the installation occasions must be from the workplace.</p>

PLEASE READ THE TABLE NOTES ON THE NEXT PAGE

ASSESSMENT CRITERIA CONTINUED ON NEXT PAGE

Table Notes:

¹ A 'Traditional Boiler' for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer.

² A 'System Boiler' for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer.

³ A 'Combination Boiler' for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery).

⁴ The documented numbers required to be evidenced do include the assessment occasions.

⁵ The appliance must be of a different 'Primary Range' type than that the one utilised as part of the RWE Assessment.

- 8.2** Fabricate gas and electricity system components required by the installation plan
- 8.3** Position the appliance and confirm it meets the location, siting and clearances required by the manufacturers' and industry standards' specification
- 8.4** Provide the required ventilation for new or replacement appliance installations and systems
- 8.5** Ensure existing gas systems are clean and free from debris
- 8.6** Fix and connect the gas and electricity system components to the appliance
- 8.7** Fix and connect the condensate disposal system as required
- 8.8** Carry out tightness testing and purging procedures
- 8.9** Use **electrical testing procedures** to confirm the integrity of the installed electrical system and appliance
- Electrical testing procedures**
- Polarity
 - Earth continuity
 - Insulation resistance
- 8.10** Use industry standard checks and testing procedures to confirm the integrity of the newly installed or existing chimney system and appliance flue seals
- 8.11** Take precautionary actions to prevent the unauthorised use of un-commissioned gas appliances, gas systems, electrical systems and components by isolation procedures and use of warning notices
- 8.12** Apply the gas industry unsafe situations procedure
- 8.13** Complete all installation and commissioning **documentation and records**
- Documentation and records**
- Gas testing & purging – domestic (NG) certificate
 - Benchmark logbook
 - Landlord/home owner gas safety record
 - Chimney/Hearth notice plate
 - Notification of completed works (building regulations)
- 8.14** Carry out the handover procedure.

Learning outcome 9

Maintain domestic water heating and wet central heating appliances

Assessment criteria

- 9.1** Identify the **routines and sequences** of the maintenance process of water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturers' specification and industry standards
- Routines and sequences** to include:
- Effect of ineffective appliance case seals
 - Operation of mechanical and electrical gas safety control devices
 - Principle of adjustment of air/gas ratio valves
 - CO and combustion ratio checks using an ECGA when commissioning a condensing boiler incorporating air/gas ratio control valve technology
 - 2 or more domestic central heating boilers fitted within a single space with an aggregate total in excess of 70kW
- 9.2** Confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for existing gas appliances, systems, or components
- 9.3** Remove existing gas and electricity system components as required by the maintenance activities
- 9.4** Confirm the gas system operating pressures
- 9.5** Describe the tests and checks to confirm the suitability and performance of the ventilation system
- 9.6** Explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components to ensure safe functioning
- 9.7** Explain the **procedures for checking** that the hot water performance of water heating gas appliances and combination boilers complies with the manufacturers' specification
- Procedures for checking**
- There is sufficient pressure
 - Flow rate
 - Correct temperatures are achieved

THE ASSESSMENT CRITERIA AND LEARNING OUTCOME ARE CONTINUED ON NEXT PAGE

9.8 Carry out the maintenance process in accordance with the manufacturers' specification and industry standards

Maintain gas water heating and wet central heating appliances			
Assessment requirements: <ul style="list-style-type: none"> Assessments must be carried out as documented in this table Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 			
Routine full service of a gas fired boiler			
Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
Primary Range: <ul style="list-style-type: none"> Traditional Boiler ¹ System Boiler ² Combination Boiler ³ Gas Fire & Back Boiler ⁴ Secondary Range: <ul style="list-style-type: none"> Open-Flued Natural Draught Appliance (incl. Draught Diverter) (<i>Appliance Type B11</i>) Room Sealed Natural Draught Appliance (<i>Appliance Type C11</i>) Room Sealed Fanned Draught Appliance (<i>Appliance Type C12 or C13 or C32 or C33 or C52 or C53</i>) Condensing Appliance Non-Condensing Appliance 	One Successful Assessment	One Successful Assessment ⁶	<p>Evidence of experience undertaking the satisfactory full servicing of gas fired boilers is required across the documented ranges.</p> <p>At least 5⁵ separate servicing occasions must occur with the Learner demonstrating experience across the Assessment Criteria (but not necessarily all the criteria) on each occasion.</p> <p>At least 3⁵ of the servicing occasions must be from the workplace.</p>
Table Notes: <p>¹ A 'Traditional Boiler' for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer.</p> <p>² A 'System Boiler' for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer.</p> <p>³ A 'Combination Boiler' for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery).</p> <p>⁴ A 'Gas Fire & Boiler' for the purpose of this document is deemed to be a boiler, not a back circulator, that is connected to a flexible flue liner and has a gas fire connected to the front of the appliance.</p> <p>⁵ The documented numbers required to be evidenced do include the assessment occasions.</p> <p>⁶ The appliance must be of a different 'Primary Range' type than that the one utilised as part of the RWE Assessment.</p>			
Routine full service of a gas fired instantaneous water heater			

Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
Primary Range: Multipoint Water Heater	One Successful Assessment	N/A	N/A
Table Notes: ¹ A 'Traditional Boiler' for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer. ² A 'System Boiler' for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer. ³ A 'Combination Boiler' for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery). ⁴ A 'Gas Fire & Boiler' for the purpose of this document is deemed to be a boiler, not a back circulator, that is connected to a flexible flue liner and has a gas fire connected to the front of the appliance. ⁵ The documented numbers required to be evidenced do include the assessment occasions. ⁶ The appliance must be of a different 'Primary Range' type than that the one utilised as part of the RWE Assessment.			
Carry out <ul style="list-style-type: none"> • Visual inspection • Ensure appliance is correctly located, level and stable • Dismantle and clean appliance operational gas safety components <ul style="list-style-type: none"> – Burners – Primary air ports – Combustion chambers – Flue ways • Operation of control components • Effective operation of thermostats • Effective operation of safety controls • Operation/ adjustment. • Check and adjust the hot water flow rate • Check air gas ratio • Carry out a flue gas analysis • Use appropriate cleaning methods and agents • Follow manufacturer's instructions 			

LEARNING OUTCOME CONTINUED ON NEXT PAGE

- 9.9 Carry out the maintenance processes** minimising damage to customer property and building features
- Carry out**
- Visual inspection
 - Ensure appliance is correctly located, level and stable
 - Dismantle and clean appliance operational gas safety components
 - Burners
 - Primary air ports
 - Combustion chambers
 - Flue ways
 - Operation of control components
 - Effective operation of thermostats
 - Effective operation of safety controls
 - Operation/ adjustment.
 - Check and adjust the hot water flow rate
 - Check air gas ratio
 - Carry out a flue gas analysis
 - Use appropriate cleaning methods and agents
 - Follow manufacturer's instructions
- 9.10** Check the positioning of the appliance to confirm it meets the location, siting and clearances required by the manufacturers' and industry standards' specification
- 9.11** Check existing ventilation for appliances and system meets industry requirements for the installation
- 9.12** Ensure existing gas systems are clean and free of debris
- 9.13** Re-connect the gas and electricity system components to the appliance
- 9.14 Use tightness testing and purging procedures to confirm the integrity of the re-connected gas system and appliance**
- 9.15** Describe the process and procedures, equipment, and legislative requirements for applying electrical safety tests to appliances, systems and components to ensure safe functioning
- 9.16** Use electrical testing procedures to confirm the integrity of the re-installed electrical system and appliance
- 9.17** Describe the tests and checks to confirm the integrity, suitability and performance of the chimney system and appliance flue seals where required
- 9.18** Use industry standard checks and testing procedures to confirm the integrity of the existing chimney system and appliance flue seals where required
- 9.19** Complete the system handover procedures and demonstrate the operation of replacement systems and components to end user.

Learning outcome 10

Diagnose and rectify faults on domestic water heating and wet central heating appliances

Assessment criteria

10.1 Use job information to plan the **fault diagnosis** work

Fault diagnosis

Identify and repair faults on gas fired boilers and instantaneous water heaters

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the learner's portfolio and be assessed as meeting the minimum documented requirements.

Unit Components	Realistic Working Environment Assessment	Workplace Assessment	Work Experience
Primary Range: <ul style="list-style-type: none"> • Traditional Boiler ¹ • System Boiler ² • Combination Boiler ³ • Multipoint Water Heater Secondary Range: <ul style="list-style-type: none"> • Open-Flued or Room Sealed Natural Draught Appliance • (<i>Appliance Type B11 or C11</i>) • Open-Flued or Room Sealed Fanned Draught Appliance • (<i>Appliance Type B12 or B13 or B14 or C12 or C13 or C32 or C33</i>) • Gas Safety Control Defect ⁷ • Electrical Control Defect ⁷ • Water Control Defect ⁷ 	One Successful Assessment	N/A	<p>Evidence of experience undertaking the identification and repairing of faults on gas fired boilers and instantaneous water heaters is required across the documented ranges.</p> <p>At least 4⁵ separate fault rectification occasions must occur with the Learner demonstrating experience across the Assessment Criteria (but not necessarily all the criteria) on each occasion.</p> <p>At least 2⁵ of the fault rectification occasions must be from the workplace.</p>

PLEASE READ THE TABLE NOTES ON THE NEXT PAGE

ASSESSMENT CRITERIA CONTINUED ON NEXT PAGE

CONTINUED FROM TABLE ABOVE**Table Notes:**

¹ A 'Traditional Boiler' for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer.

² A 'System Boiler' for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer.

³ A 'Combination Boiler' for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery).

⁵ The documented numbers required to be evidenced do include the assessment occasions.

⁷ The defects listed are 'Appliance Defects' and relate to controls within the appliance casing and do not refer to defects on controls on the heating or hot water systems.

10.1 Add Faults from MoGS Gas Safety Disc**Cont.**

- Unsatisfactory ignition of burner(s) inc. Delayed ignition for Instantaneous Water Heater (IWH)
- Unstable flame picture
- Signs of flue spillage
- Inoperative thermostat/limit stat(s)
- Inoperative pressure switch(s)
- Defective flame supervision device(s)
- Scaled heat exchanger (IWH)
- Defective gas valve assembly.

10.2 Comply with health and safety requirements when carrying out fault diagnosis work

10.3 Establish details of the fault from other persons

10.4 Test the component to diagnose the cause of the fault

10.5 Isolate unsafe components that are not to be rectified and leave the appliance, gas system in a safe condition

10.6 **Isolate the component** from the supply source or outgoing service

Isolate the component

- Isolate the gas supply to the component
- Turn off the electricity and water supply to the component
- Prevent the use of un-commissioned appliances

10.7 Take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete

10.8 Carry out the rectification or replacement of the component to industry requirements

10.9 Re-connect the gas and electricity system components to the appliance

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 10 **continued**

Diagnose and rectify faults on domestic water heating and wet central heating appliances

Assessment criteria

- 10.10** Use tightness testing and purging procedures to confirm the integrity of the re-connected gas system and appliance
- 10.11** Use electrical testing procedures to confirm the integrity of the re-installed electrical system and appliance
- 10.12** Test the component for effective operation
- 10.13** Use industry standard checks and testing procedures to confirm the integrity of the existing chimney system and appliance flue seals where required
- 10.14** Advise other persons that work on the system or component has been successfully completed.

Learning outcome 11

Commission domestic gas water heaters and wet central heating appliances

Assessment criteria

- 11.1** Describe the routines and sequences for re-commissioning water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturers' specification and industry standards
- 11.2** Confirm the complete appliance installation complies with all **relevant requirements**
Relevant requirements
- The manufacturers' specification
 - Industry standards, Gas Safety (Installation & Use) Regulations
 - British Standards
 - Building Regulations
- 11.3** Describe how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for existing gas appliances, systems, or components
- 11.4** Check that the condition of the gas and electricity systems will allow safe commissioning
- 11.5** State the procedures for checking and confirming the gas system operating pressures
- 11.6** Describe the tests and checks to confirm the suitability and performance of the ventilation system
- 11.7** **Commission** domestic gas water heaters and wet central heating appliances in accordance with manufacturers' specification and industry standards.
Commission
- Confirm suitability of ventilation
 - Confirm the appliance operating pressure and the heat input
 - Test chimney performance
 - Operational checks
 - Check burners flame picture, stability and ignition
 - Check user controls are operating correctly
 - Check safety control devices are operating correctly
 - Check temperature controls are operating correctly
 - Complete documentation
 - Handover

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 11 **continued**

Commission domestic gas water heaters and wet central heating appliances

Assessment criteria

11.8	Describe the procedures for checking and confirming the appliance operating pressure and the heat input
11.9	Describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance
11.10	Check the combustion performance as required Combustion performance <ul style="list-style-type: none">• Visual inspection• Conducting flue gas analysis using an electronic flue gas analyser• Air/gas ratio setting is correct
11.11	Explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components to ensure safe functioning
11.12	Confirm the operation of the gas appliance and components to ensure they function safely and operate in accordance with manufacturers' instructions
11.13	Describe the tests and checks to confirm the integrity, suitability and performance of the chimney system
11.14	Test chimney performance and reconfirm it performs according to manufacturer's and industry requirements (where required)
11.15	Describe the process and procedures, equipment and legislative requirements for applying electrical safety tests to appliances, systems and components to ensure safe functioning
11.16	Confirm the electrical system and components function safely and operate in accordance with the manufacturers' instructions
11.17	Check and confirm the operation of the condensate disposal system
11.18	Explain the procedures for checking that the hot water performance of water heating gas appliances and combination boilers complies with the manufacturers' specification Hot water performance <ul style="list-style-type: none">• Sufficient pressure & flow rate• Correct temperatures are achieved
11.19	Check the hot water performance of water heating gas appliances and combination boilers complies with the manufacturers' specification Hot water performance <ul style="list-style-type: none">• Sufficient pressure & flow rate• Correct temperatures are achieved
11.20	Explain the system handover procedures and demonstrating the operation of replacement systems and components to end user
11.21	Instruct the property occupier on the correct operation of the appliance and gas system and provide them with their copy of the appliance literature
11.22	Take precautionary actions by isolation procedures and use of warning notices to prevent the unauthorised use of un-commissioned gas appliances, gas systems, electrical systems and components.

10.2. Oil Pathway

10.2.1. Unit 16 Core Principles of Oil Fuel Systems for Dwellings (Safety and Efficiency)

Unit Level	3	<i>This knowledge unit provides learning in operating principles, linked to legislation covering energy efficiency, installation requirements, fault finding, commissioning and decommissioning of oil fuel systems.</i>	
GLH	170		
Unit	Learning Outcomes		Assessment Criteria
Core principles of oil fuel systems for dwellings (safety and efficiency)	LO1 Know the health and safety risks and safe systems of work associated with oil storage, appliances and heating systems installation work		1.1 to 1.5
	LO2 Demonstrate the procedure to be followed in the case of oil spills		2.1 to 2.2
	LO3 Know the oil supply legislation, regulations and guidance		3.1 to 3.7
	LO4 Understand actual and potential risks relating to oil tanks and associated pipework		4.1 to 4.4
	LO5 Select domestic oil storage tanks and associated fittings to meet installation requirements		5.1 to 5.11
	LO6 Know the requirements for the installation of non- domestic oil storage tanks		6.1 to 6.9
	LO7 Install oil storage tanks		7.1 to 7.8
	LO8 Install oil supply pipelines		8.1 to 8.16
	LO9 Test oil pipework for soundness		9.1 to 9.7
	LO10 Diagnose and rectify faults for oil supply systems		10.1 to 10.4
	LO11 Know how to Safely decommission oil storage tanks		11.1

Learning outcome 1

Know the health and safety risks and safe systems of work associated with oil storage, appliances and heating systems installation work

Assessment criteria

- 1.1** State the characteristics of **oil fuels**
- Paraffin
 - Kerosene
 - Gas oil
 - Light fuel oil
 - Medium fuel oil
 - Heavy fuel oil
 - Bio liquids
- 1.2** Identify the health **hazards** relating to petroleum products and bio-fuels
- Hygiene precautions
 - Inhalation
 - Skin contact
 - Eye contact
 - Ingestion and aspiration
- 1.3** Identify the **dangers** and the safety precautions to be taken when working with petroleum products
- Fire and explosion
 - Electrical equipment
 - Product storage (plastic and steel tanks)
 - Fabrication
 - Product handling
 - Product delivery
 - Combustion of fuels
 - Combustion products
 - Combustion air supply and product discharge
 - Indications of danger and poisoning
- 1.4** Outline the safe **working procedures** regarding boiler and furnace maintenance
- Removal of combustion products
 - Residual oil deposits
 - Pressurised oil lines
 - Oil ash
- 1.5** State the **environmental aspects** of petroleum products
- Environmental hazards
 - Product disposal.

Learning outcome 2

Demonstrate the procedure to be followed in the case of oil spills

Assessment criteria

2.1 Follow the correct **course of action** in the event of an oil spill
course of action

- Prevent further release of oil
- Clean up any oil present
- Reporting to householder
- Reporting to relevant authorities
- Employing specialist spill contractors
- Use of warning labels

2.2 State the possible **implications** of an oil spill
implications

- Structural damage
- Health effects
- Legislation
- Environmental hazard.

Learning outcome 3

Know the oil supply legislation, regulations and guidance

Assessment criteria

3.1 Identify the **statutory legislation and guidance** that applies to oil installation and maintenance work.

Statutory legislation and guidance

- Building Regulations
- Industry standards
- Manufacturer installation & service/maintenance instructions

3.2 State the recommended **responsibilities** of key personnel relating to the installation and maintenance of oil fired equipment

Responsibilities

- Business registration and competence
- Personnel registration and competence
- Consumers – private householders and tenants

3.3 Identify the legislative requirements related to the prevention of pollution from oil storage and supply systems

3.4 Interpret the requirements of specific oil safety legislation

3.5 Define the range of information that would be contained within a **commissioning record** for oil fired equipment

Commissioning record

- Oil storage tank and supply pipework
- Oil fired appliances

3.6 Explain the procedure for **notifying works** carried out to the relevant building control body

Notifying works

- Notification to the building control body
- Self-certification via a competent persons scheme

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Know the oil supply legislation, regulations and guidance

Assessment criteria

3.7 State the **regional variations** to oil supply legislation, regulations and guidance

Regional variations

- England
 - The Building Regulations England and Wales
 - Statutory Instruments
 - Competent Persons
 - Work Notification
 - Oil Storage Tank Installation
 - Underground Pipework
 - Contact Details
- Wales
 - The Building Regulations England and Wales
 - Statutory Instruments
 - Competent Persons
 - Work Notification
 - Oil Storage Tank Installation
 - Contact Details
- Scotland
 - The Building (Scotland) Regulations 2004.

Learning outcome 4

Understand actual and potential risks relating to oil tanks and associated pipework

Assessment criteria

4.1 Identify potential **safety risks**

safety risks

- Location of oil tank
- Size and structure of oil tank base
- Location of fire valve

4.2 Identify potential **environmental risks**

environmental risks

- Capacity of single skin oil storage tank
- Location of oil storage tank
- Condition of oil storage tank

4.3 Identify **immediate risks**

immediate risks

- Location of flue terminal
- Oil storage tank support
- Leakages
- Inadequate oil storage tank fill point

4.4 Explain the key factors to consider when undertaking a risk assessment of existing oil tank installations.

Learning outcome 5

Select domestic oil storage tanks and associated fittings to meet installation requirements

Assessment criteria

- 5.1** Describe the main features of oil **storage tanks**
- storage tanks**
- Steel tanks
 - Polyethylene tanks
 - Single skin tanks
 - Double skin tanks
 - Integrally bunded tanks
 - Top outlet oil storage tank
 - Underground oil storage tank
 - Underground tank chamber
- 5.2** Describe oil storage tank **location** requirements
- location**
- Planning Permission
 - Liquid Petroleum Gas (LPG) proximity
 - Fire Protection
 - Fire Ratings of Existing Domestic Structures
 - Fire Protection of Underground Oil Storage Tanks
 - Oil Storage Tank Restraint
 - Multiple Oil Storage Tank Installations
- 5.3** Explain the **installation requirements** for oil storage tanks
- Installation requirements**
- Steel Oil Storage Tanks
 - Plastic Oil Storage Tanks
 - Underground Oil Storage Tanks
 - Underground Tank Chamber
 - Height Considerations
 - Oil Storage Tank Bases
 - Ground Types for Oil Storage Tanks
 - General Site Layout of an Oil Storage Tank Base
- 5.4** Explain the purpose of oil **tank fittings**
- tank fittings**
- Fill pipe
 - Extended fill pipe
 - Vent pipe
 - Drain valve
 - Isolating valve
 - Contents gauge
 - Sight glass
 - Hydrostatic pressure operated
 - Float operated
 - Electronic gauges with remote readout
 - Overfill alarms and prevention devices
 - Electronic
 - mechanical
 - Puddle flange

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

- 5.5** Explain the installation requirements of oil **tank fittings**
- tank fittings**
- Fill pipe
 - Extended fill pipe
 - Vent pipe
 - Drain valve
 - Isolating valve
 - Contents gauge
 - Sight glass
 - Hydrostatic pressure operated
 - Float operated
 - Electronic gauges with remote readout
 - Overfill alarms and prevention devices
 - Electronic
 - mechanical
 - Puddle flange
- 5.6** Specify **environmental protection** for domestic oil storage tanks
- environmental protection**
- Secondary Containment
 - Masonry and Concrete Bunds
 - Multiple Oil Storage Tank Installations
- 5.7** Explain the **key factors** to consider when undertaking a risk assessment to determine whether secondary containment to an oil storage tank is required
- Key factors**
- Tank capacity
 - Tank proximity to controlled water sources
 - Tank proximity to spillage running into open drain or loose fitting inspection chamber cover
 - Tank proximity to borehole or spring
 - Tank siting on hard ground providing run-off to controlled water source
 - Tank vent pipe not visible from the fill point
 - Tank serving other than a single family dwelling
- 5.8** Specify types of **secondary containment** that can be provided to oil storage tanks
- secondary containment**
- Integrally bunded storage tanks
 - Use of bunds (catchpits)
- 5.9** Describe the **main features** when constructing a bund to act as secondary containment to an oil storage tank
- main features**
- Bund holding capacity
 - Bund base
 - Bund walls
 - Bund surface sealant materials
 - Pipework projection through bund via puddle flange
- 5.10** State the recommended capacity of storage tanks relevant to appliance rated output
- 5.11** State the typical size of oil storage tanks.

Learning outcome 6

Know the requirements for the installation of non domestic oil storage tanks

Assessment criteria

- 6.1** Describe the main features of non-domestic **storage tanks**
- Steel Oil Storage Tanks (OFS T200)
 - Steel Integrally Bunded Oil Storage Tanks (OFS T200)
 - Polyethylene Oil Storage Tanks (OFS T100)
 - Polyethylene Integrally Bunded Oil Storage Tanks
 - Underground Oil Storage Tanks
 - Service Tanks (BS 5410 : Part 2)
 - Rooftop Tanks (BS 5410 : Part 2)
 - Maintenance of Oil Storage Tanks
- 6.2** Describe oil non domestic storage tank **location** requirements
- External Oil Storage Tank Location
 - Oil Storage Classes
 - Fire Protection
 - External Non Domestic Oil Storage Tanks
 - External Non Domestic Oil Storage Tanks above 3500L
 - Fire Protection of Service/Rooftop Tanks
 - Fire Ratings of Existing Non Domestic Structures
 - Steel Portal Frame Buildings
- 6.3** Explain the **installation requirements** for non-domestic oil storage tanks
- Installation requirements**
- Steel Oil Storage Tanks
 - Polyethylene Oil Storage Tanks
 - Single Skin Oil Storage Tanks
 - Double Skin Oil Storage Tanks
 - Integrally Bunded Oil Storage Tanks
 - Underground Oil Storage Tanks
 - Underground Tank Chamber
 - Service Tanks
 - Rooftop Tanks
 - Earthing of Oil Storage Tanks
 - Height Considerations
 - Impact Protection
 - Oil Storage Tank Bases
 - Plastic
 - steel
 - Ground Types for Oil Storage Tank Bases

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

6.4 State the installation requirements for **internal** oil tank installations

Internal

- Oil Storage Classes
- Non Domestic Oil Storage Tanks under 1250L (located within, on or over a building)
- Non Domestic Oil Storage Tanks above 1250L, but not above 3500L (located within, on or over a building)
- Non Domestic Oil Storage Tanks above 3500L (located within a building)
- Non Domestic Oil Storage Tank (located within a detached chamber, but within 6m of the main building)
- Non Domestic Oil Storage Tank (located within an external chamber which is adjoined to the main building)
- Non Domestic Oil Storage Tank Chamber (located within the main building)
- Non Domestic Oil Storage Tank Chamber (located on a roof or within the top storey of a building)
- Oil Storage Tank Chamber Services

6.5 Explain the purpose of oil **tank fittings**

tank fittings

- Fill pipe
- Extended fill pipe
- Vent pipe
- Drain valve
- Isolating valve
- Contents gauge
 - Sight glass
 - Hydrostatic pressure operated
 - Float operated
 - Electronic gauges with remote readout
- Overfill alarms and prevention devices
 - Electronic
 - mechanical

6.6 Explain the installation requirements of oil **tank fittings**

tank fittings

- Fill pipe
- Extended fill pipe
- Vent pipe
- Drain valve
- Isolating valve
- Contents gauge
 - Sight glass
 - Hydrostatic pressure operated
 - Float operated
 - Electronic gauges with remote readout
- Overfill alarms and prevention devices
 - Electronic
 - Mechanical.

Learning outcome 6 **continued**

Know the requirements for the installation of non domestic oil storage tanks

Assessment criteria

- 6.7** Specify **environmental protection** for non-domestic oil storage tanks.
Environmental protection
- Standards
 - Secondary containment
- 6.8** State the recommended capacity of storage tanks relevant to appliance rated output
- 6.9** State the typical size of oil storage tanks.

Learning outcome 7

Install oil storage tanks

Assessment criteria

- 7.1** State the points that need to be considered when **positioning the base** of a storage tank for height
positioning the base
- Access to maintain a connected oil filter
 - Vertical distance between base and oil control valve/ pump in gravity feed systems
- 7.2** Identify appropriate types of **base support** to oil storage tanks
base support
- Polyethylene tanks
 - Tank sited on a concrete base
 - Tank sited on pre-cast lintels
 - Tank sited on paving slabs
 - Tank sited on platform with concrete base
 - Tank sited on platform with lintel base
 - Methods of preventing tank floatation in high wind conditions
 - Steel tanks
 - With integral base supports
 - Tank sited on piers with concrete base
 - Tank sited on piers with lintel base
- 7.3** State the minimum **fire separation distance** to non-fire rated building components for external oil storage tanks serving single family dwellings (below 45kW and 3500 litres)
fire separation distance
- Proximity to non-fire rated building or structure
 - Proximity to fire rated building or structure with door or window openings
 - Proximity to flue terminations
 - Proximity to non-fire rated building eaves
 - Proximity to non-fire rated boundary e.g. hedge or fence
- 7.4** Describe the features of **fire protection barriers** applied to oil storage tanks
fire protection barriers
- Fire resistance requirements of fire protection barriers
 - Minimum dimensions of a fire protection barrier
 - Installed at the side of the tank
 - Installed at the rear of the tank
 - Installed above tank at non-fire rated eaves

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 7 **continued**

Install oil storage tanks

Assessment criteria

7.5 State the fire protection requirements to multiple oil tank installations serving single family dwellings

7.6 Define the installation requirements for **internally sited** oil storage tanks

internally sited

- Fire protection chamber
- Bunding requirements
- Chamber ventilation requirements
- Tank maintenance requirements
- Filling methods
 - Via chamber access door
 - Extended fill line

7.7 Describe the features of oil storage tanks **sited underground**

sited underground

- Type of tank to be used
- Chamber requirements
- Fire protection requirements

7.8 Install domestic oil storage tanks.

Install domestic oil storage tanks

Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none"> Assessments must be carried out as documented in this table Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 		
Install an oil storage tank: <ul style="list-style-type: none"> Plastic Steel 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of an oil fuel system required across the documented ranges. At least Three separate jobs from the workplace must be included and evidenced in the work log.
Notes: <ul style="list-style-type: none"> Assessments must be carried out as specified above and evidenced in the work log Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

Learning outcome 8

Install oil supply pipelines

Assessment criteria

8.1 Specify the **layout features** of oil supply pipeline systems

layout features

- Entry to buildings
- Component layout
- Gravity
- Sub gravity

Oil supply

sub-gravity

- Top outlet tanks
- Mechanical fuel supply methods
- Suction oil supply system with de-aerator
- Suction oil supply system with oil lifter
- Multiple de-aerator installations
- Anti-syphon valves

gravity

- Bottom outlet tanks
- Gravity fuel supply methods
- Maximum/minimum head pressure
- Multiple appliance and/or multiple storage tank installations

8.2 Explain the function of oil supply **pipeline components**

pipeline components

- Service/isolation valves
- Oil filters
- De-aerators – internal and external
- Oil lifters
- Fire valves
- Anti-syphon valves
- Pressure reducing valves

8.3 State the correct procedure to select, locate and install **fire valves**

fire valves

- Positioning
 - Standard external fire valve positioning
 - External (internal) fire valve positioning
 - Fire valve positioning for an external boiler
 - Fire valve positioning for a vaporising range cooker
 - Fire valve positioning for a vaporising room heater (stove)
 - Fire valve positioning for an oil lifter
- Correct fitment for different supply systems
 - Single appliance gravity supply systems
 - Multiple appliance oil supply systems
- Correct operation and testing methods for different types
 - Dead weight/fusible link type
 - Remote acting phial and capillary fire valve

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 8 **continued**

Install oil supply pipelines

Assessment criteria

- 8.4** Specify the **pipework materials** and jointing processes suitable for oil supply lines
pipework materials
- R220 copper
 - Low carbon steel
 - Plastic
 - Compression fittings with internal support
 - Manipulative (type b) flared fittings
 - Flexible oil line
- 8.5** Describe the support and fixing **requirements** for oil supply pipework
requirements
- Requirements for sleeving
 - External and internal surface mounted installation pipework
 - Copper
 - Low carbon steel
 - Plastic
 - Pipework protection against corrosion
- 8.6** State the installation requirements of underground oil **supply lines**
Supply lines
- Proximity to other services
 - Pipework protection against corrosion
 - Use of pipework ducts
 - Minimum trench depth
 - Trench preparation
 - Use of warning tape
 - Access to underground joints
 - Use of a pipe in pipe system (sleeving)
 - Production of records
- 8.7** Describe the installation requirements of **oil filters**
oil filters
- Oil filter positioning
 - Storage tank
 - Oil fired appliances
 - Oil filter clearance requirements for maintenance
- 8.8** Explain the installation requirements of **de-aerator devices**
de-aerator devices
- Types of oil fired appliance used with de-aerator devices
 - External de-aerator
 - Internal de-aerator
 - In proximity to a flue terminal
 - Multiple deaerator installations
- 8.9** Define the installation requirements of **oil lifters**
oil lifters
- Types of oil fired appliance used with oil lifters
 - Lifter positioning

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 8 **continued**

Install oil supply pipelines

Assessment criteria

- 8.10** State the installation requirements of oil **supply line components**
- supply line components**
- Anti-syphon valves
 - Pressure reducing valves
- 8.11** Specify the types of fire valves considered suitable for use in dwellings
- 8.12** State the requirements for oil supply **systems above 45KW**
- systems above 45KW**
- Size of Oil Supply Pipes
 - Gravity Supply Systems
 - Using a Transfer Pump
 - Pumped Ring Main Systems (Gravity and Sub-Gravity)
 - Rooftop Appliance/Plant Rooms
 - Oil Suction Lines
- 8.13** **Calculate** the size of sub gravity oil supply pipework
- Calculate**
- Single pipe system with oil lifter
 - Single pipe suction system with de-aerator
 - Suction Pipe Sizing for Appliances over 30kW Output using a De-aerator
- 8.14** Describe sizing **methods** for gravity supply pipework
- Methods**
- Bottom Outlet Tanks
 - Maximum Head Pressure
 - Minimum Head Pressure
 - Multiple Appliance Installations
 - Multiple Oil Storage Tank Installations
- 8.15** Describe earth bonding requirements of oil supply pipework systems and components

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 8 **continued**

Install oil supply pipelines

Assessment criteria

8.16 Install oil supply pipework and components in accordance with manufacturer's and regulatory requirements.

Install oil supply pipework and components in accordance with manufacturers and regulatory requirements

Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none"> Assessments must be carried out as documented in this table Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 		
Install oil supply pipework and components in accordance with manufacturer's and regulatory requirements Primary range: <ul style="list-style-type: none"> Plastic Copper Secondary range <ul style="list-style-type: none"> Standard external Fire valve Earth bonding Oil filter De-aerator (if required) Compression fittings with internal supports or Flared fittings Oil lifter (if required) 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of an oil fuel system required across the documented ranges. At least Three separate jobs from the workplace must be included and evidenced in the work log.
Notes: <ul style="list-style-type: none"> Assessments must be carried out as specified above and evidenced in the work log Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

Learning outcome 9

Test oil pipework for soundness

Assessment criteria

- 9.1** Describe a soundness test to industry requirements
- 9.2** Explain the soundness test **requirements** for new and existing oil supply pipework
- Requirements**
- Minimise oil pollution
 - Visual inspection
 - Test medium
 - Test equipment
 - Test holding times
- 9.3** Explain the soundness test requirements for extended fill lines
- 9.4** Describe how to locate leaks and make repairs
- 9.5** Outline how to fill and purge air from the oil pipework system on completion of soundness testing
- 9.6** **Test oil pipework for soundness**

Test oil pipework for soundness

Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none"> • Assessments must be carried out as documented in this table • Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 		
Test for soundness oil supply pipework and components in accordance with manufacturer's and regulatory requirements Primary range: <ul style="list-style-type: none"> • Plastic • Copper Secondary range <ul style="list-style-type: none"> • Standard external Fire valve • Earth bonding • Oil filter • De-aerator (if required) • Compression fittings with internal supports or Flared fittings • Oil lifter (if required) 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of an oil fuel system required across the documented ranges. At least Three separate jobs from the workplace must be included and evidenced in the work log.
Notes: <ul style="list-style-type: none"> • Assessments must be carried out as specified above and evidenced in the work log • Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre • The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log • The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

- 9.7** Fill and purge oil supply pipes.

Learning outcome 10

Diagnose and rectify faults for oil supply systems

Assessment criteria

- 10.1** Describe methods of obtaining details of oil supply system faults from users
- 10.2** Follow manufacturer's instructions and industry standards to establish the diagnostic requirements of oil supply systems
- 10.3** Carry out **routine diagnostics** on oil supply systems to identify the causes of poor or no oil supply at appliances
- routine diagnostics**
- Unauthorised isolation of service/isolation valves
 - Water contamination in the oil storage tank
 - Incorrect oil in the storage tank
 - Blockage or air locks in the supply pipework
 - Gravity system
 - Suction system
 - Blockage/ operation of de-aerator devices
 - Correct operation/positioning of the appliance fire valve
- 10.4** **Inspect** existing oil supply systems
- Inspect**
- Steel
 - Plastic.

Learning outcome 11

Know how to Safely decommission oil storage tanks

Assessment criteria

- 11.1** Outline the correct **procedures** for the decommissioning of oil storage tanks
- procedures**
- Planning and risk assessment
 - Waste management hierarchy
 - Removal of residual liquid
 - Disposal of hazardous waste residues
 - Isolation of the storage tank
 - Disconnection from supply lines and outlet capping
 - Application of warning notices
 - Disconnection of and warning notice to extended fill line
 - De-gassing (vapour dispersion)
 - Inerting
 - Cleaning
 - Cutting (if required) and safe disposal
 - Transportation.

10.2.2. Unit 17 Install, commission, maintain and service oil systems and appliances in the workplace

Unit Level	3	<i>The aim of this unit is to enable learners to demonstrate occupational competence in how to plan, install, test, commission, and hand over oil systems.</i>
GLH	230	
Unit	Learning Outcomes	Assessment Criteria
Install, Commission, Maintain and Service Oil Systems and Appliances in the Workplace	LO1 Know the combustion process and the types of burners used in oil fired appliances	1.1 to 1.10
	LO2 Know ventilation requirements of oil fired appliances	2.1 to 2.9
	LO3 Know the standards of chimneys and flue systems to be used with oil fired appliances	3.1 to 3.11
	LO4 Test oil fired appliance flue systems for effective operation	4.1 to 4.3
	LO5 Know how to identify and respond to unsafe situations relating to oil systems and appliances	5.1 to 5.2
	LO6 Know the types of pressure jet oil fired appliances	6.1 to 6.2
	LO7 Know condensate disposal requirements of condensing oil fired appliances	7.1 to 7.3
	LO8 Know energy efficiency legislation applicable to pressure jet oil fired appliances	8.1 to 8.5
	LO9 Size and select pressure jet oil fired appliances to meet customers' needs	9.1 to 9.3
	LO10 Install pressure jet oil fired appliances	10.1 to 10.2
	LO11 Commission pressure jet oil fired appliances	11.1 to 11.11
	LO12 Decommission pressure jet oil fired appliances	12.1 to 12.6
	LO13 Carry out service and maintenance of pressure jet oil fired systems and appliances	13.1 to 13.7
	LO14 Carry out fault diagnosis of pressure jet oil fired appliances	14.1 to 14.9

Learning outcome 1

Know the combustion process and the types of burners used in oil fired appliances

Assessment criteria

- 1.1** Explain the uses of **heating oils** to supply oil fired appliances
- heating oils**
- Class C2 – Kerosene
 - Class D – Gas oil

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Know the combustion process and the types of burners used in oil fired appliances

Assessment criteria

1.2 Define the **key properties** of heating oils

key properties

- Viscosity
- Density
- Flashpoint temperature
- Sulphur content
- Ash content
- Water content
- Sediment content
- Carbon residue
- Char value
- Smoke point
- Cold filter plugging point
- Calorific value – gross and nett
- Mean specific heat capacity
- Minimum storage temperature
- Atomisation temperature
- Constituents of fuel oils

1.3 Describe the **combustion process** of heating oils

combustion process

- The combustion equation
- Air requirements for combustion
- Common causes of poor combustion in oil flames for pressure jet appliances
- Main constituents of complete combustion
- Main constituents and effects of incomplete combustion
 - Carbon Monoxide
 - Soot deposits
 - Smoke
 - Efficiency loss

1.4 Describe the **potential effects** of Carbon Monoxide when incomplete combustion takes place

potential effects

- Effects of exposure to Carbon Monoxide on the human body
- Symptoms of CO poisoning
- Advice to give to a person who describes symptoms of being affected by products of combustion

1.5 Describe the **effects** of excess CO₂ in the atmosphere

Effects

- Air pollution
- Global warming and climate change

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

- 1.6** Explain the **measures necessary** to ensure that exposure to Carbon Monoxide does not take place
- measures necessary**
- Primary measures – correct appliance installation and maintenance
 - Secondary measures – use of Carbon Monoxide detectors
 - Types of CO detectors available and standards of manufacture
 - The positioning requirements for Carbon Monoxide detectors
 - Causes of activation of CO detectors & indicators
- 1.7** Describe the layout features of **burners** to oil fired appliances
- Burners**
- Pressure jet
 - Vaporising
- 1.8** Describe the basic operating principles of burners to oil fired appliances
- 1.9** Identify the **components** of an oil pressure jet burner
- Burner Components**
- Motor
 - Fan and Air Supply
 - Fuel Pumps
 - Single Pipe Suction Oil Supply
 - Couplings
 - Pressure Regulating and Cut-off Valve
 - Internal Pump Filter
 - Pump Seals
 - Solenoid Valves
 - Ignition:
 - Transformer
 - Spark Generators
 - High Tension Leads Electrodes
 - Oil Pre-Heater
 - Air Diffuser
 - Control Box
- 1.10** Identify the **characteristics** of atomising nozzles
- Characteristics:**
- General
 - Handling
 - Functions
 - Spray Angles and Spray Patterns
 - Capacities
 - Nozzle Definition Points
 - Calculating Nozzle Size and throughput Pressures.

Learning outcome 2

Know ventilation requirements of oil fired appliances

Assessment criteria

- 2.1 Calculate the ventilation requirements for open flued oil fired appliances**
Calculate
- Adventitious air supplies
 - For single open flued appliances installed in a room or space
 - For multiple open flued appliances installed in the same room or space
 - For appliances fitted with a flue draught stabiliser
- 2.2 Explain the requirement for excess combustion air**
Excess Combustion Air
- Excess Air Requirement
 - Excess Air Measurement
 - Why Excess Combustion Air must be Carefully Controlled
- 2.3 State the maximum permissible extract rates for fans sited in the same space as an open flued oil fired appliance**
oil fired appliance
- Pressure jet
 - Vaporising
- 2.4 Calculate the ventilation required for appliances located in compartments**
Appliances
- Open flued
 - Room sealed
- 2.5 Describe the types of grilles and vents available for ventilation**
- 2.6 Calculate the free area of marked and unmarked grilles and vents**
- 2.7 Determine locations for ventilation to open flued and room sealed appliances**
locations for ventilation
- Restrictions to ventilator/grille locations
 - Installation of vents through walls (including cavity walls)
 - Ventilation paths via other rooms
 - Ventilation paths to compartments including ducts
 - Siting of ventilation
 - Wall
 - Window
 - Floor/ceiling (ducted and un-ducted)
- 2.8 Explain the effect that other heat producing appliances have on the requirement for ventilation of oil fired appliances**
heat producing appliances
- Gas
 - Solid fuel
- 2.9 Explain the effect that other types of extraction have on the requirement for ventilation of oil-fired appliances.**

Learning outcome 3

Know the standards of chimneys and flue systems to be used with oil fired appliances

Assessment criteria

- 3.1** Explain the requirements of the **British Standards**
- British Standards**
- Product Discharge
 - Fire Protection
 - Vertical Balanced Compartment Flues
 - Extended Balanced Flues
 - Condensing Flues
 - Condensing Appliance Flue Termination Clearances
 - Clearances
 - Regular Appliance (Open, LLD and Balanced) Flue Termination Clearance
- 3.2** Explain how oil fired appliances are **classified** according to the type of chimney or flue used
- Classified**
- Open flued
 - Natural draught
 - Forced (fanned) draught
 - Room sealed
- 3.3** Describe components and working principles of **flue systems** serving oil fired appliances
- flue systems**
- Open flued chimneys
 - Room sealed - natural draught
- 3.4** State the effects that the **flue gas temperature** from oil fired appliances has on the selection of suitable materials for the open flue/chimney construction
- flue gas temperature**
- Appliances with a flue gas temperature above 250°C
 - Appliances with a flue gas temperature below 250°C
- 3.5** Describe the types and general layout features of chimney and **flue construction**
- flue construction**
- Rigid chimney types
 - Brick / masonry
 - Pre-cast flue blocks
 - Metallic (single & double wall flues)
 - Flexible metallic liner installation
- 3.6** Describe the requirements for **new and existing** chimney/flue installation
- new and existing**
- Minimum cross sectional area of new chimney installations to serve appliances & Types of flue liners – during construction (salt glazed, clay etc.)
 - Poured/pumped concrete flue liners - Pre-cast flue blocks - Flexible flue liners
 - Restrictions on the use of poured concrete liners
 - Pre-cast flue design - Minimum cross sectional area of new flue blocks/ Minimum requirement of vertical flue blocks before off-sets/ Jointing material for pre-cast flue blocks/ Minimum flue size diameter for connecting pre-cast transfer blocks to termination point/ Effects of temperature on installation requirements for pre-cast flues
 - Flexible flue liners- Sealing & support requirements for flexible flue liners in chimneys/ Flexible liner components/ Termination of flue liners

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

- 3.7** Explain the **design requirements** of flues used with oil fired appliances
- design requirements**
- Requirements of designer, builder, provider or installer when installing chimneys
 - Requirements for hearths – flue/hearth dataplate
 - Chimney system design
 - Distance requirements when passing through combustible material
 - Special requirements for chimneys passing adjacent to combustible material or through other dwellings
 - Temperature effects and condensation problems caused by flue pipe runs
 - Excess flue draught
 - Open flued chimney system
 - Parts of an open flue chimney system
 - Room-sealed chimney system
 - Parts of a room sealed flue chimney system
- 3.8** State the requirements for the **provision of hearths** to oil fired appliances
- provision of hearths**
- Appliances with base temperature below 100°C
 - Appliances with base temperature above 100°C
- 3.9** Describe the requirements for the **termination of flue** systems serving oil fired appliances
- termination of flue**
- Room sealed flue positions - including the restrictions on fuel type for flue outlets discharging below 2m from ground level
 - Condensing appliances
 - Terminal guard requirements
 - Open flue terminal positions
 - Methods of dealing with down-draught on steeply pitched roofs
 - Multiple flue terminations
- 3.10** State the working principles of flue draught stabilisers and their uses with open flued oil fired appliances
- 3.11** Describe the requirements for installing **chimney fans** to open flues/chimney systems
- chimney fans**
- Requirements prior to installing fans in flues
 - Additional safety requirements when fans are installed in flues.

Learning outcome 4

Test oil fired appliance flue systems for effective operation

Assessment criteria

- 4.1** Carry out a visual inspection of a **flue system** prior to undertaking commissioning of the oil fired appliance/ flue system
- Flue system**
- Open
 - Room sealed
- 4.2** Describe **factors** that can affect flue system performance
- factors**
- Downdraught conditions
 - Wind effects at the appliance termination
 - Passive stack ventilation
 - Extraction fans sited in the vicinity of open flued appliances
 - Open flues
 - Low Level Discharge Flues (LLDs)
 - Vertical Balanced Compartment Flues
 - Extract Fans
 - Other Causes of Air Supply Interference
- 4.3** Use testing **procedures** to check the correct operation of chimney/flue system and installations
- Procedures**
- existing chimney/flue system:
 - Flue flow test
 - Spillage test
 - Flue testing procedures with appliances sited in the vicinity of extraction fans
 - Testing fanned draught open-flue systems and associated safety controls
 - **room sealed fanned:**
 - Checking case seals/ case integrity
 - Checking flue pipe/ air inlet connections for leakage.

Learning outcome 5

Know how to identify and respond to unsafe situations relating to oil systems and appliances

Assessment criteria

- 5.1** Identify **types** of unsafe situation that may be found with appliances and supply system installations
- Types**
- Immediate Risk – safety and environmental
 - Actions to take
 - Do not use notices and labels
 - Warning notice forms (including installation and service/Landlords safety report)
 - Potential Risk – safety and environmental
 - Actions to take
 - Warning notices

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 continued

Know how to identify and respond to unsafe situations relating to oil systems and appliances

Assessment criteria

- 5.2** Describe the use of general **notices and warning** labels to avoid the occurrence of unsafe situations
- notices and warning labels**
- Oil fired installation commissioning certificates
 - Oil fired service certificates
 - Landlords safety certificates
 - Hearth certificates.

Learning outcome 6

Know the types of pressure jet oil fired appliances

Assessment criteria

- 6.1** Identify types of pressure jet oil fired **appliances**
- appliances**
- Traditional boilers
 - Condensing boilers
 - System boilers
 - Combination boilers
 - Freestanding boilers
 - Wall mounted boilers – internal and external
 - Open flued boilers
 - Room sealed boilers – high level and low level discharge
 - External independent boilers
 - Open flued cookers
 - Central heating pressure jet cookers
- 6.2** Outline the operating principles of oil fired **appliances** that contain a pressure jet oil burner
- appliances**
- Traditional boilers
 - Condensing boilers
 - System boilers
 - Combination boilers
 - Freestanding boilers
 - Wall mounted boilers – internal and external
 - Open flued boilers
 - Room sealed boilers – high level and low level discharge
 - External independent boilers
 - Open flued cookers
 - Central heating pressure jet cookers.

Learning outcome 7

Know condensate disposal requirements of condensing oil fired appliances

Assessment criteria

7.1 State the properties of condensate water discharged from condensing boilers

7.2 Explain the main **installation requirements** of condensate pipework

installation requirements

- Acceptable pipework materials
- Fall required
- Maximum recommended length of run
- Recommended pipe sizes
- Trapping requirement
- Insulation requirement (external pipework)
- Condensate pumps

7.3 Identify the **layout features** of condensate waste disposal systems

Layout features

- Internal connection to a main soil stack
- Internal connection to an existing waste pipe
- External connection to a soakaway
- External connection to a gulley..

Learning outcome 8

Know energy efficiency legislation applicable to pressure jet oil fired appliances

Assessment criteria

8.1 Describe types of oil fired boiler that must be installed to meet the **requirements** of energy efficiency legislation

requirements

- New
- Replacement

8.2 Describe SEDBUK and SAP ratings

8.3 Outline the main features of the condensing boiler installation assessment procedure

8.4 Explain the requirements for central heating controls to be provided in heating and hot water systems incorporating oil fired boilers

8.5 Explain gross and net energy efficiencies.

Learning outcome 9

Size and select pressure jet oil fired appliances to meet customers' needs

Assessment criteria

- 9.1** Explain the **criteria** used when selecting oil fired pressure jet appliances
- criteria**
- Customers' needs/preference
 - Provision of suitable flueing arrangements
 - Restrictions placed on boilers installed in certain rooms and locations
 - Bathrooms shower rooms
 - Bedroom/ bedsitting rooms
 - Understairs cupboards
 - Loft spaces
 - Garages
 - Externally sited appliances
 - Proximity of combustible materials to the appliance
 - Casing temperature above 100°C
 - Casing temperature below 100°C
 - Building layout and features – suitable appliance space
 - Suitability of heating system
 - Loadings placed on the oil fired appliance
 - Energy efficiency legislation requirements
 - Environmental impact
- 9.2** Calculate the size of an oil fired appliance required for given situations
- 9.3** Recommend an appropriate pressure jet appliance that meets the needs of the customer.

Learning outcome 10

Install pressure jet oil fired appliances

Assessment criteria

- 10.1** Carry out a **pre-installation inspection** to determine that the pressure jet appliance can be correctly installed
- pre-installation inspection**
- Appliance location/ position
 - Hearth provision
 - Flueing arrangements and termination
 - Appliance ventilation provision
 - Fuel supply arrangements
 - Condensate disposal arrangements
 - Heating/ hot water system provision
 - Electrical connection arrangements

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Install pressure jet oil fired appliances

Assessment criteria

10.2 Install pressure jet oil fired appliances**install**

- Assemble and position the appliance
- Make connections to, or assemble the appliance flue system/ connection
- Make connections to the heating/ hot water system
- Position and fix the condensate disposal pipework
- Make final connections to the oil supply pipework
- Make final electrical connections to the central heating control system
- Take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed

Install pressure jet oil fired appliances**Assessment requirements:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Install an oil fuel boiler in accordance with manufacturer's and regulatory requirements Primary Range: <ul style="list-style-type: none"> • Traditional boilers • Condensing boilers • System boilers • Combination boilers Secondary range: <ul style="list-style-type: none"> • Open flued boilers • Room sealed boilers • External independent boilers • Open flued cookers • Central heating pressure jet cookers 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of an oil fuel system required across the documented ranges. At least five separate jobs must be included and evidenced in the work log. At least three of these must be from the workplace.

Notes:

- Assessments must be carried out as specified above and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Learning outcome 11

Commission pressure jet oil fired appliances

Assessment criteria

11.1 Interpret information sources required to complete commissioning work on pressure jet oil fired appliances

11.2 **Carry out** visual inspection **checks** of a pressure jet oil fired appliance to confirm that it is ready to be commissioned

Checks

- Oil storage tank
- Oil supply system – checked, filled and ready for operation
- Air supply – combustion and ventilation
- Flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser
- Pressure jet appliance – correct positioning and assembly of components such as flue baffles
- Water connections to the appliance – provision of suitable heating/ hot water system controls, checked filled and ready for operation
- Electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
- Appliance burner and controls – setting, positioning etc.
- Required heat output rating

Commission pressure jet oil fired appliances

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Test, commission and handover an oil fuel boiler installation in accordance with manufacturer's requirements.	One test and commission directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory testing and commissioning of an oil fuel system required across the documented ranges. At least five separate jobs must be included and evidenced in the work log. At least three of these must be from the workplace.

Notes:

- Assessments must be carried out as specified above and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

- 11.3** Apply **pre-operational tests** to be carried out prior to appliance light up
Pre-operational tests
- Flue flow test (where required)
- 11.4** **Carry out** operational tests on initial **appliance light up**
Appliance light up
- Initial function of appliance burner
 - Correct operation of burner safety controls
 - Oil pressure readings, set and adjust the oil pump
 - Initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - Flue operational tests – flue spillage (where required, flue draught interference test)
- 11.5** **Carry out** tests to determine the **appliance combustion** and adjust/fine tune the burner accordingly
Appliance combustion
- Combustion analysis:
 - Reasons for Combustion Analysis
 - Combustion Efficiency Readings
 - Types of Test Equipment
 - Oil Pressure and Vacuum Gauges and Test
 - Smoke Tester
 - Draught Gauge
 - Electronic Test Equipment
 - Manual/Wet Analysis Equipment
 - Maintenance of Manual Instruments
- 11.6** **Carry out** checks to ensure that the appliance temperature controls are **operating correctly**
operating correctly
- Appliance control thermostat
 - Appliance energy cut-out device
- 11.7** **Carry out** checks to ensure that connected **water heating** systems are functioning correctly
water heating
- Hot water systems
 - Central heating systems
- 11.8** Describe the actions to take in the event that the **appliance/component** cannot be correctly commissioned
appliance/component
- Use of the unsafe situations procedure
 - Provision of suitable warning notices
- 11.9** Complete the information detailed on a commissioning record for an oil fired pressure jet appliance
- 11.10** Demonstrate the procedure for notifying works carried out to the relevant authority
- 11.11** Hand over a completed installation to the end-user.

Learning outcome 12

Decommission pressure jet oil fired appliances

Assessment criteria

- 12.1** Liaise with other persons to determine the decommissioning work to be carried out
- 12.2** Provide relevant information to other persons before decommissioning work takes place
- 12.3** Arrange for temporary heating to be available (if required) for the duration of decommissioning work
- 12.4** **Decommission** pressure jet appliances
- Decommission**
- Permanent
 - Temporary
 - Decommission activities:
 - Safe isolation of the fuel supply system
 - Safe isolation of the heating/hot water system
 - Safe isolation of the heating/hot water electrical control system
 - Temporary capping of pipework sections
 - Use of warning notices and signs
 - Take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed
- 12.5** Safely **drain and dispose** of system contents
- drain and dispose**
- Central heating/ hot water system
 - Fuel supply system
- 12.6** Advise other persons that the appliance has been successfully decommissioned.

Learning outcome 13

Carry out service and maintenance of pressure jet oil fired systems and appliances

Assessment criteria

- 13.1** State the periodic servicing intervals of pressure jet oil fired appliances
- 13.2** State the **activities** to be carried out during the periodic service of an oil fired pressure jet appliance
- activities**
- Servicing the appliance:**
- Requirements
 - Planned procedure
 - Safety
 - Safe electrical isolation
 - Cleanliness
 - Observation

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

13.3 State the checks to be carried out on the **components** of a pressure jet oil fired system and appliance

Components:

- **Oil storage**
 - Oil storage tank
 - Tank location
 - Contents gauge
 - Overfill alarm
- **Oil pipework**
 - Oil supply system
 - Oil line filter
 - Fire valves
 - Equipotential bonding
- **Air supply**
 - Combustion air supply
 - Ventilation air supply
 - 'Make-up' air supplies
- **Flues/chimneys**
 - Inspection
 - Draught stabilisers
 - Termination
 - Flue safety
- **Heat exchanger**
 - Inspection and cleaning
 - Condensing appliances
- **Combustion chamber**
 - Examination for flame impingement
 - Clean surfaces
 - General maintenance
- **Burner**
 - Electrical Components
 - Fans and Motors
 - Nozzles
 - Flexible Oil Line
 - Fuel Pumps
 - Controls
- **Safety controls**
 - Safety valve
 - High limit thermostat
 - Boiler thermostat
 - Frost thermostat
 - Expansion vessel
- **System controls**
 - Temperature controls
 - Motorised valves
 - Programmers and timeclocks
 - TRVs
 - Non-electrical hot water thermostats (if fitted)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Carry out service and maintenance of pressure jet oil fired systems and appliances

Assessment criteria

- 13.4** Conduct a visual inspection of existing pressure jet oil fired appliances to confirm that they are installed to manufacturer/ standards requirements
- 13.5** Safely isolate pressure jet oil fired appliances to prevent them being brought into operation during service and maintenance work.
- 13.6** **Service** pressure jet oil fired appliances

Carry out service and maintenance of pressure jet oil fired systems and appliances

Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none"> Assessments must be carried out as documented in this table Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 		
Service an oil fuel boiler/system in accordance with manufacturers requirements Range: <ul style="list-style-type: none"> Oil storage Oil pipework Air supply Flues/chimneys Heat exchanger Combustion chamber Burner Safety controls System controls 	One service directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory servicing of an oil fuel system required across the documented ranges. At least five separate jobs must be included and evidenced in the work log. At least three of these must be from the workplace.
Notes: <ul style="list-style-type: none"> Assessments must be carried out as specified above and evidenced in the work log Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

- 13.7** Complete a servicing and maintenance report.

Learning outcome 14

Carry out fault diagnosis of pressure jet oil fired appliances

Assessment criteria

- 14.1** Identify methods of obtaining details of system faults from end users
- 14.2** Conduct a visual inspection of existing pressure jet oil fired appliances to confirm that they are installed to manufacturer/ standards requirements
- 14.3** Interpret manufacturer's instructions and industry standards to establish the diagnostic requirements of pressure jet oil fired appliances
- 14.4** Safely isolate pressure jet oil fired appliances to prevent them being brought into operation during service and maintenance work
- 14.5** Carry out **routine checks** and diagnostics on pressure jet oil fired appliances as part of a fault-finding process
- Routine checks**
- Cleaning system components
 - Checking for blockages/ poor flow rate
 - Heat exchanger
 - Fuel supply system including oil nozzle
 - Checking the flue system for correct operation
 - Checking for provision of adequate ventilation to the appliance
 - Checking for correct operation of pressure jet appliance burner components
 - Checking oil availability:
 - Inspection
 - Oil Check
 - Storage Tanks
 - Valves
 - Filter(s)
 - Oil Line
 - De-aeration Device
 - Fire Valves
 - Oil Pressure and Vacuum
 - Oil Leakage and Pressure Testing
- 14.6** State methods of identifying and repairing **faults** in oil fired pressure jet burners
- Faults**
- Oil pump defects/ incorrect settings
 - Solenoid defects
 - Motor/ fan defects
 - Incorrect air shutter settings
 - Nozzle – defects/incorrect selection
 - Blast tube assembly – defects/positioning
 - Ignition electrodes – defects/positioning
 - Ignition transformer - defects
 - Photoresistor - defects
 - Control box – defects
 - Combustion faults:
 - Flame failure after start-up
 - Basic fault finding procedures for pressure jet appliances
 - Pressure jet burners

Learning outcome 14

Carry out fault diagnosis of pressure jet oil fired appliances

Assessment criteria

14.7 Carry out fault diagnosis and rectification on oil fired pressure jet appliances

Carry out fault diagnosis and rectification

Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none">Assessments must be carried out as documented in this tableLearners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.		
<p>Find and rectify faults on an oil fuel boiler/system</p> <p>Range:</p> <ul style="list-style-type: none">Oil pump defectsSolenoid defectsMotor/fan defectsIncorrect air shutter settingsNozzle defectsBlast tube assembly defectsIgnition electrodes defects/positioningIgnition transformer defectsPhotoresistor defectsControl box defects	<p>Due to the nature of this task, no direct observation is required.</p>	<p>To demonstrate satisfactory fault finding and rectification on an oil fuel system required across the documented ranges.</p> <p>At least four separate jobs must be included and evidenced in the work log.</p> <p>At least two of these must be from the workplace.</p> <p>A minimum of 3 faults in the range must be covered</p>
Notes: <ul style="list-style-type: none">Assessments must be carried out as specified above and evidenced in the work logOnsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centreThe role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work logThe assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.		

14.8 State the **actions to take** in the event that the appliance/ component fault cannot be rectified

Actions to take

- Use of the unsafe situations procedure
- Provision of suitable warning notices

14.9 Outline procedures to re-commission appliances following completion of fault repair activities.

10.3. Solid fuel/Biomass Pathway

10.3.1. Unit 18 Safety Principles (Solid Mineral Fuel and Biomass Combustion)

Unit Level	3	<i>This unit provides learning in operating principles linked to legislation covering energy efficiency and installation requirements for solid mineral fuel and biomass appliances.</i>
GLH	170	
Unit	Learning Outcomes	Assessment Criteria
Safety Principles (Solid Mineral Fuel and Biomass Combustion)	LO1 Understand solid mineral fuel and biomass combustion legislation that applies to work in dwellings	1.1 to 1.5
	LO2 Understand the types of solid fuels and the factors affecting fuel selection	2.1 to 2.4
	LO3 Understand the factors that affect the selection of solid fuel appliances	3.1 to 3.4
	LO4 Know the combustion process and the principles of safe combustion of solid fuels	4.1 to 4.8
	LO5 Apply ventilation requirements of solid mineral fuel and biomass combustion appliances installed in dwellings	5.1 to 5.10
	LO6 Understand standards of chimneys and flue systems to be used with solid mineral fuel and biomass combustion appliances in dwellings	6.1 to 6.10
	LO7 Understand methods of diagnosing problems with flue/chimney performance	7.1 to 7.4
	LO8 Understand the requirements for hearths and fireplace surrounds to solid mineral fuel and biomass combustion appliances	8.1 to 8.5
	LO9 Understand how to test solid mineral fuel and biomass combustion appliances and associated flue systems in dwellings for effective operation	9.1 to 9.7
	LO10 Understand how to identify and respond to unsafe situations relating to flue systems and appliances in dwellings	10.1 to 10.2

Learning outcome 1

Understand solid mineral fuel and biomass combustion legislation that applies to work in dwellings

Assessment criteria

- 1.1** Identify types of statutory **legislation** and guidance information that applies to installation and maintenance work in the industry
- Legislation**
- Building Regulations
 - Industry standards
 - Manufacturer installation and service/maintenance instructions
- 1.2** Define the **recommended responsibilities** of key personnel relating to the installation and maintenance of equipment
- Recommended responsibilities**
- Business registration and competence
 - Personnel registration and competence
 - Consumers – private householders and tenants

Learning outcome 1 *continued*

Understand solid mineral fuel and biomass combustion legislation that applies to work in dwellings

Assessment criteria

- 1.3** Explain the legislative requirements related to clean air (smoke control areas) in the UK
- 1.4** Analyse and interpret the requirements of specific safety legislation
- 1.5** Explain the procedure for **notifying works** carried out to the relevant building control body
- Notifying works**
- Notification to the building control body
 - Self-certification via a competent persons' scheme.

Learning outcome 2

Understand the types of solid fuels and the factors affecting fuel selection

Assessment criteria

- 2.1** Identify types of **solid mineral fuels** burnt in solid fuel appliances
- Solid mineral fuels**
- Bituminous (house) coals
 - Bituminous coal briquettes
 - Natural smokeless fuels
 - Manufactured smokeless fuels
- 2.2** List types of **wood** burnt in solid fuel appliances
- Wood**
- Wood logs
 - Wood chips
 - Wood briquettes
 - Wood pellets
- 2.3** Define 'sustainable sources' related to the production and burning of wood in solid fuel appliances
- 2.4** Explain **factors** which affect the selection of solid fuel
- Factors**
- Customer preference
 - Appliance type
 - Fuel storage requirements
 - Smoke control legislation.

Learning outcome 3

Understand the factors that affect the selection of solid fuel appliances

Assessment criteria

- 3.1** Explain the minimum solid fuel appliance efficiency requirements laid down by statutory legislation
- 3.2** Describe the impact of **smoke control legislation** on the selection of solid fuel appliances
- Smoke control legislation**
- Appliance fuel types restricted in smoke control areas
 - Use of exempted appliances
- 3.3** Identify fuel storage requirements of solid fuel appliances burning solid mineral fuels

Learning outcome 3 **continued**

Understand the factors that affect the selection of solid fuel appliances

Assessment criteria

3.4 Identify **fuel storage** requirements of solid fuel appliances burning wood

Fuel storage

- Seasoning requirements for wood logs
 - Soft woods
 - Hard woods
- Storage requirements for wood logs during the seasoning process
- Storage requirements for wood ready for burning
 - Wood logs
 - Wood chips
 - Wood briquettes
 - Wood pellets.

Learning outcome 4

Know the combustion process and the principles of safe combustion of solid fuels

Assessment criteria

4.1 Define the **terms** related to solid fuel composition

Terms

- Calorific value
- Moisture content
- Volatile content

4.2 Clarify the **combustion process** with solid fuels used in dwellings

Combustion process

- The combustion equation
- Air requirements for combustion including excess air
- Optimum combustion temperature
- Impact of fuel size on the combustion process
- Main constituents of complete combustion
- Soot production as a by-product of the combustion process

4.3 Explain the main causes of **incomplete combustion** with solid fuels

Incomplete combustion

- Inadequate air supply
- Incorrect fuel
- Inadequate flue/ chimney performance

4.4 Identify the production of Carbon Monoxide as a possible by-product of incomplete combustion

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Know the combustion process and the principles of safe combustion of solid fuels

Assessment criteria

- 4.5** Identify the potential **effects** of Carbon Monoxide when incomplete combustion takes place
Effects
- Symptoms of CO poisoning
 - Advice to give to a person who describes symptoms of being affected by products of combustion
- 4.6** Explain **measures** necessary to ensure that exposure to Carbon Monoxide does not take place
Measures
- Primary measures – correct appliance installation and maintenance
 - Secondary measures – use of Carbon Monoxide detectors
 - Types of CO detectors available and standards of manufacture
 - The positioning requirements for Carbon Monoxide detectors
 - Causes of activation of CO detectors & indicators
- 4.7** Demonstrate the use of **CO analysers** in measuring CO concentrations in ambient air
CO analysers
- Test procedure for measuring CO in ambient air
 - Response required based on CO in ambient air levels (action levels)
- 4.8** Requirements to install a CO monitor in dwelling.

Learning outcome 5

Apply ventilation requirements of solid mineral fuel and biomass combustion appliances installed in dwellings

Assessment criteria

- 5.1** Identify dwelling construction and the impact where additional combustion air is required
- 5.2** **Calculate** the ventilation requirements for open flued appliances
Calculate
- Single open flued appliances installed in a room or space
 - Multiple open flued appliances installed in the same room or space including mixed solid fuel and gas or oil fired appliances
- 5.3** Identify types of **grilles and vents** available for ventilation
Grilles and vents
- Types of grilles and vents
 - Restrictions on the use of flyscreens
 - Sizing of grilles and vents (free area availability)
- 5.4** Calculate the free area of unmarked grilles and vents
- 5.5** Identify acceptable **locations for ventilation** to appliances
Locations for ventilation
- Restrictions to ventilator/grille locations
 - Installation of vents through walls (including cavity walls)
 - Ventilation paths via other rooms
 - Siting of ventilation
 - Wall
 - Window
 - Floor/ceiling (ducted and un-ducted)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Apply ventilation requirements of solid mineral fuel and biomass combustion appliances installed in dwellings

Assessment criteria

- 5.6** Explain the **effect** that other heat producing appliances and extractor fans have on the requirement for ventilation of appliances
- Effect**
- Gas or solid fuel appliances and flue systems
 - Passive stack ventilation
 - Extractor fans
 - Cooker hoods
 - Tumble driers
- 5.7** Recognise other options to provide combustion air, such as a dedicated external air supply, and its limitations
- 5.8** Verify adequate combustion air requirements have been provided by carrying out appropriate test(s) / commissioning.
- 5.9** Carry out appropriate risk assessment to provide combustion air by an alternative approach
- 5.10** Verify appropriate ventilation for existing appliances/chimneys/flues.

Learning outcome 6

Understand standards of chimneys and flue systems to be used with solid mineral fuel and biomass combustion appliances in dwellings

Assessment criteria

- 6.1** Explain the **function** of an open flue/ chimney system
- Function**
- Clearing the products of combustion
 - Inducing combustion air into the appliance
- 6.2** Define the working principles of open flue systems including the effect that height has on flue performance
- 6.3** Identify the types and general layout features of chimney and **flue construction**
- Flue construction**
- Rigid chimney types
 - Brick / masonry
 - Pre-cast flue blocks
 - Metallic (single and double wall flues)
 - Flexible metallic liner installation – types and suitability

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Understand standards of chimneys and flue systems to be used with solid mineral fuel and biomass combustion appliances in dwellings

Assessment criteria

6.4 Explain the **requirements** for new and existing chimney/flue installation

Requirements

- Relevant Approved documents and standards, and regulation requirements.
- Minimum cross-sectional area of new chimney installations to serve appliances
- Insulation requirements for flues/chimneys
- Restrictions placed on (bends) changes of direction in the chimney/ flue system
- Types of flue liners – during construction (salt glazed, clay etc.)
 - Poured/pumped concrete flue liners
 - Pre-cast flue blocks
 - Flexible flue liners: Flue system jointing methods
- Restrictions on the use of poured concrete liners
- Pre-cast flue design
 - Minimum cross-sectional area of new flue blocks
 - Minimum requirement of vertical flue blocks before off-sets
 - Jointing material for pre-cast flue blocks
 - Minimum flue size diameter for connecting pre-cast transfer blocks to termination point
 - Effects of temperature on installation requirements for pre-cast flues
- Flexible flue liners
 - Sealing & support requirements for flexible flue liners in chimneys
 - Flexible liner components
 - Termination of flue liners
- Metallic rigid flue/ chimney systems
 - Support requirements
 - Jointing methods
 - Use external to the building

6.5 Explain the **design requirements** of flues used with appliances

Design requirements

- Requirements of designer, builder, provider or installer when installing chimneys
- Chimney system design
 - Distance requirements when passing through combustible material
 - Fire-stopping requirements when passing through compartments
 - Methods of preventing contact of combustible materials with metallic internal flue pipes e.g. in cupboards, roof spaces
 - Special requirements for chimneys passing adjacent to combustible material or through other dwellings
 - Proximity of single skin flue pipes to combustible materials
- Temperature effects and condensation problems caused by flue pipe runs
- Requirements for access to appliances and chimneys/ flue systems for cleaning purposes

6.6 Define the requirements for the **termination** of flue systems serving appliances

Termination

- Low level open flue appliance termination (pellet burners)
- Open flue terminal positions on roof surfaces
- Open flue terminal positions on easily ignited roof surfaces
- Methods of dealing with down-draught on steeply pitched roofs
- Types of chimney pots and approved cowls for use with solid fuel flue systems

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Understand standards of chimneys and flue systems to be used with solid mineral fuel and biomass combustion appliances in dwellings

Assessment criteria

6.7 Identify methods of making correct **appliance connection** to the flue system

Appliance connection

- Forming chimney gathers – open fires
- Throats to open fires
- Use, positioning and sizing of canopies to open fires

6.8 Explain the working principles of flue draught stabilisers and their uses with appliances

6.9 Clarify the requirements for installing **chimney fans** to open flues/chimney

Chimney fans

- Requirements prior to installing fans in flues
- Additional safety requirements when fans are installed in flues

6.10 Explain the procedure for re-lining **existing chimneys**

Existing chimneys

Pre-installation inspection: carry out appropriate site survey:

- Carry out testing of existing chimneys
- Verify the structural condition of existing chimneys, recognise the need to carry out remedial work including relining of existing chimneys.
- Verify existing chimney suitability for installed appliance, or recognise new chimney requirements.
- Recognise new flueing arrangements and termination (including the siting of new bespoke chimney systems, internal and external factory-made chimneys systems and their components)

Installation: Relining an existing chimney

- Safe removal of existing liner where required
- Ensure chimney is swept / cleaned and made ready prior to:
 - Install appropriate lining system
 - Provision of Register plate / closure plate
 - Insulate if appropriate
 - Termination
 - Connection to an appliance
- Re-test and completion of a commissioning report

Installation: prepare, position and erect external factory-made chimneys systems

- Prepare external walls including structural consideration to accept flue pipes passing through walls
- Assemble, position, erect and support factory made chimneys systems
- Weather seal and make good
- Termination
- Connection to an appliance
- Testing and completion of a commissioning report

Installation: prepare, position and erect internal factory-made chimneys systems

- Prepare ceiling, floors and roof including structural consideration to accept flue pipes passing next to structural floor and roof joists
- Assemble chimney system and position ventilated and non-ventilated fire stops, joist and rafter supports
- Erect enclosures and protective surrounds
- Install weather proofing and make weather tight
- Termination
- Connection to an appliance
- Testing and completion of a commissioning report.

Learning outcome 7

Understand methods of diagnosing problems with flue/chimney performance

Assessment criteria

- 7.1** Identify range of faults and their potential solution associated with flues/ chimneys sited in high pressure zones
- 7.2** Identify a range of faults and their potential solution associated with insufficient flue draught
- 7.3** Identify a range of faults and their potential solution associated with no, or limited chimney updraught
- 7.4** Identify a range of faults and their potential solution associated with chimney down-draughting.

Learning outcome 8

Understand the requirements for hearths and fireplace surrounds to solid mineral fuel and biomass combustion appliances

Assessment criteria

- 8.1** State the requirements for the **provision of hearths** to appliances
Provision of hearths
 - Appliances with base temperature below 100°C
 - Appliances with base temperature above 100°C
- 8.2** Explain the **constructional features** of hearths to appliances (base temperatures above 100°C)
Constructional features
 - Constructional hearth dimensions
 - Superimposed hearth dimensions
 - Proximity of appliances on hearths to combustible materials
- 8.3** Define methods of forming recessed fireplace openings
- 8.4** Explain methods of installing fireplace surrounds including the suitability of surround material
- 8.5** Describe the requirements for the provision of a flue/appliance hearth dataplate.

Learning outcome 9

Understand how to test solid mineral fuel and biomass combustion appliances and associated flue systems in dwellings for effective operation

Assessment criteria

- 9.1** Identify the requirements for sweeping an existing flue system prior to new appliance installation
- 9.2** Describe the key points to be checked in the visual inspection of a flue system prior to undertaking commissioning of the appliance/flue system
- 9.3** State circumstances in which CCTV inspection of a flue system may be required
- 9.4** Explain the **factors** that can affect flue system performance
Factors
 - Downdraught conditions
 - Wind effects at the appliance termination
 - Passive stack ventilation
 - Extractor fans sited in the vicinity of open flued appliances

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 9 **continued**

Understand how to test solid mineral fuel and biomass combustion appliances and associated flue systems in dwellings for effective operation

Assessment criteria

9.5 Specify the **testing procedures** that should be performed to check the correct operation of an existing chimney/flue system

Testing procedures

- Coring ball test
- Smoke test
- Flue testing procedures with appliances sited in the vicinity of extraction fans
- Flue flow test

9.6 Specify the testing procedures applied to **appliances**

Appliances

- Appliance air leakage test (closed appliances)
- Appliance spillage test (open appliances)
- Taking flue draught readings and adjustment of appliance air control devices

9.7 Explain the procedures for using combustion analysis equipment to commission selected appliances.

Learning outcome 10

Understand how to identify and respond to unsafe situations relating to flue systems and appliances in dwellings

Assessment criteria

10.1 Clarify the types of **unsafe situation** that may be found with appliances and flue systems

Unsafe situation

- Types of risk
 - Actions to take
 - 'Do not use' notices and labels
 - Warning notice forms

10.2 Explain the use of **general notices** and warning labels to avoid the occurrence of unsafe situations

General notices

- Commissioning certificates
- Service certificates.

10.3.2. Unit 19 Plan, Install, Commission, Service and Maintain Solid Mineral Fuel and Biomass Combustion Appliances

Unit Level	3	<i>The aim of this unit is to enable learners to demonstrate knowledge and occupational competence in meeting installation, commissioning, decommissioning, servicing and maintenance requirements for solid mineral fuel and biomass combustion appliances.</i>
GLH	230	
Unit	Learning Outcomes	Assessment Criteria
Plan, Install, Commission, Service and Maintain Solid Mineral Fuel and Biomass Combustion Appliances	LO1 Know types of solid mineral fuel and biomass combustion appliances and their operating principles	1.1 to 1.3
	LO2 Know the energy efficiency legislation applicable to solid mineral fuel and biomass combustion	2.1 to 2.4
	LO3 Select solid mineral fuel and biomass combustion appliances to meet customers' needs	3.1 to 3.3
	LO4 Install solid mineral fuel and biomass combustion appliances	4.1 to 4.3
	LO5 Commission solid mineral fuel and biomass combustion appliances	5.1 to 5.12
	LO6 Decommission solid mineral fuel and biomass combustion appliances	6.1 to 6.10
	LO7 Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances	7.1 to 7.12

Learning outcome 1

Know types of solid mineral fuel and biomass combustion appliances and their operating principles

Assessment criteria

- 1.1 Identify types of appliances**
- Types of appliances**
- Open fire:
- Inset (dry)
 - Freestanding (dry)
 - Convector (dry)
 - With underfloor air supply
 - With small hot water only boiler
 - With high output back boiler
- Room heaters:
- Inset (dry)
 - Freestanding (dry)
 - With integral boiler
 - Automatic feed type e.g. pellet burners
- Cookers:
- Cooking only
 - Cooking with small hot water boiler
 - Cooking with high output boiler
- Independent boilers:
- Batch fed appliances (log boilers)
 - Gravity fed appliances
 - Automatic feed type e.g. pellet burners

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

1.2 Define the **operating principles** of appliances

Operating principles

Solid mineral

- Batch fed open fires – with/ without boilers
- Batch fed room heaters – with/without boilers
- Batch fed cookers – with/without boilers
- Semi-automatic independent boilers

Biomass

- Log burner – batch type appliance
- Wood pellet burner – fully automatic
- Automatic wood pellet burning stoves
- Automatic wood pellet burning boilers
- Batch fed wood log burning stoves
- Batch fed wood log burning boilers

1.3 Define the purpose of **components** of appliances

Components

Solid mineral

- Open fires
 - Chairbrick/boiler: Connection to the flue system
 - Firefront parts
 - Damper mechanism (where fitted)
 - Underfloor air mechanism
- Roomheaters
 - Combustion chamber
 - Firebed
 - Connection to the flue system
 - Ash removal
 - Appliance door seals
 - Air supply control
- Cookers
 - Combustion chamber
 - Firebed
 - Connection to the flue system
 - Ash removal
 - Appliance door seals
 - Air supply control
- Independent boilers
 - Combustion
 - Firebed
 - Fuel storage
 - Connection to the flue system
 - Ash removal system
 - Appliance seals
 - Blocked flue cut-off
 - Thermostatic control
 - Air supply fan
 - Primary air supply

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Know types of solid mineral fuel and biomass combustion appliances and their operating principles

Assessment criteria

1.3 Biomass

cont.

- Log burner
 - Fuel store
 - Heat exchanger
 - Heat exchanger cleaning mechanism
 - Ash removal: Fire bed/combustion chambers
 - Primary/secondary air control
 - Air supply (suction) fan
 - Flue gas exhaust control
 - Flue gas temperature sensor
 - Lambda sensor
 - Combustion controller (PCB)
- Wood pellet burner
 - Fuel store
 - Fuel supply system – suction and drive feed systems
 - Heat exchanger
 - Heat exchanger cleaning mechanism
 - Automatic ignition system
 - Automatic heat exchanger/flue cleaning mechanism
 - Automatic ash removal system
 - Combustion air fan
 - Flue gas temperature sensor
 - Lambda sensor: Combustion controller (PCB).

Learning outcome 2

Know the energy efficiency legislation applicable to solid mineral fuel and biomass combustion

Assessment criteria

- 2.1** Specify the types of solid mineral and biomass fuel appliances that must be installed to meet the requirements of **energy efficiency legislation**
- Energy efficiency legislation**
- New properties
 - Replacement of boilers in existing properties
- 2.2** Explain the limitations on the installation of solid mineral and biomass fuel appliances laid down by the Clean Air Act
- 2.3** Specify the level of **central heating controls** to be provided in heating and hot water systems incorporating solid mineral and biomass fuel appliances
- Central heating controls**
- New properties
 - When carrying out replacement of existing fossil fuel burning appliances
- 2.4** Describe the effects of excess CO₂ in the atmosphere.

Learning outcome 3

Select solid mineral fuel and biomass combustion appliances to meet customers' needs

Assessment criteria

3.1 Explain the **criteria** used when selecting appliances

Criteria

- Customers' needs/preference
- Provision of suitable flueing arrangements
- Restrictions placed on boilers installed in certain rooms
 - Bathrooms shower rooms
 - Bedroom/bedsitting rooms
 - Understairs cupboards
 - Loft spaces
 - Garages
 - Externally sited appliances
- Proximity of combustible materials to the appliance
- Building layout and features – suitable appliance space and fuel storage
- Suitability of heating system
- Limitations of use of underfloor heating
- Loadings placed on the solid mineral fuel appliance
- Energy efficiency legislation requirements
- Smoke control legislation (to include exempted appliances)
- Environmental impact
- Provision for fuel delivery
- Operating characteristics and output efficiencies and loadings
- Fuel usage and storage options (including space, location and fuel integrity)

3.2 Calculate the size of appliance required for a boiler replacement

3.3 Recommend an appropriate appliance that meets the needs of the customer.

Learning outcome 4

Install solid mineral fuel and biomass combustion appliances

Assessment criteria

4.1 Carry out **pre-installation inspection** to determine that appliances can be correctly installed

Pre-installation inspection

- Appliance location/position
- Hearth provision
- Flueing arrangements and termination
- Appliance ventilation provision
- Fuel supply arrangements
- Heating/ hot water system provision
- Electrical connection arrangements

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Install solid mineral fuel and biomass combustion appliances

Assessment criteria

4.2 Position, fix and connect appliances to **manufacturers' requirements**

Install solid mineral fuel and biomass combustion appliances		
Task	Direct observation requirements	Evidence
Assessment requirements: <ul style="list-style-type: none"> Assessments must be carried out as documented in this table Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements. 		
Install one of the following in accordance with regulatory requirements and manufacturer's instructions: <ul style="list-style-type: none"> Solid mineral fuel system Biomass fuel system Primary Range: Types of appliances <ul style="list-style-type: none"> Open fire Room heaters Cookers Independent boilers 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of the chosen system required across the documented ranges. At least five separate jobs, three of which must be from the workplace must be included and evidenced in the work log.
Notes: <ul style="list-style-type: none"> As a minimum, learners must complete each assessment task with reference to one of the above systems. Installations carried out on site MUST be of a different FUEL SYSTEM than the appliance installed in the centre Assessments must be carried out as specified below and evidenced in the work log Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Install solid mineral fuel and biomass combustion appliances

Assessment criteria

4.2 Manufacturers' requirements

cont.

- Assemble and position the appliance
- Make connections to, or assemble the appliance flue system/ connection
- Make/assemble the appliance fuel storage arrangements
- Assemble the fuel delivery system
- Make connections to the heating/ hot water system
- Make final electrical connections to the central heating control system

4.3 Take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Learning outcome 5

Commission solid mineral fuel and biomass combustion appliances

Assessment criteria

5.1 Interpret information sources to identify the range of commissioning work required on appliances

5.2 Specify flue draught **reading**/combustion analysis equipment and its maintenance and calibration requirements

Reading equipment

- Draught gauge
- Electronic test equipment

5.3 Carry out a **visual inspections** of appliances to confirm that they are ready to be commissioned

Visual inspections

- Fuel supply/storage system – correctly assembled, sited and correct fuel supplied
- Air supply – combustion and ventilation
- Flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser (where required)
- Appliance – correct positioning and assembly of components such as flue mechanism, ash cleaning mechanism, temperature sensors, ignition, etc.
- Water connections to the appliance – provision of suitable heating/ hot water system controls, checked filled and ready for operation
- Electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation

5.4 Carry out **operational tests** prior to appliance light up

Operational tests

- Flue flow test (where required)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Commission solid mineral fuel and biomass combustion appliances

Assessment criteria

5.5 Carry out operational tests on initial **appliance light up**

Appliance light up

- Initial appliance combustion
- Appliance air leakage test
- Correct operation of combustion safety controls
- Initial readings to determine the flue draught
- Flue operational tests – flue spillage (where required, flue draught interference test (where required)).

Commission solid mineral fuel and biomass combustion appliances

Task	Direct observation requirements	Evidence
<p>Test, commission and handover in accordance with the manufacturer's instructions one of the following:</p> <ul style="list-style-type: none"> • Solid mineral fuel system • Biomass fuel system <p>Primary Range:</p> <ol style="list-style-type: none"> 1. Reading equipment - (a or b) 2. Visual inspections - (all points in range) 3. Flue flow test 4. Appliance light up - (all points in range) 5. Functioning correctly - (all points in range) 6. Handover - (all points in range) 	<p>One test and commission directly observed (by a competent witness or assessor) in the workplace</p>	<p>To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges.</p> <p>At least five separate jobs, three of which must be from the workplace must be included and evidenced in the work log.</p>

Notes:

- As a minimum, learners must complete each assessment task with reference to one of the above systems
- Installations carried out on site **MUST** be of a different FUEL SYSTEM than the appliance installed in the centre
- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

5.6 Test appliance combustion efficiency and adjust/fine tune controls

5.7 Check to ensure that the appliance temperature controls are operating correctly

5.8 Check to ensure that connected water heating systems are **functioning correctly**

Functioning correctly

- Determine combustion efficiency
- Adjust burning rate
- Check temperature controls for correct operation
- Check functioning of central heating and hot water systems
- Complete commissioning report

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 5 **continued**

Commission solid mineral fuel and biomass combustion appliances

Assessment criteria

- 5.9** Define **actions** to take in the event that the appliance/ component cannot be correctly commissioned
- Actions**
- Use of the unsafe situations procedure
 - Provision of suitable warning notices
- 5.10** Complete the details contained in a commissioning record for appliances
- 5.11** Complete the procedure for notifying works carried out to the relevant authority
- 5.12** Points to be covered when **handing over** a completed installation to the end-user
- Handover**
- Customer left with operating instructions
 - Appliance controls demonstrated to customer
 - Customer aware of service intervals
 - Customer aware of appliance error codes and consequences of overriding safety controls
 - Ensure customer is aware of what fuel specification is required and the consequences of burning inappropriate / poor fuel
 - Customer aware of maintenance requirements
 - Cleaning system components
 - Checking for blockages.

Learning outcome 6

Decommission solid mineral fuel and biomass combustion appliances

Assessment criteria

- 6.1** Liaise with other persons to determine the decommissioning work to be carried out
- 6.2** Provide information to other persons before decommissioning work takes place
- 6.3** Use methods that reduce the periods during which appliances are not available to building users and provide temporary heating as appropriate
- 6.4** Explain the importance of arranging temporary heating to be available (if required) for the duration of decommissioning work
- 6.5** **Isolate** the appliance from the supply source
- Isolate**
- Turn off the electricity supply and make safe
 - Turn off the water supply to the system
- 6.6** **Safely drain** and dispose of system contents
- Safely drain**
- Central heating
 - Hot water system
 - Fuel and ash system
- 6.7** Temporarily decommission appliances
- 6.8** Permanently decommission appliances

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Decommission solid mineral fuel and biomass combustion appliances

Assessment criteria

6.9 Take **precautions** to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete

Precautions

- Safe isolation of the fuel supply system
- Safe isolation of the heating/hot water system
- Safe isolation of the heating/hot water electrical control system
- Temporary capping of pipework sections
- Use of warning notices and signs
- Management of waste

6.10 Advise other persons that the appliance has been successfully decommissioned.

Learning outcome 7

Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances

Assessment criteria

7.1 Obtain the relevant information required to enable the work to take place

7.2 Determine periodic servicing requirements of appliances

7.3 Obtain details of system faults from end users

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 7 **continued**

Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances

Assessment criteria

7.4 Carry out **periodic servicing** of appliances

Service solid fuel and biomass appliances

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
<p>Service in accordance with the manufacturer's instructions one of the following:</p> <ul style="list-style-type: none"> • Solid mineral fuel system • Biomass fuel system <p>Primary Range: Periodic servicing points</p> <ol style="list-style-type: none"> Visual inspection of the installation for compliance with regulation requirements Checking of system water content Cleaning system components Checking for blockages in the heat exchanger Checking the flue system for correct operation Checking for provision of adequate ventilation to the appliance Checking for correct operation of appliance components – thermostats, fans etc. Functional tests 	<p>One service directly observed (by a competent witness or assessor) in the workplace</p>	<p>To demonstrate satisfactory servicing of the chosen system required across the documented ranges.</p> <p>At least five separate jobs must be included and evidenced in the work log.</p> <p>At least three of these must be from the workplace.</p>

Notes:

- As a minimum, learners must complete each assessment task with reference to one of the above systems
- Installations carried out on site **MUST** be of a different FUEL SYSTEM than the appliance installed in the centre
- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 7 continued

Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances

Assessment criteria**7.5** Perform safety checks and Complete maintenance records relating to appliances**7.6** Identify **faults** in appliances**Rectify faults in appliances****Assessment requirements:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
<p>Find and rectify faults on one of the following:</p> <ul style="list-style-type: none"> • Solid mineral fuel system • Biomass fuel system <p>Primary Range: Faults</p> <ol style="list-style-type: none"> Defective firebars Defective thermostatic controls Flue performance problems Inadequate appliance ventilation Defective fans/ combustion controls Defective door seals Defects in flue performance Defective fuel supply system Failure in the heat exchanger/ flue cleaning system Failure of the ignition system Sensor/microprocessor faults Inadequate flow rate through the appliance 	Due to the nature of this task, no direct observation is required.	<p>To demonstrate satisfactory fault finding and rectification on the chosen system required across the documented ranges.</p> <p>At least four separate jobs must be included and evidenced in the work log.</p> <p>At least two occasions must be from the workplace.</p> <p>At least 3 faults from the range must be assessed</p>

Notes:

- As a minimum, learners must complete each assessment task with reference to one of the above systems
- Installations carried out on site **MUST** be of a different FUEL SYSTEM than the appliance installed in the centre
- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 7 continued**Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances****Assessment criteria**

- | | |
|-------------|---|
| 7.7 | Interpret manufacturer's instructions and industry standards to establish the diagnostic requirements of appliances |
| 7.8 | Safely isolate appliances to prevent them being brought into operation before the work has been fully completed |
| 7.9 | Rectify faults in appliances |
| 7.10 | Describe the actions to take in the event that the appliance/ component fault cannot be rectified |
| 7.11 | Re-commission appliances following completion of fault repair activities |
| 7.12 | Complete maintenance report forms following rectification work. |

10.4. Environmental Technologies Pathway

10.4.1. Unit 20 Air Source Heat Pump Systems

Unit Level	3	<i>The aim of this unit is to enable learners to demonstrate knowledge and occupational competence in how to plan, install, test, commission, and hand over air source heat pump systems.</i>
GLH	160	
Unit	Learning Outcomes	Assessment Criteria
Air Source Heat Pump Systems	LO1 Health and safety risks and legislation associated with air source heat pump systems	1.1 to 1.3
	LO2 Different types of air source heat pump systems	2.1 to 2.6
	LO3 Design air source heat pump systems	3.1 to 3.17
	LO4 Install air source heat pump systems	4.1 to 4.5
	LO5 Service and maintenance of air source heat pump systems	5.1 to 5.4
	LO6 Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems	6.1 to 6.6
	LO7 Perform a test, commission and handover of air source heat pump systems	7.1 to 7.8

Learning outcome 1

Health and safety risks and legislation associated with air source heat pump systems

Assessment criteria

1.1 State which aspects of installation work pose health and safety **risks**.

Risks

- Electrocution/electric shock
- Burns
- Toxic poisoning
- Personal injury through component/equipment handling

1.2 Describe safe systems of work for installation work

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Health and safety risks and legislation associated with air source heat pump systems

Assessment criteria

- 1.3** State **legislation** relevant to installation, testing and commissioning
- Legislation**
- Building regulations**
- Installation requirements
 - Energy conservation
 - Testing and commissioning
 - Compliance certification
- Water regulations**
- Energy conservation
 - Safe operation
 - Testing and commissioning
- F gas regulations**
- Refrigerant tested by the manufacturer
 - Refrigerant assembled and tested on site
 - Leak checking on refrigerant circuits
 - Recovery of fluorinated greenhouse gases on the refrigerant circuits.

Learning outcome 2

Different types of air source heat pump systems

Assessment criteria

- 2.1** State the purpose and operation of heat pump system **components**
- Components**
- Evaporator
 - Low pressure switch
 - Compressor
 - High pressure switch
 - Condenser
 - Dryer/receiver
 - Sight glass
 - Expansion valve
 - Expansion valve phial
 - Refrigerant four way valve
 - Emitter circuit electro-mechanical valves
 - Fan coil
 - Buffer tanks (integrated, series and parallel)
- 2.2** Describe how the vapour compression refrigerant circuit within a heat pump unit operates
- 2.3** Identify different **types** of heat pump system
- Types**
- External air, packaged (indoor)
 - External air, packaged (outdoor)
 - External air, internal heat pump unit with circuit between fan coil unit and heat pump unit
- 2.4** State the meaning of monovalent system and bivalent system

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Different types of air source heat pump systems

Assessment criteria

- 2.5** Identify the **monovalent hydraulic emitter circuits**
Monovalent hydraulic emitter circuits
- Heating only
 - Heating with buffer tank
 - Heating with buffer tank and indirect stored domestic hot water
 - Heating with buffer tank and indirect stored domestic hot water with solar coil
 - Heating with thermal store.
- 2.6** Identify the **parallel bivalent hydraulic emitter circuits** incorporating secondary heat sources
Parallel bivalent hydraulic emitter circuits
- Heating with buffer tank
 - Heating with buffer tank and indirect stored domestic hot water
 - Heating with buffer tank and indirect stored domestic hot water with solar coil
 - Heating with buffer tank and thermal store.

Learning outcome 3

Design air source heat pump systems

Assessment criteria

- 3.1** Confirm the meaning of the **coefficient of performance (COP)** and its relationship with input and emitter temperatures
COP
- Heat pump input temperature
 - Heat pump emitter temperature
- 3.2** Describe the effect that ambient temperature can have on:
- Coefficient of performance
 - Heat pump output
- 3.3** State the meaning of the seasonal performance factor (SPF) and factors that affect it
- 3.4** Confirm the meaning of system efficiency and factors that affect it
- 3.5** State why achieving minimum heat loss from the building is important when designing a heat pump system.
- 3.6** State the effects of oversizing and under sizing a heat pump
- 3.7** State how to identify heat pump hydraulic flow rate requirements
- 3.8** State how to use **manufacturers' data** to select heat pump units
Manufacturers' data
- Output charts (including bivalent points)
 - Other data
- 3.9** State how heat pump **output capacity** is affected
Output capacity
- Heat pump input/output temperature

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Design air source heat pump systems

Assessment criteria

- 3.10** Describe the suitability of the following types of **hydraulic heating system emitters** for use with heat pump systems and their typical mean water temperatures
- Hydraulic heating system emitters**
- Underfloor heating
 - Fan assisted convector heaters
 - Panel radiators
 - Bivalent points/auxiliary heat requirements
 - Mean water temperatures
- 3.11** State how correction factors are used to determine emitter output requirements in relation to mean water temperature and room temperature difference
- 3.12** State the advantages and disadvantages of including a buffer tank in the system design
- 3.13** Describe the method of determining the size of a monovalent heat pump system
- 3.14** State the typical annual **operating hours** for a heat pump that is being used for:
- Heating only
 - Heating and domestic hot water
- Operating hours**
- Heat only
 - Heating and DHW
 - Type of building
 - Geographic location
- 3.15** State why heat pump annual operating hours vary
- 3.16** Explain factors to be considered in selecting and positioning air source heat pump systems in relation to its fan coil unit
- 3.17** Describe the defrost cycle options (including sizing a buffer tank) for an air source heat pump systems.

Learning outcome 4

Install air source heat pump systems

Assessment criteria

- 4.1** State the **pre-installation checks** for air source heat pump systems connected to hydraulic emitter circuits.
- Pre-installation checks**
- Tools, materials and equipment are safe and suitable
 - Building structure
 - Authorisation
 - Access
 - Collation of relevant information
 - Location of fan coil unit, heat pump unit and internal system components
 - Confirm design-heat pump rating, emitter circuit, buffer tank, electrical input
- 4.2** State the pre-installation checks that are specific to the positioning of fan coil units

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Install air source heat pump systems

Assessment criteria

- 4.3** State the requirements for moving and handling heat pump units to avoid damage to the unit.
- 4.4** Identify the **installation requirements** where heat transfer fluid circuit pipework passes through the external building fabric
- Installation requirements**
- Heat transfer fluid circuit passes through external building fabric
 - Provision of movement
 - Protect against freezing
 - Prevent water ingress
- 4.5** Install the heat pump to the hydraulic emitter circuit.

Install a heat pump

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Install the following: <ul style="list-style-type: none">• Air source heat pump system	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Learning outcome 5

Service and maintenance of air source heat pump systems

Assessment criteria

- 5.1** Identify how to use documentation to be available to inspect, service and maintain heat pump systems
- 5.2** State the industry requirements for recording the outcomes of inspection, service and maintenance of heat pump systems
- 5.3** State the action(s) to be taken in the event of a failure or suspected failure of the refrigerant circuit and/or a suspected refrigerant circuit defect
- 5.4** Inspect **service and maintain** air source heat pump systems
- Service and maintain**
- Visual inspection requirements
 - Leaks and dampness
 - Position of components
 - Quality, condition and positioning of pipework insulation
 - Safety labels
 - Security of fixing of system components
 - Setting electrical controls and temperature sensors
 - Cleaning of components
 - Checking of system water content/ fluid levels
 - Functional checks
 - Safe operation
 - Efficient operation
 - Function of system
 - Noise vibration levels
 - Pressure levels
 - Protection of the system against freezing
 - Cleaning, adjustment and lubrication of system components and controls
 - Complete documentation and actions if required

Inspect service and maintain air source heat pump systems

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Service the following: <ul style="list-style-type: none">• Air source heat pump system	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Learning outcome 6

Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems

Assessment criteria

- 6.1** Describe the sequence of actions to enable diagnosis and rectification of heat pump system defects and malfunctions
- 6.2** Obtain the **information** required to enable fault diagnosis and rectification to be undertaken
- Information**
- End user
 - Manufacturers' instructions
 - Fault diagnosis flow chart
 - Service history.
- 6.3** Identify the cause of **faults** on heat pump systems and carry out remedial work

Identify the cause of faults on heat pump systems and carry out remedial work

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
<p>Find and rectify faults on the following:</p> <ul style="list-style-type: none">• Air source heat pump system <p>Faults</p> <ul style="list-style-type: none">• Heat pump high/ low pressure trip/alarm activated by an emitter circuit malfunction• Insufficient heat output to emitter circuit• Domestic hot water heat up is satisfactory but space heating is not operating• System noise and/or vibration	<p>Due to the nature of this task, no direct observation is required.</p>	<p>To demonstrate satisfactory fault finding and rectification on the chosen system required across the documented ranges.</p> <p>At least four separate jobs must be included in the work log.</p> <p>At least two of the jobs must be evidenced from the workplace.</p>

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 6 **continued**

Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems

Assessment criteria

- 6.4** Advise the client of the cause of the malfunction and the actions required to rectify
- 6.5** Take precautionary actions to prevent unauthorised use of the system and minimise risk of injury prior to or during fault rectification
- 6.6** Undertake post-rectification functional tests in accordance with manufacturers' instructions.

Learning outcome 7

Perform a test, commission and handover of air source heat pump systems

Assessment criteria

- 7.1 Prepare** a heat pump system for testing and commissioning
Prepare
- System design and specification
 - System/component manufacturer requirements
 - Suitability of the electrical supply circuit
 - System is ready for flushing of installation debris
 - System is ready for filling and venting the hydraulic circuits
 - System is ready for adding protection against freezing
 - Client requirements are met
 - System is compliant with statutory regulations and/or industry recognised procedures
 - Conditions required for dynamic commissioning
- 7.2** Describe the requirements for **charging, flushing** and treating hydraulic heat emitter circuits
Charging and flushing
- Equipment required
 - Purging air and debris
- 7.3 Commission** the system in accordance with manufacturer's instructions, design specification, client's and statutory requirements and industry recognised procedures
Commission
- Visual check
 - Fill and vent
 - Test
 - Flush
 - Operational checks
 - Commissioning documentation
 - Handover procedure

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

7.3 cont.**Commission the system****Assessment requirements:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Test, commission and handover an air source heat pump system. Commission <ul style="list-style-type: none"> • Visual check • Fill and vent • Test • Flush • Operational checks • Commissioning documentation • Handover procedure 	One test and commission directly observed (by a competent witness or assessor) in the workplace.	To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

7.4 Undertake final **checks** to ensure that the system is ready for **handover** to client.

Checks

- Mechanical controls
- Electrical controls/ temperature sensors
- Functional tests

Handover

- Provision of written/diagrammatic/verbal information
- Demonstration of system operation and use.

7.5 Explain and demonstrate to the client the operation and use of the heat pump system using manufacturer's / users instructions

7.6 Explain to the client any aspects of the system at variance with the agreed design specification

7.7 Obtain confirmation of acceptance from the client of the handover of the heat pump system

7.8 Ensure that **handover** documentation is completed and passed to the client in accordance with manufacturer's instructions

Handover

- Provision of written/diagrammatic/verbal information
- Demonstration of system operation and use

10.4.2. Unit 21 Rainwater Harvesting and Grey Water Re-use systems

Unit Level	3	<i>The aim of this unit is to enable learners to demonstrate knowledge and occupational competence in how to plan, install, test, commission, and hand over rainwater harvesting and greywater reuse systems</i>
GLH	130	
Unit	Learning Outcomes	Assessment Criteria
Rainwater Harvesting and Greywater Reuse Systems	LO1 Rainwater harvesting and greywater reuse systems	1.1 to 1.7
	LO2 Install rainwater harvesting and greywater reuse system components	2.1 to 2.4
	LO3 Test, commission and handover rainwater harvesting and greywater reuse systems	3.1 to 3.5
	LO4 Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems	4.1 to 4.5

Learning outcome 1

Rainwater harvesting and greywater reuse systems

Assessment criteria

- 1.1** Identify the **health and safety risks** and safe systems of work
- Health and safety risks**
- Electrocution/electric shock
 - Infection
 - Toxic poisoning
 - Asphyxiation
 - Drowning
 - Personal injury through component/equipment handling
- 1.2** Interpret **building regulations** and **water regulations** guidance documentation
- Water regulations**
- Prevention of contamination/microbial growth
 - Keeping the stored water dark and cold
 - Provision and sizing of an overflow
 - Prevention of surcharging via overflow pipework
 - Termination of overflows from rainwater harvesting storage tanks
 - Termination of overflows from greywater reuse storage tanks
 - Provision of covers and vents
 - Prevention of stagnation of the stored water
- Building regulations/standards**
- Notification of the work
 - Maintaining the structural integrity of the building
 - Maintaining the fire resistant integrity of the building
 - Prevention of moisture ingress (building water-tightness)
 - Prevention of stagnation of the stored water
- 1.3** State the advantages and disadvantages of rainwater harvesting and greywater reuse systems

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

- 1.4** Describe the **design requirements** for types and layouts of rainwater harvesting systems
- Design requirements – rainwater**
- Building occupancy
 - Demand/usage
 - Roof plan area (tiled pitched roofs)
 - Average annual rainfall depth for the location
 - Design requirements for rainwater harvesting storage tank/cistern
 - Water treatment
 - Filtration
 - Yield
 - Usage
- Design requirements – greywater**
- Building occupancy
 - Demand/usage
 - Storage capacity (litres) of a greywater reuse system within premises using the simplified approach
 - Design requirements for greywater reuse storage tank/cistern
 - Water treatment
 - Filtration
 - Yield
 - Usage
- 1.5** Describe the **design requirements** for types and layouts of greywater reuse systems
- Design requirements – rainwater**
- Building occupancy
 - Demand/usage
 - Roof plan area (tiled pitched roofs)
 - Average annual rainfall depth for the location
 - Design requirements for rainwater harvesting storage tank/cistern
 - Water treatment
 - Filtration
 - Yield
 - Usage
- Design requirements – greywater**
- Building occupancy
 - Demand/usage
 - Storage capacity (litres) of a greywater reuse system within premises using the simplified approach
 - Design requirements for greywater reuse storage tank/cistern
 - Water treatment
 - Filtration
 - Yield
 - Usage
- 1.6** Confirm **backflow prevention** arrangements for wholesome back up water supplies
- Backflow prevention**
- Type AB air gap
 - Type AA
 - Air gap gravity supply

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 1 **continued**

Rainwater harvesting and greywater reuse systems

Assessment criteria

1.7 Identify the purpose of **components** used within rainwater harvesting and greywater reuse systems

Components

- Anti-surge valve
- Calmed inlet
- Inlet filter
- Level sensor/float switch
- Module (including pump and air gap)
- Pump control unit
- System control unit
- Expansion vessel (direct systems)
- Water level gauge.

Learning outcome 2

Install rainwater harvesting and greywater reuse system components

Assessment criteria

2.1 Identify the **information requirements** used to select, size and position components

Information requirements

- Water quality and efficiency
- Roof drainage system installation
- Rainwater and greywater storage tank installation
- Design requirements for rainwater harvesting and greywater reuse storage tank/cistern
- Connection arrangement where rainwater and greywater overflow and drainage pipework connects to the underground drainage system
- Prepare a rainwater harvesting or greywater reuse system for testing and commissioning to include checks/actions to:
 - confirm compliance with the system design and specification
 - confirm compliance with system/component manufacturer requirements
 - confirm the suitability of electrical supply circuit arrangement

2.2 Confirm the **pre-installation design requirements**

Pre-installation design requirements

- Building occupancy
- Demand/usage
- Any special features
- Storage capacity (litres) of a greywater reuse system within premises using the simplified approach

2.3 State the **preparatory work** required for system installation work

Preparatory work

- Confirm pre installation checks
- Confirm tools and equipment are safe and to industry standard
- Compliance certification
- Backflow and contamination prevention requirements
- Marking and labelling requirements

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 continued

Install rainwater harvesting and greywater reuse system components

Assessment criteria**2.4 Install rainwater harvesting and greywater reuse components.****Install rainwater harvesting and greywater reuse components****Assessment requirements:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Install the following: <ul style="list-style-type: none"> • Rainwater harvesting and greywater reuse Components <ul style="list-style-type: none"> • Storage tank (connection to tank only) • System control unit (water connections only) • Pump 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.
Notes: <ul style="list-style-type: none"> • Assessments must be carried out as specified below and evidenced in the work log • Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre • The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log • The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway. 		

Learning outcome 3

Test, commission and handover rainwater harvesting and greywater reuse system

Assessment criteria

- 3.1 Identify statutory regulations and recognise procedures**
- Regulations**
- Building regulations
 - Water regulations
- 3.2 Identify marking and labelling to system pipework and components as per regulations**
- Regulations**
- Building regulations
 - Water regulations

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Test, commission and handover rainwater harvesting and greywater reuse system

Assessment criteria

3.3 Describe the **requirements** to test and commission rainwater harvesting and greywater re-use system installations

Requirements

- Compliance with system design and specification
- Compliance with system component/manufacturer requirements
- Suitability of electrical supply circuit arrangements

3.4 **Test and commission** rainwater and greywater systems

Test and commission

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
<p>Test, commission and handover rainwater harvesting and greywater reuse system:</p> <p>Test and commission</p> <ul style="list-style-type: none"> • Soundness test • Performance test • Setting of the system fluid levels • Setting of mechanical controls • Setting of electrical controls • System functional tests • Water quality checks • Confirm the provision of appropriate marking and labelling to system pipework and components 	<p>One test and commission directly observed (by a competent witness or assessor) in the workplace</p>	<p>To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges.</p> <p>At least five separate jobs must be included in the work log.</p> <p>At least three of the jobs must be evidenced from the workplace.</p>

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Test, commission and handover rainwater harvesting and greywater reuse system

Assessment criteria

3.5 Handover to end user

Handover

- Provision of written/diagrammatic/verbal information
- Demonstration of system.

Learning outcome 4

Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems

Assessment criteria

4.1 Identify information to maintain systems

Information

- Manufacturer's instructions
- Statutory regulations
- Service records
- Fault finding flow charts

4.2 Describe types and rectification of possible faults or suspected failure of components

Faults

- Poor or no flow into storage tank
- System pump fails to operate
- Back-up water supply fails to operate
- Water quality is unacceptable

Components

- Anti-surge valve
- Calmed inlet
- Inlet filter
- Level sensor/float switch
- Module (including pump and air gap)
- Pump control unit
- System control unit
- Expansion vessel (direct systems)
- Water level gauge

4.3 Describe rectification of possible faults or suspected failure of components

Faults

- Poor or no flow into storage tank
- System pump fails to operate
- Back-up water supply fails to operate
- Water quality is unacceptable

Components

- Anti-surge valve
- Calmed inlet
- Inlet filter
- Level sensor/float switch
- Module (including pump and air gap)
- Pump control unit
- System control unit
- Expansion vessel (direct systems)
- Water level gauge

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems

Assessment criteria

4.4 **Inspect and maintain** systems in accordance with **British Standards**

Inspect and maintain

- Compliance with manufacturer's Installation instructions
- Compliance with statutory regulations
- Condition of system components including cleanliness
- Correct positioning of system components
- Security of fixing of system components
- System water levels
- Checking the system water quality
- Dissolved oxygen (stored rainwater)
- Cleaning of components
- Functional tests
- Suspended solids
- Colour
- Turbidity
- pH
- Residual chlorine
- Residual bromine
- Cleaning of system components
- Adjustment of system controls
- Efficient operation
- Functioning of system components/controls.
- Visual inspection requirements

British Standards

- BS 8515
- BS 7592

Inspect and maintain systems

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Service the following: <ul style="list-style-type: none"> • Rainwater harvesting and greywater reuse system 	One service directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory servicing of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 4 **continued**

Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems

Assessment criteria

4.5 Carry out diagnosis and rectification **procedure** on faults

Procedure

- Diagnose
- Notify client
- Safe isolation
- Decommission
- Rectify
- Re-commission
- Handover

Faults

- Poor or no flow into storage tank
- System pump fails to operate
- Back-up water supply fails to operate
- Water quality is unacceptable

Carry out diagnosis and rectification procedure

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Find and rectify faults on the following: <ul style="list-style-type: none">• Rainwater harvesting and greywater reuse system	Due to the nature of this task, no direct observation is required.	To demonstrate satisfactory fault finding and rectification on the chosen system required across the documented ranges. At least four separate jobs must be included in the work log. At least two of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

10.4.3. Unit 22 Solar Thermal Hot Water Systems

Unit Level	3	<i>The aim of this unit is to enable learners to demonstrate knowledge and occupational competence in how to plan, install, test, commission and hand over an active solar thermal hot water system.</i>
GLH	160	
Unit	Learning Outcomes	Assessment Criteria
Solar Thermal Hot Water Systems	LO1 Health and safety and relevant legislation, regulations and standards	1.1 to 1.3
	LO2 Fundamental design principles for solar thermal hot water systems	2.1 to 2.10
	LO3 Install solar thermal hot water systems	3.1 to 3.6
	LO4 Test, commission and handover of solar thermal hot water systems	4.1 to 4.3
	LO5 Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation	5.1 to 5.3

Learning outcome 1

Health and safety and relevant legislation, regulations and standards

Assessment criteria

- 1.1** State industry recognised **legislation, regulations and standards** relevant to solar thermal hot water systems.
- Legislation, regulations and standards**
- Building Regulations
 - Town and country planning
 - Water Regulations
 - British Standards
 - European Standards
- 1.2** Define safe systems of work for dealing with **hazards**
- Hazards**
- Working at height
 - Electrocuting/electric shock
 - Burns
 - Toxic poisoning
 - Injury through flash to steam of system heat transfer fluid
 - Personal injury through component/equipment handling
- 1.3** State **risks** associated with solar thermal collectors
- Risks**
- Size
 - Weight
 - Fragility
 - Wind
 - Thermal properties and outputs.

Learning outcome 2

Fundamental design principles for solar thermal hot water systems

Assessment criteria

2.1 Identify system **information requirements**

Information requirements

- Building design
- Building dimensions/angles
- Building location and orientation
- Building fabric/material details
- Existing input services
- Existing hot water/heating systems
- Building occupancy
- Required hot water usage pattern

2.2 State how to determine typical domestic **hot water storage vessel requirements**

Hot water storage vessel requirements

- Daily demand (vd) (litres/day per person or litres/day per m² of floor area)
- Boiler volume (vb)
- Dedicated solar volume (vs) (litres per m² of collector area or as a % of vd)
- Total cylinder volume (vt)
- Solar heat exchange coil surface area (m² of surface area in relation to collector flow rate and collector surface area)

2.3 Determine hot water storage vessel requirements

2.4 State **collector area requirements**

Collector area requirements

- Building occupancy
- Proposed angle of collector
- Installation
- Proposed orientation of collector installation
- Shading that may affect collector performance

2.5 State system **annual irradiation yield requirements**

Annual irradiation yield requirements

- Collector orientation
- Collector angle
- Collector over shading
- Circulation rates

2.6 Identify system **primary circuit pipe size requirements**

Primary circuit pipe size requirements

- Primary circuit circulation rates
- Collector area
- Primary circuit pipework length
- Primary circuit water content volume

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 2 **continued**

Fundamental design principles for solar thermal hot water systems

Assessment criteria

- 2.7** State system **expansion vessel size requirements**
Expansion vessel size requirements
- Primary circuit water content
 - Volume
 - Collector height above cylinder
 - Typical sizing requirements for drainback vessel:
 - Net collector area
 - Total volume of the system
- 2.8** Identify system **pump size requirements**
Pump size requirements
- Fully filled systems
 - Drainback systems
- 2.9** State **factors** affecting solar thermal collector installation
Factors
- A listed property - installations to listed buildings
 - Property in conservation areas
 - Permitted development
 - Flat roof loading calculations/approval
 - Wind uplift
 - Roof types
 - Azimuth (direction)
 - Angle of inclination
 - Shading
 - Brackets, rails and fixings
 - Specialist tools
 - Components
 - Incentive schemes
- 2.10** Define the considerations of solar fraction.

Learning outcome 3

Install solar thermal hot water systems

Assessment criteria

- 3.1** Describe system **components** and placement
Components
- Solar collector
 - Differential temperature controller
 - Cylinder sensor(s)
 - Solar collector sensor
 - Drain back vessel
 - Flow meter
 - Flow regulator (mechanical)
 - Expansion vessel

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Assessment criteria

3.2 Confirm the key operating principles of **collectors** and their efficiency

Collectors

- Unglazed collector
- Flat plate glazed collector
- Roof integrated glazed collector
- Evacuated tube collector – direct flow
- Evacuated tube collector – heat pipe

3.3 Describe **system types** and efficiencies

System types

- Fully filled system, collector array connected in series
- Fully filled system, collector array connected in parallel
- Fully filled system, collector array connected with east/west split
- Drainback system, single collector array
- Fully filled (active)
- Drainback (active)
- Passive (thermosiphon)
- Direct (fully filled) dhw storage cylinder only
- Indirect, sealed collector circuit, dhw storage cylinder only (solar primary coil only)
- Indirect, sealed collector circuit, dhw storage cylinder only (dual coil)
- Indirect, sealed collector circuit, pre-heat cylinder and dhw storage cylinder
- Indirect, sealed collector circuit, thermal store
- Combination boilers connected to STHW systems.

3.4 Describe **weathering requirements**

Weathering requirements

- Flat plate, surface mounted, inclined roof with single lap roof covering
- Flat plate, surface mounted, inclined roof with double lap roof covering
- Flat plate, integrated, inclined single lap roof covering
- Flat plate, integrated, inclined double lap roof covering
- Evacuated tube, inclined single lap roof covering
- Evacuated tube, inclined double lap roof covering
- Frame mounted, inclined (roof, wall or ground)
- Frame mounted, horizontal (roof or ground)

LEARNING OUTCOME CONTINUED ON NEXT PAGE

Learning outcome 3 **continued**

Install solar thermal hot water systems

Assessment criteria

- 3.5** State pre-installation **checks** and **documentation** for the installation of solar thermal hot water
- | | |
|---|---|
| <p>Checks</p> <ul style="list-style-type: none"> • Authorisation for the work to proceed • Verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load • Availability of appropriate access to all required work areas • Inspection of existing domestic hot water/heating system installations • Availability of a suitable electrical input service • Proposed siting of key internal system components • Suitability of the building structure in relation to the proposed installation • Suitability of the proposed location and position of the solar collector panel(s) for optimum collection capacity • Suitability of the building fabric in relation to the installation of the solar collector panel(s) | <p>Documentation</p> <ul style="list-style-type: none"> • Drawings • Specifications • Schedules • Method statements • Risk assessments • Manufacturers' information • Regulations governing buildings |
|---|---|

3.6 Install systems

Install systems

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Install the following: <ul style="list-style-type: none"> • Solar thermal hot water system 	One installation directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory installation of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Learning outcome 4

Test, commission and handover of solar thermal hot water systems

Assessment criteria

4.1 State the requirements for **testing and commissioning** a system

Testing and commissioning

- Compliance with the system design and specification
- Compliance with system/component manufacturer requirements
- Suitability of electrical supply circuit arrangements
- Flushing the system of installation debris
- Selection of suitable heat transfer fluid
- Filling and venting the hydraulic circuits
- Checking system water quality
- Protection against freezing
- Provision of system labelling

4.2 State the requirements for **handover** of a system

Requirements for handover

- Provision of written/diagrammatic/verbal information
- Demonstration of system operation and use.

4.3 **Test, commission and handover** of a system

Test, commission and handover of a system

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Test, commission and handover a Solar Thermal hot water system <ul style="list-style-type: none">• Hydraulic test• Setting of the expansion vessel• Charge pressure• Setting of the system fluid level• Setting of mechanical controls• Setting of electrical controls and temperature sensors• System functional tests• The system is ready for handover• Written/diagrammatic/verbal information supplied• System operation and use demonstrated.	One test and commission directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

Learning outcome 5

Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation

Assessment criteria

5.1 State the **requirements** for service and maintenance and the diagnosis of faults

Requirements

- Visual Inspection
- Safe isolation
- Compliance with manufacturer's installation instructions
- Compliance with statutory regulations
- Condition of system components including cleanliness
- Correct positioning of system components
- Component functional checks
- Security of fixing of system components
- Complete documentation

5.2 Service and maintain a system

Service and maintain a system

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Service and maintain a solar thermal hot water system Service and maintain <ul style="list-style-type: none">• Checking the system water levels• Checking provision for the expansion of system water• Checking for protection of the system water against freezing• Cleaning of system components• Adjustment of system controls• Safe operation• Efficient operation• The correct functioning of system components/controls• Complete documentation	One test and commission directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges. At least five separate jobs must be included in the work log. At least three of the jobs must be evidenced from the workplace.
Notes: <ul style="list-style-type: none">• Assessments must be carried out as specified below and evidenced in the work log• Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre• The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log• The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.		

Learning outcome 5

Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation

Assessment criteria

5.3 Diagnose and rectify faults

Diagnose and rectify faults

Assessment requirements:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

Task	Direct observation requirements	Evidence
Diagnose and rectify faults on a solar thermal hot water system Faults <ul style="list-style-type: none">• Loss of system pressure without evidence of discharge• Discharge from pressure relief valve on the solar primary circuit• Insulation melting on solar collector circuit pipework• Overheating of solar collector circuit• Lack of circulation within the solar collector circuit• Poor or no system performance• System noise and/or vibration	One test and commission directly observed (by a competent witness or assessor) in the workplace	To demonstrate satisfactory testing and commissioning of the chosen system required across the documented ranges. At least four separate jobs must be included in the work log. At least two of the jobs must be evidenced from the workplace.

Notes:

- Assessments must be carried out as specified below and evidenced in the work log
- Onsite direct observation can be carried out by a competent witness from the workplace or the assessor from the delivery centre
- The role of the competent witness is to observe the candidate onsite and validate evidence recorded in the work log
- The assessor from the delivery centre must make the final judgement on evidence submitted by the candidate and sign off the content of the work log on completion of the pathway.

11. Marking Strategies

11.1. On-line Multiple-Choice Tests

1. The on-line multiple-choice tests within this qualification are all **closed book**. The pass rate for all on-line exams is 60%
2. If the pass rate of 60% is not achieved a full re-sit will be required (see note below)
3. The centre should use the exams summary report to identify any areas that would need further training before offering any re-sits.
4. The centre should not enter any learner into any exams without first confirming they are ready.

NOTE: Centres should use the information supplied in section 7.3 within this qualification specification for further guidance on the re-sit/re-take policy.

There are four multiple choice tests in phases 1, 2 and 3, and 1 Multiple Choice test on the environmental pathway.

Phase 1	Health and Safety MCT	20 questions	40 minutes	Closed book
Phase 1	End of Phase MCT	40 questions	80 minutes	Closed book
Phase 2	End of Phase MCT	50 questions	100 minutes	Closed book
Phase 3	End of Phase MCT	20 questions	40 minutes	Closed book
Pathway 4	Environmental MCT	25 questions	50 minutes	Closed book

11.2. Paper Based Exams/Assessments

Gas summative assessments

Paper based gas theory exams

1. The gas exams are **open book**
2. The pass rate for all gas exams is 100%
3. The learner will complete a first attempt
4. If the learner does not achieve the 100% pass mark, they will be given a second attempt at answering any questions answered incorrectly on the first attempt
5. Oral Verification - providing the learner has achieved a minimum of 80% during their second attempt, the learner will be orally questioned in an attempt to establish competence in all remaining areas. Any oral question asked should be recorded by the assessor and be submitted along with the other assessment paperwork.

Learners who have not achieved the 80% pass mark after their second attempt will be deemed to have failed the knowledge assessment. Learners wishing to retake the assessment will be required to re-attempt the full theory exam in its entirety.

Practical gas assessments

1. The pass rate for all gas assessments is 100%

2. The learner will complete a first attempt at demonstrating competence in the practical task in the assessment
3. If the learner fails to demonstrate competence in the practical task during their first attempt, they will be given a second attempt at demonstrating competence
4. Oral Verification – at the discretion of the assessor, the learner will be orally questioned in an attempt to establish competence in all remaining areas. Any oral question asked should be recorded by the assessor and be submitted along with the other assessment paperwork.

Oil pathway and Solid fuel/Biomass fuel Pathway

Summative assessments

For the summative theory exams and practical assessments please follow the appropriate guidance within the assessment documentation for HEATAS and OFTEC.

Environmental Pathway

11.3. Written Assignments

The pass mark for written assignments is 100%

Section 7.3 must be followed and adhered to when undertaking re-takes or re-sits.

11.4. Practical Assessments

The pass mark for practical assessments is pass/fail.

Section 7.3 must be followed and adhered to when undertaking re-takes or re-sits.

11.5. On-Site Assessments

The pass mark for on-site assessments is pass/fail.

11.6. Environmental Online Multiple-Choice Test

1. The 25 question on-line multiple-choice tests within this unit is **closed book**. The pass rate for all on-line exams is 60%
2. If the pass rate of 60% is not achieved a full re-sit will be required (see note below)
3. The centre should use the exams summary report to identify any areas that would need further training before offering any re-sits.
4. The centre should not enter any learner into any exams without first confirming they are ready.