

Level 3 Diploma in Plumbing and Domestic Heating (9189-04/05/06/07)

Version 2.2 (November 2023)

Qualification Handbook

Qualification at a glance

Subject area	Plumbing
City & Guilds number	9189
Age group approved	16-19, 19+
Entry requirements	None
Assessment types	E-assessment, multiple choice tests, practical assignments, portfolios of evidence
Approvals	Qualification approval
Support materials	Sample examination questions, assessment packs, work logs
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	GLH	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 3 Diploma in Plumbing and Domestic Heating – Environmental Technologies	1517	1875	9189-04	603/4146/4
Level 3 Diploma in Plumbing and Domestic Heating – Natural Gas	1517	1875	9189-05	603/4146/4
Level 3 Diploma in Plumbing and Domestic Heating – Solid Fuel	1467	1825	9189-06	603/4146/4
Level 3 Diploma in Plumbing and Domestic Heating – Oil	1467	1825	9189-07	603/4146/4

Date/Version	Change Details	Section
July 2020 v1.0	Document created	
November 2020 v2.0	Conflict of Interest statement added	Centre requirements
August 2021 v2.1	Relationships to other qualifications information added	Appendix 1
November 2023 v2.2	Added ISA and QP evidence retention period	Page 15

Contents

Qualification at a glance	2
Contents	4
1 Introduction	6
Structure	7
Total qualification time and guided learning	11
2 Centre requirements	12
Approval	12
Resource requirements	12
Learner entry requirements	13
Age restrictions	13
3 Delivering the qualification	14
Initial assessment and induction	14
Support materials	14
Assessor requirements	16
Internal Quality Assurers (IQAs)	17
External Quality Assurers (EQAs)	18
4 Assessment	19
Phased assessment	19
Test specifications	26
Specialist assessments and competent person schemes	36
Recognition of prior learning (RPL)	39
5 Units	40
Structure of the units	40
Unit 301 Health and safety systems	41
Unit 302 Common processes and techniques	50
Unit 303 Scientific principles	57
Unit 304 Planning and supervision	64
Unit 305 Cold water systems	70
Unit 306 Hot water systems	83
Unit 307 Central heating systems	92
Unit 308 Rainwater systems	101
Unit 309 Sanitation systems	107
Unit 310 Environmental technology systems	117

Unit 311	Domestic fuel systems	119
Unit 312	Electrical work and the control of plumbing and domestic heating systems	125
Unit 313	Install, commission, service and maintain domestic plumbing and heating systems	135
Unit 314	Air source heat pump systems	143
Unit 315	Rainwater harvesting and greywater reuse systems	151
Unit 316	Solar thermal hot water systems	157
Unit 317	Specific domestic core safety for natural gas	165
Unit 318	Install and maintain gas water heating and wet central heating appliances	189
Unit 319	Core principles of oil fuel systems for dwellings (safety and efficiency)	209
Unit 320	Install, commission, maintain and service oil systems and appliances in the workplace	225
Unit 321	Safety principles (solid mineral fuel and biomass combustion)	244
Unit 322	Plan, install, commission, service and maintain solid mineral fuel and biomass combustion appliances	255
6	Summary of on-site assessment requirements	269
	9189-04 Environmental Technologies	269
	9189-05 Natural Gas	271
	9189-06 Solid Fuel	272
	9189-07 Oil	273
Appendix 1	Relationships to other qualifications	275

1 Introduction

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

Area	Description
Who are the qualifications for?	These qualifications allow learners to become competent to industry standards in plumbing and heating or domestic heating. Learners are required to demonstrate the ability to perform the necessary skills and the knowledge required to plan, select, install, service, commission and maintain all aspects of plumbing and domestic heating systems.
What do these qualifications cover?	These qualifications cover accurate measuring, marking, cutting, bending and jointing metallic and non-metallic pipework. Appliances and equipment can include gas, oil and solid fuel boilers as well as pumps, heat emitters, bathroom furniture or controls as part of a cold water, hot water, and central heating or above ground drainage and rainwater systems. The specialist options cover environmental technologies like heat pumps, solar thermal systems and water recycling systems, natural gas, oil and solid fuel, including biomass.
What opportunities for progression are there?	Learners can progress into supervisory job roles and/or into areas such as design and planning.
Who did we develop these qualifications with?	The content of this qualification is based on the knowledge, skills and behaviours within the Plumbing and Domestic Heating Technician Level 3 Apprenticeship Standard that has been designed by an Employer Group. The qualification was designed and developed by City & Guilds in association with EAL, BPEC, NAPT and APHC.
Is it part of an apprenticeship framework or initiative?	Yes, ST303/AP01 Plumbing and Domestic Heating Technician Level 3 Apprenticeship.

Structure

To achieve the 9189-04, candidates must be taught and complete the associated assessments for 13 core units and three environmental units (see below).

Level 3 Diploma in Plumbing and Domestic Heating – 9189-04 Environmental Technologies

City & Guilds unit number	Unit title	GLH
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Core

301	Health and safety systems	88
302	Common processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water systems	138
306	Hot water systems	138
307	Central heating systems	180
308	Rainwater systems	30
309	Sanitation systems	106
310	Environmental technology systems	15
311	Domestic fuel systems	30
312	Electrical work and the control of plumbing and domestic heating systems	70
313	Install, commission, service and maintain domestic plumbing and heating systems	60

Environmental

314	Air source heat pump systems	160
315	Rainwater harvesting and greywater reuse systems	160
316	Solar thermal hot water systems	130

To achieve the 9189-05, candidates must be taught and complete the associated assessments for 13 core units and two natural gas units (see below).

Level 3 Diploma in Plumbing and Domestic Heating – 9189-05 Natural Gas

City & Guilds unit number	Unit title	GLH
Core		
301	Health and safety systems	88
302	Common processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water systems	138
306	Hot water systems	138
307	Central heating systems	180
308	Rainwater systems	30
309	Sanitation systems	106
310	Environmental technology systems	15
311	Domestic fuel systems	30
312	Electrical work and the control of plumbing and domestic heating systems	70
313	Install, commission, service and maintain domestic plumbing and heating systems	60
Natural gas		
317	Specific domestic core safety for natural gas	190
318	Install and maintain gas water heating and wet central heating appliances	260

To achieve the 9189-06, candidates must be taught and complete the associated assessments for 13 core units and two solid fuel units (*see below*).

Level 3 Diploma in Plumbing and Domestic Heating – 9189-06 Solid Fuel

City & Guilds unit number	Unit title	GLH
Core		
301	Health and safety systems	88
302	Common processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water systems	138
306	Hot water systems	138
307	Central heating systems	180
308	Rainwater systems	30
309	Sanitation systems	106
310	Environmental technology systems	15
311	Domestic fuel systems	30
312	Electrical work and the control of plumbing and domestic heating systems	70
313	Install, commission, service and maintain domestic plumbing and heating systems	60
Solid fuel		
321	Safety principles (solid mineral fuel and biomass combustion)	170
322	Plan, install, commission, service and maintain solid mineral fuel and biomass combustion appliances	230

To achieve the 9189-07, candidates must be taught and complete the associated assessments for 13 core units and two oil units (see below).

Level 3 Diploma in Plumbing and Domestic Heating – 9189-07 Oil

City & Guilds unit number	Unit title	GLH
Core		
301	Health and safety systems	88
302	Common processes and techniques	88
303	Scientific principles	70
304	Planning and supervision	54
305	Cold water systems	138
306	Hot water systems	138
307	Central heating systems	180
308	Rainwater systems	30
309	Sanitation systems	106
310	Environmental technology systems	15
311	Domestic fuel systems	30
312	Electrical work and the control of plumbing and domestic heating systems	70
313	Install, commission, service and maintain domestic plumbing and heating systems	60
Oil		
319	Core principles of oil fuel systems for dwellings (safety and efficiency)	170
320	Install, commission, service and maintain oil systems and appliances in the workplace	230

Total qualification time and guided learning

Total qualification time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. Guided learning (GL), also expressed in hours, is time spent under the direct supervision of a provider of education or training (including assessment). Guided learning contributes to TQT.

TQT and GL values are estimates.

Title and level	GLH	TQT
Level 3 Diploma in Plumbing and Domestic Heating – Environmental Technologies	1517	1875
Level 3 Diploma in Plumbing and Domestic Heating – Natural Gas	1517	1875
Level 3 Diploma in Plumbing and Domestic Heating – Solid Fuel	1467	1825
Level 3 Diploma in Plumbing and Domestic Heating – Oil	1467	1825

2 Centre requirements

Approval

Centres approved to offer 6189 Level 2/Level 3 NVQ Diploma in Plumbing and Domestic Heating, and have been active in the last two years, will be granted automatic approval for registration.

Inactive Centres, approved to offer 6189 Level 2/Level 3 NVQ Diploma in Plumbing and Domestic Heating, may seek approval using the fast track approval form, available from the City & Guilds website, if:

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

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

New centres will need to gain both centre and qualification approval. Please refer to the Centre Manual - Supporting Customer Excellence for further information.

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

Resource requirements

Resources

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

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should be occupationally competent or technically knowledgeable in the area[s] for which they are delivering training and/or have experience of providing training (this knowledge must be to the same level as the training being delivered).

Centre staff may undertake more than one role, e.g. tutor and assessor or internal quality assurer, but cannot internally verify their own assessments.

Conflict of interests

Assessors involved in providing direct training to a learner, either as part of a group or on a 'one to one' basis should not carry out assessment for any of those trained aspects.

Alternatively, centres must agree effective quality control measures (includes enhanced IQA and data monitoring) with the assessment organisation to ensure that any potential conflicts of interest do not have an adverse effect on assessment outcomes. Any potential conflict of interest must be documented and available for scrutiny in line with our [Quality Assurance Requirements](#)

For further details of onsite assessments please refer to the '*Gas common assessment strategy*' on our website

Learner entry requirements

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

Age restrictions

City & Guilds cannot accept any registrations for learners under 16 as these qualifications are not approved for learners under 16.

3 Delivering the qualification

Initial assessment and induction

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

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

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

Support materials

The following resources are available for these qualifications:

Description	How to access
Sample examination questions	www.cityandguilds.com
Assessment packs	www.cityandguilds.com
Work logs	www.cityandguilds.com

Recording documents

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

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

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

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

Centre evidence retention – Question papers and ISAs

To ensure the security of assessment documentation the following evidence that has been completed as part of a learner's qualification must be retained and stored in secure centre files:

- Knowledge & Understanding Question Paper Answer Sheets.
- Independent Summative Assessment Assessor and Learner Documentation.

This evidence must be retained by the centre for a period of not less than six years from the date of certification.

All papers must be securely stored so that access is allowed by authorised personnel only. The External Quality Assurer will require to see that centres are operating this process.

The above requirements are in addition to the City & Guilds [Guidance on Internal Quality Assurance of Qualifications](#).

Assessor 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 City & Guilds.

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.

Unit 312 Electrical work and the control of plumbing and domestic heating systems

The person responsible for assessing Unit 312 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.

Assessor occupational competence (Environmental Technologies, Oil and Solid Fuel)

Assessors for the Environmental Technologies, Oil and Solid Fuel qualifications 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 qualification.

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

Assessor occupational competence (Natural Gas)

The centre must nominate all assessors to City & Guilds 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.

Qualifications

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

- City & Guilds Level 3 Diploma in Gas Utilisation
- City & Guilds / SQA S/NVQ in Domestic Natural Gas (Level 3) *or*
- City & Guilds 662 Certificate for Service Engineers (Gas) *or*
- City & Guilds 598-2 Certificate in Gas Installation Studies *or*
- City & Guilds 660 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.

Internal Quality Assurers (IQAs)

IQAs must hold or be working towards TAQA (V1/V2 – D34 updated). The 'working towards' IQA should be mentored by and have his/her judgements and decisions countersigned by a qualified IQA.

IQA occupational competence (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.

IQA occupational competence (Natural Gas)

In addition to the qualifications listed below, the Internal Quality Assurers for the Natural Gas qualification 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:

- City & Guilds Level 3 Diploma in Gas Utilisation
- City & Guilds/SQA - S/NVQ in Domestic Natural Gas (Level 3) *or*
- City & Guilds 662 Certificate for Service Engineers (Gas) *or*
- City & Guilds 598-2 Certificate in Gas Installation Studies *or*
- City & Guilds 660 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

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.

4 Assessment

Phased assessment

The assessments for this qualification are divided into four phases – Phases 1–3 cover core content and Phase 4 covers the specialist content (for environmental technologies, natural gas, solid fuel or oil).

Phase	Assessment component	Title	Assessment method	Where to obtain assessment materials
Core				
1	001	Health and Safety Systems	e-assessment	e-volve
	011	Phase 1 Multiple Choice Test	e-assessment	e-volve
	012	Phase 1 Practical Assignment	Assignment	City & Guilds website
2	021	Phase 2 Multiple Choice Test	e-assessment	e-volve
	022	Phase 2 Practical Assignment	Assignment	City & Guilds website
3	031	Phase 3 Multiple Choice Test	e-assessment	e-volve
	032	Phase 3 Practical Assignment	Assignment	City & Guilds website
	002	Work Log (Core)	Portfolio of evidence	City & Guilds website

Phase	Assessment component	Title	Assessment method	Where to obtain assessment materials
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Environmental technologies

4	041	Phase 4 Multiple Choice Test (Environmental Technologies)	e-assessment	e-volve
	042	Phase 4 Practical Assignment (Environmental Technologies)	Assignment	City & Guilds website
	043	Work Log (Environmental Technologies)	Portfolio of evidence	City & Guilds website

Natural gas

4	051	Phase 4 ISA (Natural Gas)	ISAs and question papers	City & Guilds website
	052	Work Log (Natural Gas)	Portfolio of evidence	City & Guilds website

Solid fuel

4	871	Phase 4 HETAS (Solid Fuel)	External assessment	HETAS
	072	Work Log (Solid Fuel)	Portfolio of evidence	City & Guilds website

Oil

4	861	Phase 4 OFTEC (Oil)	External assessment	OFTEC
	062	Work Log (Oil)	Portfolio of evidence	City & Guilds website

The four phases roughly equate to the four years of the Apprenticeship. Phase 1 assessments being delivered at the end of Year 1, Phase 2 assessments being delivered at the end of Year 2, etc. Candidates will complete a work log as they progress through the core units – Phases 1–3 – and another work log linked to the specialist units in Phase 4.

Scheduling assessments

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

- candidates must not take any assessment before they are registered for this qualification

- candidates must pass all the assessments for each phase before being entered for the assessments for the next phase
- centres should ensure all relevant content has been delivered before candidates attempt the assessments (see 'Phased delivery' below).

Resits and retakes

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

- candidates who fail an assessment are permitted one resit within 14 days
- candidates who fail a resit are permitted to retake the assessment after 60 days
- candidates who fail a retake are permitted one final resit within 14 days
- candidates awaiting the outcome of their fourth attempt at an assessment may commence training for the next phase but if the fourth attempt results in a fail, the candidate must repeat the training for that phase before taking the assess again.

Phased training delivery

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

Phase 1

Unit	Learning outcome	Assessment criteria
301 Health and safety systems	1. Know health and safety legislation that applies to the building services industry	1.1 – 1.5
	2. Understand common hazards in the building services industry	2.1 – 2.7
	3. Understand and apply personal protection measures	3.1 – 3.5
	4. Understand how to respond to accidents and incidents	4.1 – 4.5
	5. Understand and apply procedures for electrical safety	5.1 – 5.6
	6. Understand how to work safely with heat producing equipment	6.1 – 6.7
	7. Safely use access equipment	7.1 – 7.4
	8. Understand working safely in excavations and confined spaces	8.1 – 8.4
302 Common processes and techniques	1. Use hand and power tools in domestic plumbing and heating work.	1.1 and 1.2
	2. Know types of domestic plumbing and heating pipework and their jointing principles.	2.1 – 2.5

Unit	Learning outcome	Assessment criteria
	3. Understand site preparation techniques for plumbing and heating work.	3.1 – 3.4
	4. Use clips and brackets to support domestic plumbing and heating pipework and components.	4.1 – 4.4
	5. Install domestic plumbing and heating pipework	5.1 – 5.6
303 Scientific principles	1. Understand units of measurement used in the plumbing and heating industry.	1.1 – 1.3
	2. Understand properties of materials	2.1 – 2.6
	5. Understand mechanical principles in the plumbing and heating industry.	5.1 and 5.2
304 Planning and supervision	1. Know the role of the construction team within the plumbing and heating industry.	1.1 – 1.3
	2. Understand information sources in the building services industry.	2.1 and 2.2
	3. Know how to communicate with others.	3.1 – 3.4
	4. Understand responsibilities of relevant people in the building services industry.	4.1 – 4.3
	5 Produce risk assessments and method statements for the plumbing and heating industry	5.1– 5.4
	6 Produce a work programme for tasks in the plumbing and heating industry	6.1– 6.5
305 Cold water systems	1. Understand the cold water supply route to dwellings.	1.1 – 1.7
	2. Install cold water systems.	2.1
306 Hot water systems	1. Install hot water systems.	1.1
307 Central heating systems	1. Install central heating systems.	1.1
308 Rainwater systems	1. Install rainwater systems.	1.1
309 Sanitary systems	1. Install sanitary appliances and pipework systems.	1.1

Phase 2

Unit	Learning outcome	Assessment criteria
303 Scientific principles	2. Understand properties of materials	2.7
	3. Understand the relationship between energy, heat and power	3.1 – 3.6
	4. Understand principles of force and pressure and their application in the plumbing and heating industry	4.1 – 4.7
	6. Understand principles of electricity in the plumbing and heating industry	6.1 – 6.4
305 Cold water systems	2. Install cold water systems.	2.1 – 2.10
	3 Decommission cold water systems	3.1 and 3.2
	5 Perform a soundness test and commission cold water systems and components	5.1 – 5.6
306 Hot water systems	1. Install hot water systems.	1.2 – 1.12
	2 Decommission hot water systems	2.1 and 2.2
	4 Perform a soundness test and commission hot water systems and components	4.1 – 4.6
	1. Install central heating systems.	1.2 – 1.13
308 Rainwater systems	1. Install rainwater systems.	1.2 – 1.9
	2 Decommission rainwater systems	2.1 and 2.2
	4 Perform a soundness test and commission rainwater systems	4.1 – 4.7
309 Sanitation systems	1. Install sanitary appliances and pipework systems.	1.2 – 1.14
	2 Decommission sanitary appliances, pipework system and components	2.1 and 2.2
	4 Perform a soundness test and commission sanitary appliances, pipework systems and components	4.1 – 4.6

Phase 3

Unit	Learning outcome	Assessment criteria
305 Cold water systems	4 Size and select cold water systems and components for dwellings	4.1 – 4.7
	5 Perform a soundness test and commission cold water systems and components	5.7 – 5.11
	6 Perform fault diagnosis and rectification procedures on cold water systems	6.1 – 6.3
	7 Carry out service and maintenance of cold water systems	7.1 – 7.5
306 Hot water systems	3 Size and select hot water systems and components for dwellings	3.1 – 3.7
	4 Perform a soundness test and commission hot water systems and components	4.7 – 4.11
	5 Perform fault diagnosis and rectification procedures on hot water systems	5.1 – 5.3
	6 Carry out service and maintenance of hot water systems	6.1 – 6.5
307 Central heating systems	1 Install central heating systems	1.14
	2 Decommission central heating systems	2.1 and 2.2
	3 Size and select central heating systems and components for dwellings	3.1 – 3.7
	4 Perform a soundness test and commission central heating systems and components	4.1 – 4.11
	5 Perform fault diagnosis and rectification procedures on central heating systems	5.1 – 5.3
	6 Carry out service and maintenance of central heating systems	6.1 – 6.4
308 Rainwater systems	3 Size and select rainwater systems components for dwellings	3.1 – 3.6
	5 Perform fault diagnosis and rectification procedures on rainwater systems	5.1 – 5.3
309 Sanitation systems	3 Size and select sanitary appliances pipework system and components for dwellings	3.1 – 3.6

Unit	Learning outcome	Assessment criteria
	5 Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems	5.1 – 5.3
	6 Service and maintain sanitary appliances and pipework systems	6.1 – 6.4
310 Environmental technology systems	1. Know the basic operating principles of micro-renewable energy and water conservation technologies.	1.1 – 1.3
	2. Understand requirements to install micro-renewable energy and water conservation systems to existing systems	2.1 – 2.5
311 Domestic fuel systems	1. Understand factors affecting fuel selection	1.1 – 1.6
	2. Know combustion processes of fuel supply systems	2.1 – 2.9
	3. Know principles of chimney/flue systems.	3.1 – 3.7
312 Electrical work and the control of plumbing and domestic heating systems	1 Perform pre installation activity prior to undertaking electrical work on plumbing and domestic heating systems	1.1 – 1.10
	2 Apply industry standard safe isolation procedures	2.1 and 2.2
	3 Carry out the safe installation, testing and decommissioning of electrical systems	3.1 – 3.4
	4 Carry out the identification of faults and safe repair of electrical work	4.1

Test specifications

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

Assessment: 001 Health and Safety Systems

Assessment method: e-volve online multiple choice test

Duration: 30 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book

Outcome	Number of questions	%
1 Know health and safety legislation that applies to the building services industry	2	10
2 Understand hazardous situations in the building services industry	4	20
3 Apply personal protection measures	2	10
4 Understand how to respond to accidents	2	10
5 Apply procedures for electrical safety	2	10
6 Understand how to work safely with heat-producing equipment	4	20
7 Safely use access equipment	2	10
8 Understand working safely in excavations and confined spaces	2	10
Total	20	100

Assessment: 011 Phase 1 Multiple Choice Test

Assessment method: e-volve online multiple choice test

Duration: 60 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book but non-programmable calculator, paper and pencil allowed.

Unit	Outcome	Number of questions	%
302 Common processes and techniques	1 Use hand and power tools in domestic plumbing and heating work	2	5
	2 Know types of domestic plumbing and heating pipework and their jointing principles	4	10
	3 Understand site preparation techniques for plumbing and heating work	3	7.5
	4 Use clips and brackets to support domestic plumbing and heating pipework and component	3	7.5
	5 Install domestic plumbing and heating pipework	1	2.5
303 Scientific principles	1 Understand units of measurement used in the plumbing and heating industry	3	7.5
	2 Understand properties of materials	4	10
	5 Understand mechanical principles in the plumbing and heating industry	2	5
304 Planning and supervision	1 Know the role of the construction team within the plumbing and heating industry	1	2.5
	2 Understand information sources in the building services industry	1	2.5
	3 Know how to communicate with others	1	2.5
	4 Understand responsibilities of relevant people in the building services industry	1	2.5
305 Cold water systems	1 Understood the cold water supply route to dwellings	2	5
	2 Install cold water systems	3	7.5
306 Hot water systems	1 Install hot water systems	3	7.5
307 Central heating systems	1 Install central heating systems	3	7.5
308 Rainwater systems	1 Install rainwater systems	1	2.5
309 Sanitation systems	1 Install sanitary appliances and pipework systems	2	5
Total		40	100

Assessment: 012 Phase 1 Practical Assignment

Assessment method: Assignment

Duration: 10–12 hours

Grade boundaries: Pass/Fail

Unit	Outcome
301 Health and safety systems	3 Apply personal protection measures
	5 Apply procedures for electrical safety
	7 Safely use access equipment
302 Common processes and techniques	1 Use hand and power tools in domestic plumbing and heating work
	5 Install domestic plumbing and heating pipework

Assessment: 021 Phase 2 Multiple Choice Test

Assessment method: e-volve online multiple choice test

Duration: 75 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book but non-programmable calculator, paper and pencil allowed.

Unit	Outcome	Number of questions	%
303 Scientific principles	2 Understand the properties of materials	1	2
	3 Understand the relationship between energy, heat and power	2	4
	4 Understand the principles of force and pressure and their application in the plumbing and heating industry	2	4
	6 Understand the principles of electricity in the plumbing and heating industry	2	4
305 Cold water systems	2 Install cold water systems	10	20
306 Hot water systems	1 Install hot water systems	10	20
307 Central heating systems	1 Install central heating systems	13	26
308 Rainwater systems	1 Install rainwater systems	5	10
309 Sanitation systems	1 Install sanitary appliances and pipework systems	5	10
Total		50	100

Assessment: 022 Phase 2 Practical Assignment
Assessment method: Assignment
Duration: 16–18 hours
Grade boundaries: Pass/Fail

Unit	Outcome
305 Cold water systems	2 Install cold water systems
	3 Decommission cold water systems
	5 Perform a soundness test and commission cold water systems and components
306 Hot water systems	1 Install hot water systems
	2 Decommission hot water systems
	4 Perform a soundness test and commission hot water systems and components
308 Rainwater systems	1 Install rainwater systems
	2 Decommission rainwater systems
	4 Perform a soundness test and commission rainwater systems
309 Sanitation systems	1 Install sanitary appliances, pipework systems and components
	2 Decommission sanitary appliances, pipework systems and components
	4 Perform a soundness test and commission sanitary appliances, pipework systems and components

Assessment: 031 Phase 3 Multiple Choice Test
Assessment method: e-volve online multiple choice test
Duration: 30 minutes
Grade boundaries: Pass is approximately 60%
Permitted materials: Closed book

Unit	Outcome	Number of questions	%
310 Environmental technology systems	1 Know the basic operating principles of micro-renewable energy and water conservation technologies	2	10
	2 Understand requirements to install micro-renewable energy and water conservation systems to existing systems	2	10
311 Domestic fuel systems	1 Understand factors affecting fuel selection	4	20
	2 Know combustion processes of fuel supply systems	4	20
	7 Know principles of chimney/flue systems	4	20
312 Electrical work	1 Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating	4	20
Total		20	100

Assessment: 032 Phase 3 Practical Assignment

Assessment method: Assignment

Duration: 12 hours

Grade boundaries: Pass/Fail

Unit	Outcome
305 Cold water systems	4 Size and select cold water systems and components for dwellings
	5 Perform a soundness test and commission cold water systems and components
	6 Perform fault diagnosis and rectification procedures on cold water systems
	7 Carry out service and maintenance of cold water systems
306 Hot water systems	3 Size and select hot water systems and components for dwellings
	4 Perform a soundness test and commission hot water systems and components
	5 Perform fault diagnosis and rectification procedures on hot water systems
	6 Carry out service and maintenance of hot water systems
307 Central heating systems	1 Install central heating systems
	2 Decommission central heating systems
	3 Size and select central heating systems and components for dwellings
	4 Perform a soundness test and commission central heating systems and components
	5 Perform fault diagnosis and rectification procedures on central heating systems
	6 Carry out service and maintenance of central heating systems
308 Rainwater systems	3 Size and select rainwater system components for dwellings
	5 Perform fault diagnosis and rectification procedures on rainwater systems
309 Sanitation systems	3 Size and select sanitary appliances pipework systems and components for dwellings
	5 Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems
	6 Service and maintain sanitary appliances and pipework systems
312 Electrical work and the control of plumbing and domestic heating systems	1 Perform pre-installation activity prior to undertaking electrical work on plumbing and domestic heating systems
	2 Apply industry standard safe isolation procedures
	3 Carry out the safe installation, testing and decommissioning of electrical systems
	4 Carry out the identification of faults and safe repair of electrical work

Assessment: 002 Work Log (Core)
Assessment method: Portfolio of evidence
Duration: Phases 1–3
Grade boundaries: Pass/Fail

Unit	Outcome
313 Install, commission, service and maintain domestic plumbing and heating systems	1 Apply health and safety and welfare in the workplace
	2 Prepare for the installation of plumbing and heating systems and components
	3 Install plumbing and heating systems and components in the workplace
	4 Perform fault diagnosis and rectification procedures
	5 Commission plumbing and domestic heating systems in the workplace

Assessment: 041 Phase 4 Multiple Choice Test (Environmental Technologies)

Assessment method: e-volve online multiple choice test

Duration: 40 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book

Unit	Outcome	Number of questions	%
314 Air source heat pump systems	1 Health and safety risks and legislation associated with air source heat pump systems	3	12
	2 Different types of air source heat pump systems	5	20
315 Rainwater harvesting and greywater reuse systems	1 Rainwater harvesting and greywater reuse systems	5	20
	2 Install rainwater harvesting and greywater reuse system components	4	12
316 Solar thermal hot water systems	1 Health and safety and relevant legislation, regulations and standards	3	12
	2 Install solar thermal hot water systems	5	20
Total		25	100

Assessment: 042 Phase 4 Practical Assignment (Environmental Technologies)
Assessment method: Assignment
Duration: TBC
Grade boundaries: Pass/Fail

Unit	Outcome
314 Air source heat pump systems	3 Design air source heat pump systems
	4 Install air source heat pump systems
	5 Service and maintain air source heat pumps
	6 Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems
315 Rainwater harvesting and greywater reuse systems	2 Install rainwater harvesting and greywater reuse system components
	3 Test, commission and handover rainwater harvesting and greywater reuse systems
	4 Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems
316 Sanitation systems	2 Fundamental design principles for solar thermal hot water systems
	3 Install solar thermal hot water systems
	4 Test, commission and handover of solar thermal hot water systems
	5 Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation

Specialist assessments and competent person schemes

9189-04 Environmental Technologies

Learners who achieve 041 Multiple Choice Test, 042 Practical Assignment and 043 Work Log (Environmental Technologies), will meet the criteria to register on the MCS competent person scheme for:

- Solar Thermal Nominated Technical Persons
- Heat Pump Nominated Technical Persons.

9189-05 Natural Gas

In addition to 052 Work Log (Natural Gas), and in order that learners can apply to become a member of the Gas Safe Register, they will also have to complete a series of:

- Independent Summative Assessments (ISAs) developed to meet Gas Safe Register competence requirements – learners' competence in performing specific gas-safety-related tasks is assessed by an independent assessor in a managed assessment environment.
- Question papers developed to meet the knowledge and understanding elements of the Gas Safe Register competence requirements – learners will complete externally set and internally assessed question papers.

Further details of the ISAs and question papers can be found in the 9189-05 ISA and QP Candidate and Assessor Packs.

The ISAs and question papers in the ISA and QP Candidate and Assessor Packs are periodically reviewed and revised and it is important that the most up-to-date versions are used.

To gain access to the ISA and QP Candidate and Assessor Packs, centres must complete an 'ISA and QP Password Application Form' and submit this to Blue Flame Associates by email to PWrequest@blueflameassociates.com.

The 9189-05 ISA packs (containing current versions of the ISAs and question papers) and password application form can be downloaded from the 9189 webpage on the City & Guilds website.

9189-06 Solid Fuel

In addition to 072 Work Log (Solid Fuel), learners will also have to complete HETAS units and assessments at a HETAS Accredited training facility. Learners who achieve these units and assessments will receive a statement of results, which will be used:

- by centres, to claim the assessment component 871 for the Level 3 Diploma in Plumbing and Domestic Heating
- by learners, to enable application for registration on HETAS Competent Person Scheme.

The categories of competence and the associated units and assessments required to receive the statement of results are as follows:

H003/DS	HETAS Dry Appliance Installer (includes service and maintenance competency)
HTU01K	Fuel types, storage and selection, principles of combustion, causes of incomplete combustion CO poisoning

HTU02C	Appliance types, operating principles and selection
HTU03K	Legislation, regulations and industry guidance
HTU04C	Flue system and ventilation requirements for solid fuel appliances
HTU05C	Flue and chimney system inspection, testing and fault diagnosis
HTU06C	Design principles, installation and testing of prefabricated metal wall rigid system chimneys
HTU07C	Dry solid fuel appliance sizing, selection, installation, commissioning and decommissioning
HTU08C	Wet solid fuel appliance sizing selection, installation, commissioning and decommissioning
HTU09C	Dry solid fuel appliance service and maintenance

H004	HETAS Wet Appliance Installer (includes service and maintenance competency) – candidate must possess H003/DS as a pre-requisite
HTU08C	Wet solid fuel appliance sizing selection, installation, commissioning and decommissioning
HTU10C	Wet solid fuel appliance service and maintenance
H005/DE	HETAS Biomass Installer – candidate must possess H003/DS as a pre-requisite
HTU11C	Biomass appliance selection, installation, commissioning and decommissioning
HTU12C	Biomass service and maintenance
H006	HETAS Internal System Chimney – candidate must possess H003/DS as a pre-requisite
HTU06C	Design principles, installation and testing of prefabricated metal wall rigid system chimneys
H008	CPD Unit only – candidate must possess H003/DS as a pre-requisite
HTU13C	Dry pellet stove sizing, selection, installation, commissioning and decommissioning

Note: H001 – Introduction to Solid Fuel and H002 Solid Fuel Regulations and Standards are knowledge courses only and although the units are embedded into the qualifications, suite H00 and H002 are not deemed as a competency and alone do not facilitate a route to installer registration on CPS.

9189-07 Oil

In addition to 062 Work Log (Oil), and in order that learners can register on the OFTEC competent person scheme, they will also have to complete:

OFT10-101 Single stage pressure jet servicing and commissioning

This course is for technicians who wish to service and commission pressure-jet appliances. The vast majority of household boilers fall into this category. The course covers health and safety, fire valve installation, regional legislation and requirements, safe electrical isolation, oil storage and supply, appliance installation, knowledge of heating systems, and practical servicing and commissioning.

OFT10-105E Installation of oil and bio-liquid fuelled fixed combustion appliances and systems

This course is for technicians who wish to install oil-fired appliances such as boilers and AGAs. This course covers health and safety, fire valve installation, regional legislation and requirements, safe electrical isolation, knowledge of oil storage and supply, appliance installation, heating systems, and energy efficiency.

OFT10-600a Installation of oil fuel storage and supply systems connected to fixed combustion appliances

This course is for technicians who wish to install oil tanks and associated pipework and equipment. This course covers health and safety, fire valve installation, regional legislation and requirements, safe electrical isolation and oil storage and supply.

Learners completing these courses and associated assessments at an OFTEC Accredited training facility will receive statement of results enabling them to register with the OFTEC competent person scheme for the three scopes:

- OFT10-10 Commission, service, maintenance of single stage pressure jet appliances
- OFT10-105E Installation of oil combustion appliances, heating and vented hot water systems
- OFT10-600a Installation of oil storage tanks and supply systems to fixed combustion appliances

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience, or qualifications that have already been achieved, to contribute to a new qualification.

For this qualification, RPL is allowed.

5 Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- Title
- Level
- Guided learning hours (GLH)
- Learning outcomes, which are comprised of a number of assessment criteria

Centres must deliver the full breadth of the range. Specialist equipment or commodities may not be available to all centres, so centres should ensure that their delivery covers their use. This may be covered by a practical demonstration (e.g. video). For the practical assessments for this qualification, centres should ensure that there are sufficient resources to complete the tasks but are not required to use all the equipment or commodities in the range.

Unit 301

Health and safety systems

Unit level:	2
GLH:	88
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 1.1 identify **health and safety legislation** in protecting the workforce and members of the public
- 1.2 define responsibilities of members of the **construction team**
- 1.3 describe the legal status of **health and safety guidance** materials
- 1.4 identify the role of **enforcing authorities**
- 1.5 state the **control measures** of inspectors.

Range

(AC1.1) **Health and safety legislation:**

- general legislation
- construction specific legislation
- building services specific legislation – to include CSCS card

(AC1.2) **Construction team:**

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

(AC1.3) **Health and safety guidance:**

- acts of parliament

- regulations
- approved codes of practice
- HSE guidance notes

(AC1.4) **Enforcing authorities:**

- Health and Safety Executive
- local authority

(AC1.5) **Control measures:**

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

Learning outcome

The learner will:

- 2 Understand hazardous situations working in the building services industry.

Assessment criteria

The learner can:

- 2.1 identify types of site hazards that may be encountered while at **work** or by members of the public
 - 2.2 define **strategies** used to prevent accidents during work activities
 - 2.3 state how the hazards of some substances and mixtures can be identified from the **labels** on packaging
 - 2.4 describe how to deal with commonly encountered **substances**
 - 2.5 identify **common building materials and services** components that may contain asbestos
 - 2.6 identify types of **asbestos** that may be encountered in the workplace
 - 2.7 state **procedures** that must be used to safely work with asbestos cement based materials.
-

Range

(AC2.1) **Work:**

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

(AC2.2) **Strategies:**

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

(AC2.3) **Labels:**

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

(AC2.4) Commonly-encountered hazardous substances:

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

(AC2.5) Components that may contain asbestos:

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

(AC2.6) Types of asbestos:

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

(AC2.7) Procedures:

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

Learning outcome

The learner will:

- 3 Apply personal protection measures.

Assessment criteria

The learner can:

- 3.1 state the purpose of **personal protective equipment (PPE)**
- 3.2 apply and use personal protective equipment (PPE)
- 3.3 define **procedures** for manual handling
- 3.4 carry out correct manual handling
- 3.5 use **mechanical lifting aids**.

Range

(AC3.1) **Personal protective equipment (PPE):**

- clothing protection including high visibility
- eye protection
- hand protection
- head protection
- foot protection
- hearing protection
- respiratory protection
- vibration protection
- harnesses

(AC3.3) **Procedures:**

- assessment of a safe load
- safe kinetic lifting technique

(AC3.5) **Mechanical lifting aids:**

- sack trolley

Learning outcome

The learner will:

- 4 Understand how to respond to accidents.

Assessment criteria

The learner can:

- 4.1 state requirements for first-aid provision in the **workplace**
- 4.2 describe actions that should be taken when an accident or emergency is discovered
- 4.3 identify procedures for dealing with **minor injuries**
- 4.4 identify procedures for dealing with **major injuries**

4.5 state **recording procedures** for accidents and near misses at work.

Range

(AC4.1) **Workplace:**

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

(AC4.3) **Minor injuries:**

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

(AC4.4) **Major injuries:**

- bone fractures
- unconscious co-workers
- electric shock
- concussion

(AC4.5) **Recording procedures:**

- statutory requirements
 - accident books
 - details to be recorded on a simple accident/incident report form
-

Learning outcome

The learner will:

5 Apply procedures for electrical safety.

Assessment criteria

The learner can:

- 5.1 identify common **electrical dangers** encountered on construction sites and in private dwellings
 - 5.2 state methods of safe supply for **electrical tools** and equipment on site
 - 5.3 state the procedure that should be applied for tools and equipment that fail safety checks
 - 5.4 identify safe isolation procedure when replacing **attachments** to power tools
 - 5.5 conduct **visual inspection** of a power tool for safe condition before use
 - 5.6 use temporary continuity bonding when working on pipework components.
-

Range

(AC5.1) **Electrical dangers:**

- faulty electrical equipment
 - signs of damaged or worn electrical cables – power tools and property hard wiring system
 - trailing cables
 - proximity of cables to services pipework
-

- buried/hidden cables
- inadequate over-current protection devices

(AC5.2) **Electrical tools:**

- battery-powered
- 110 volt
- 230 volt

(AC5.4) **Attachments:**

- drill bits
- cutting blades

(AC5.5) **Visual inspection:**

- valid PAT test
 - visual checks for general condition
-

Learning outcome

The learner will:

- 6 Understand how to work safely with heat-producing equipment.

Assessment criteria

The learner can:

- 6.1 identify various **types of gases** used in pipe and sheet jointing processes
- 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
- 6.4 describe how gas heating equipment is **safely assembled** and used
- 6.5 identify the three elements of the fire triangle and how combustion takes place
- 6.6 identify the dangers of working with heat-producing equipment and how to prevent fires occurring
- 6.7 describe the method for **fighting small localised fires** that can occur in the workplace.
-

Range

(AC6.1) **Types of gases:**

- propane
- MAP gas
- butane
- oxy acetylene

(AC6.3) **Heat-producing equipment:**

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

- blowpipes

(AC6.4) **Safely assembled:**

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

(AC6.6) **Fighting small localised fires:**

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

Learning outcome

The learner will:

- 7 Safely use access equipment.

Assessment criteria

The learner can:

- 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
- 7.3 define safety checks to be carried out on access equipment
- 7.4 **use** access equipment

Range

(AC7.2) **Access equipment:**

- 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

(AC7.4) **Use:**

- step ladders
- ladders
- mobile tower scaffold

Learning outcome

The learner will:

- 8 Understand working safely in excavations and confined spaces.

Assessment criteria

The learner can:

- 8.1 identify situations where it may be necessary to work in **excavations** and **confined spaces**
- 8.2 identify **safe working** in excavations and confined spaces
- 8.3 state **dangers** associated with excavations and confined spaces
- 8.4 state **safety measures** when working in excavations and confined spaces
-

Range

(AC8.1) **Excavations:**

- drainage systems
- cold water mains
- foundations

(AC8.1) **Confined spaces:**

- plant rooms
- main service duct-rooms
- tanks, cylinders, boilers or cisterns
- under suspended timber floors
- roof spaces

(AC8.2) **Safe working:**

- safe access into the excavation
- trench support systems

(AC8.3) **Dangers:**

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

(AC8.4) **Safety measures:**

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

Unit 302

Common processes and techniques

Unit level:	2
GLH:	88
Unit aim:	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.

Learning outcome

The learner will:

- 1 Use hand and power tools in domestic plumbing and heating work.

Assessment criteria

The learner can:

- 1.1 identify the purpose of **hand tools** and **power tools**
- 1.2 use and maintain hand and power tools.

Range

(AC1.1) **Hand tools:**

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

(AC1.1) **Power tools:**

- power drill
- circular saw

- jig saw
 - reciprocating saws
 - portable pipe threading machine
 - hydraulic machine bender
 - hydraulic crimping kit
 - portable pipe freezing kit
-

Learning outcome

The learner will:

- 2 Know types of domestic plumbing and heating pipework and their jointing principles.

Assessment criteria

The learner can:

- 2.1 identify **pipework materials and sizes** used in dwellings
 - 2.2 state methods of jointing new hot and cold water pipe to existing lead pipework
 - 2.3 identify **fitting** types used in dwellings
 - 2.4 describe methods of **jointing** pipework used in dwellings
 - 2.5 describe methods of **bending** pipework used in dwellings.
-

Range

(AC2.1) Pipework materials and sizes:

- 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

(AC2.3) Fittings types:

- couplers
 - elbows and bends
 - equal tees
 - reducing tees
 - reducers
 - tap connectors
-

- flexible connectors
- manifolds
- tank connectors

(AC2.4) **Jointing:**

- 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

(AC2.5) **Bending:**

- 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

The learner will:

- 3 Understand site preparation techniques for plumbing and heating work.

Assessment criteria

The learner can:

- 3.1 state **work methods** for preparing and protecting the building for installation work
- 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

3.4 identify **sources of information** for carrying out preparatory work.

Range

(AC3.1) **Work methods:**

- 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

(AC3.4) **Sources of information:**

- statutory regulations
 - industry standards
 - manufacturers' technical instructions
 - building plans
 - specifications
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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**
 - 4.3 identify **clip and bracket types**
 - 4.4 select and fix clips and brackets appropriate to the **system pipework** and the industry recommended spacing.
-

Range

(AC4.2) **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

(AC4.3) **Clip and bracket types:**

- munson rings
- school board clips
- copper pipework
- LCS pipework
- plastic pipework

(AC4.4) **System pipework:**

- hot water
- cold water
- central heating

Learning outcome

The learner will:

- 5 Install domestic plumbing and heating pipework.

Assessment criteria

The learner can:

- 5.1 identify pipework installation **requirements**
- 5.2 select pipework **materials** and fittings from instructions
- 5.3 measure, mark and cut pipework materials for **installation**
- 5.4 fabricate pipework **bends** to clear obstacles
- 5.5 select, position and fix pipework materials to specifications
- 5.6 **joint** pipework to specifications.

Range

(AC5.1) **Requirements:**

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

(AC5.2) **Materials:**

- copper pipework – hot, cold and central heating
- LCS pipework – central heating
- plastic pipework – hot, cold, central heating and sanitation pipework

(AC5.3) **Installation:**

- hot water
- cold water
- central heating
- sanitation

(AC5.4) **Bends:**

- 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

(AC5.6) **Joint:**

- 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

Unit 303

Scientific principles

Unit level:	2
GLH:	70
Unit aim:	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.

Learning outcome

The learner will:

- 1 Understand units of measurement used in the plumbing and heating industry.

Assessment criteria

The learner can:

- 1.1 identify internationally recognised (SI) **units of measurement**
- 1.2 state the application and use of **SI derived units**
- 1.3 describe the use of conversion tables for non-SI units.

Range

(AC1.1) **Units of measurement:**

- metre (length) m
- kilogram (mass) kg
- second (time) s
- Kelvin (temperature)
- Pascals
- bar

(AC1.2) **SI derived units:**

- area (m²)
- volume (m³)
- litres (l)
- density (kg/m³)
- velocity (m/s)

Learning outcome

The learner will:

- 2 Understand properties of materials.

Assessment criteria

The learner can:

- 2.1 compare **relative densities** of common materials
 - 2.2 identify properties and applications of **solid materials**
 - 2.3 explain **reasons** why solid materials breakdown
 - 2.4 outline methods of preventing corrosion
 - 2.5 identify applications of **liquids** and **gases**
 - 2.6 describe basic **properties of liquids**
 - 2.7 describe basic **properties of gases**.
-

Range

(AC2.1) **Relative densities:**

- relative density to air
- relative density to water

(AC2.2) **Solid materials:**

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

(AC2.3) **Reasons:**

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

(AC2.5) **Liquids:**

- water
- refrigerants
- anti-freeze/glycol mixes
- fuel oils
- lubricants/greases

(AC2.5) **Gases:**

- air and steam
-

- LPG
- natural gas
- carbon dioxide
- refrigerant gases

(AC2.6) **Properties of liquids:**

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

(AC2.7) **Properties of gases:**

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

Learning outcome

The learner will:

- 3 Understand the relationship between energy, heat and power.

Assessment criteria

The learner can:

- 3.1 identify the relationship between the Celsius and kelvin temperature scales
- 3.2 describe the principles associated with a **change of state**
- 3.3 identify the terms latent and sensible heat as they apply to liquids and gases
- 3.4 define methods of **heat transfer**
- 3.5 distinguish how **units of energy and heat** are related and derived
- 3.6 carry out heat, energy and power **calculations**.

Range

(AC3.2) **Change of state:**

- melting
- freezing
- boiling
- evaporating

- condensing

(AC3.4) **Heat transfer:**

- conduction
- convection
- radiation

(AC3.5) **Units of energy and heat:**

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

(AC3.6) **Calculations:**

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

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 4.1 state how **units of force and pressure** are derived from SI units
- 4.2 identify **pressure and flow rate** units of measurements
- 4.3 describe the application of pressure and flow rate measurements
- 4.4 carry out simple **force and pressure** calculations
- 4.5 explain the relationship between **velocity, pressure and flow rate** in systems
- 4.6 identify how **restrictions** in the pipework affects the flow of liquids and gases
- 4.7 describe the principles of a siphon.
-

Range

(AC4.1) **Units of force and pressure:**

- acceleration (m/s²)
- force due to gravity
- force - Newton (N)
- pressure (N/m²)
- atmospheric pressure
- flow rate (m³/s)

(AC4.2) **Pressure and flow:**

- pressure
 - bar/millibar
 - kPa
 - psi
-

- metre head
- flow rate
 - m³/s
 - l/s
 - kg/s

(AC4.4) **Force and pressure:**

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

(AC4.5) **Velocity, pressure and flow rate:**

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

(AC4.6) **Restrictions:**

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

Learning outcome

The learner will:

- 5 Understand mechanical principles in the plumbing and heating industry.

Assessment criteria

The learner can:

- 5.1 outline principles of **simple machines**
 5.2 outline principles of **basic mechanics**.

Range

(AC5.1) **Simple machines:**

- levers
- pulleys
- archimedes screws

(AC5.2) **Basic mechanics:**

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

- mechanical advantage
-

Learning outcome

The learner will:

- 6 Understand principles of electricity in the plumbing and heating industry.

Assessment criteria

The learner can:

- 6.1 identify **basic principles** of electron flow theory
 - 6.2 describe the purpose and application of simple **units of electrical measurement**
 - 6.3 carry out simple **electrical calculations**
 - 6.4 identify the requirements for earthing of electrical circuits.
-

Range

(AC6.1) **Basic principles:**

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

(AC6.2) **Units of electrical measurement:**

- current (amps)
- voltage (volts)
- resistance (ohms)
- power (watts)

(AC6.3) **Electrical calculations:**

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

Unit 304

Planning and supervision

Unit level:	3
GLH:	54
Unit aim:	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.

Learning outcome

The learner will:

- 1 Know the role of the construction team within the plumbing and heating industry.

Assessment criteria

The learner can:

- 1.1 identify key roles of the **site management team**
- 1.2 identify key roles of the **site operatives**
- 1.3 identify common **site visitors**.

Range

(AC1.1) **Site management team:**

- architect
- project manager
- clerk of works
- structural engineer
- surveyor
- building services engineer
- quantity surveyor
- buyer
- estimator
- contracts manager
- site manager
- health and safety manager

(AC1.2) **Site operatives:**

- sub-contractors
- site supervisor
- trade supervisor

- bricklayer
- joiner
- plasterer
- tiler
- electrician
- H&V fitter
- gas fitter
- decorator
- groundworkers

(AC1.3) **Site visitors:**

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

Learning outcome

The learner will:

- 2 Understand information sources in the building services industry.

Assessment criteria

The learner can:

- 2.1 interpret **workplace information**
- 2.2 state the importance of complying with **company policies and procedures**.

Range

(AC2.1) **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

(AC2.2) **Company policies and procedures:**

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

Learning outcome

The learner will:

- 3 Know how to communicate with others.

Assessment criteria

The learner can:

- 3.1 identify methods for effective communication with **individual's needs**
- 3.2 identify suitable **communication methods**
- 3.3 identify **appropriate actions** to deal with conflicting parties
- 3.4 explain the effects of poor communication with **individuals**.

Range

(AC3.1) **Individual's needs:**

- disabilities
- learning difficulties
- language differences
 - dialects
 - accents
 - English spoken as another language

(AC3.2) **Communication methods:**

- oral communication
- written communication
- e-mail
- fax
- letter
- text
- social media

(AC3.3) **Appropriate actions:**

- mediation
- negotiating
- compromising
- escalation

(AC3.4) **Individuals:**

- operatives
 - management
 - customers
-

Learning outcome

The learner will:

- 4 Understand responsibilities of relevant people in the building services industry.

Assessment criteria

The learner can:

- 4.1 identify different types of client
- 4.2 identify what may be communicated to the client through the progress of a job
- 4.3 define duties and methods for supervising staff.
-

Range

(AC4.1) **Client:**

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

(AC4.3) **Supervising staff:**

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

Learning outcome

The learner will:

- 5 Produce risk assessments and method statements for the plumbing and heating industry.

Assessment criteria

The learner can:

- 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

The learner will:

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

Assessment criteria

The learner can:

- 6.1 identify types of **projects**
- 6.2 state **factors** to consider when planning activities to job specifications
- 6.3 describe the impact when materials are not delivered on time against the **work programme**
- 6.4 identify **factors** which affect working time allocation to work activities
- 6.5 produce **simple** work programmes.

Range

(AC6.1) **Projects:**

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

(AC6.2) **Factors:**

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

(AC6.3) **Work programme:**

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

(AC6.4) **Time allocation:**

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

(AC6.5) **Simple work programmes:**

- bar (progress) charts

Unit 305

Cold water systems

Unit level:	3
GLH:	138
Unit aim:	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.

Learning outcome

The learner will:

- 1 Understand cold water supply route to dwellings.

Assessment criteria

The learner can:

- 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
- 1.3 describe the two main types of water **supply** to dwellings and how these are regulated
- 1.4 identify **fluid categories** of water and uses of water supplied to dwellings
- 1.5 describe the mains water treatment process and typical mains water distribution system from treatment works to property
- 1.6 identify mains water **service to the property** and isolation points
- 1.7 define the requirements to provide water whilst preventing waste, undue consumption, misuse or contamination.

Range

(AC1.2) **Sources of water:**

- surface sources
 - lakes
 - reservoirs
 - rivers
 - streams
- underground sources
 - deep and shallow wells
 - artesian wells
 - bore-holes

- springs
 - (AC1.3) **Supply:**
 - mains
 - private
 - (AC1.4) **Fluid categories:**
 - 1–5
 - (AC1.6) **Service to the property:**
 - 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
-

Learning outcome

The learner will:

- 2 Install cold water systems.

Assessment criteria

The learner can:

- 2.1 identify types and layout features of **cold water systems**
 - 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**
 - 2.5 describe **layout and installation requirements** for protected plastic storage 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**
 - 2.8 identify **sources of information** required when undertaking work on cold water systems
 - 2.9 explain **backflow** risk and required **methods** of prevention
 - 2.10 **install** cold water systems.
-

Range

- (AC2.1) **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

(AC2.4) Components:

- appliances
 - baths
 - WCs
 - over the rim bidets
 - wash hand basins
 - sinks
 - urinals
 - refrigerators
 - washing machines
 - dishwashers
- taps, outlets and valves
 - mixer taps
 - outside taps
 - pillar taps
 - bib taps
 - bi-flow mixer taps
 - ceramic disc taps
 - 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

(AC2.5) **Layout and installation requirements:**

- 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

(AC2.7) **Building fabric:**

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

(AC2.8) **Sources of information:**

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

(AC2.9) **Backflow:**

- back siphonage
- back pressure

(AC2.9) **Methods:**

- air gaps
 - AA
 - AB
 - AD
 - AG
 - AUK1
 - AUK2
 - AUK3
 - DC
- mechanical
 - BA
 - CA
 - DB
 - EA/EB
 - EC/EDHA
 - HUK1
 - HC

(AC2.10) **Install:**

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

Learning outcome

The learner will:

- 3 Decommission cold water systems.

Assessment criteria

The learner can:

- 3.1 explain **procedures** for **decommissioning** systems
- 3.2 carry out decommissioning procedures.
-

Range

(AC3.1) **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

(AC3.2) **Decommissioning:**

- permanent
 - temporary
-

Learning outcome

The learner will:

- 4 Size and select cold water systems and components for dwellings.

Assessment criteria

The learner can:

- 4.1 explain **factors** that affect the selection of cold water systems for dwellings
- 4.2 identify **information sources** required to size and select cold water systems and components
- 4.3 identify recommended **design temperatures** within cold water systems
- 4.4 calculate cold water **system requirements** used in dwellings
- 4.5 select cold water **components** in accordance with calculations from predetermined data
- 4.6 interpret information to complete a detailed **materials list**
- 4.7 present calculations and information in a suitable format for quotation and tender

Range

(AC4.1) **Factors:**

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

(AC4.2) **Information sources:**

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

(AC4.3) **Design temperatures:**

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

(AC4.4) **System requirements:**

- storage requirements
- pipe size
- outlet size and type

(AC4.5) **Components:**

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

(AC4.6) **Materials list:**

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

Learning outcome

The learner will:

- 5 Perform a soundness test and commission cold water systems and components.

Assessment criteria

The learner can:

- 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
- 5.5 state the **flushing requirements** including the use of **system additives** for new and existing cold water systems
- 5.6 carry out a soundness test
- 5.7 describe **operational checks** required during commissioning
- 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**.

Range

(AC5.4) **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

(AC5.4) **Pipework:**

- metal pipework
- plastic pipework

(AC5.5) **Flushing requirements:**

- cold
- disinfection

(AC5.5) **System additives:**

- neutralisers
- cleanser
- water softener (salt)

(AC5.7) **Operational checks:**

- temperature
- flow rate
- pressures
- operation of controls

(AC5.11) **Commissioning procedure:**

- visual inspection
- fill and vent
- soundness test
- flush
- operational checks
- commissioning documentation
- handover procedure

Learning outcome

The learner will:

- 6 Perform fault diagnosis and rectification procedures on cold water systems.

Assessment criteria

The learner can:

- 6.1 describe methods of obtaining **information** on system **faults**
- 6.2 carry out diagnostic checks for a range of faults
- 6.3 carry out repair and rectification **procedures** to deal with a range of faults.

Range

(AC6.1) **Information:**

- end user
- manufacturer instruction
- fault diagnosis flow chart

- service history

(AC6.2) **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

(AC6.3) **Procedure:**

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

Learning outcome

The learner will:

7 Carry out service and maintenance of cold water systems.

Assessment criteria

The learner can:

- 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
- 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.

Range

(AC7.2) 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

Unit 306

Hot water systems

Unit level:	3
GLH:	138
Unit aim:	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.

Learning outcome

The learner will:

- 1 Install hot water systems.

Assessment criteria

The learner can:

- 1.1 identify types and layout features of **hot water systems**
- 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
- 1.4 describe working principles of hot water systems, positioning fixing, connection and operation of **components**
- 1.5 describe insulation requirements and system frost protection
- 1.6 identify the positioning and fixing of pipework within the **building fabric**
- 1.7 explain expansion and contraction in hot water systems and negative effects
- 1.8 identify location and function of **unvented system components**
- 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
- 1.11 explain **backflow** risk and required **methods** of prevention
- 1.12 **install** hot water systems.

Range

(AC1.1) **Hot water systems (vented and unvented systems):**

- direct
 - boiler
 - immersion
- indirect
- thermal store

- instantaneous hot water heaters
- single point (point of use) heaters
- multipoint heaters
- combination boilers

(AC1.4) Components:

- cylinders (vented and unvented)
 - various grades available
 - sizes available
 - direct
 - indirect
 - primatic
 - quick recovery
 - duel 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

(AC1.6) Building fabric:

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

(AC1.8) **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)

(AC1.10) **Sources of information:**

- regulations
- industry standards
- manufacturers' technical instructions

(AC1.11) **Backflow:**

- back siphonage
- back pressure

(AC1.11) **Methods:**

- air gaps
 - AA
 - AB
 - AD
 - AG
 - AUK1
 - AUK2
 - AUK3
 - DC
- mechanical
 - BA
 - CA
 - DB
 - EA/EB
 - EC/EDHA
 - HUK1
 - HC

(AC1.12) **Install:**

- cylinder (open vented)
- cylinder (unvented)

- bath
 - WHB
 - shower
 - pipework
 - plastic
 - copper
-

Learning outcome

The learner will:

- 2 Decommission hot water systems.

Assessment criteria

The learner can:

- 2.1 explain procedures for decommissioning **systems**
- 2.2 carry out decommissioning **procedures**.
-

Range

(AC2.1) **Systems:**

- permanent
- temporary

(AC2.2) **Procedure:**

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

Learning outcome

The learner will:

- 3 Size and select hot water systems and components for dwellings.

Assessment criteria

The learner can:

- 3.1 explain **factors** which affect the selection of hot water systems for dwellings
- 3.2 identify **information sources** required to size and select hot water systems and components
-

- 3.3 identify recommended **design temperatures** within hot water systems
 - 3.4 calculate hot water **system requirements** used in dwellings
 - 3.5 select hot water **components** in accordance with calculations from predetermined data
 - 3.6 interpret information to complete a detailed **materials list**
 - 3.7 present calculations and information in a suitable format for quotation and tender.
-

Range

(AC3.1) **Factors:**

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

(AC3.2) **Information sources:**

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

(AC3.3) **Design temperatures:**

- pipework
- secondary circulation
- storage
- appliance outlet

(AC3.4) **System requirements:**

- storage requirements
- pipe size

(AC3.5) **Components:**

- storage vessel
- pipe
- pump
- expansion vessel
- safety device

(AC3.6) **Materials list:**

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

Learning outcome

The learner will:

- 4 Perform a soundness test and commission hot water systems and components.

Assessment criteria

The learner can:

- 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
- 4.5 state the **flushing requirements** including the use of **system additives** for new and existing hot water systems
- 4.6 carry out a soundness test
- 4.7 describe **operational checks** required during commissioning
- 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 **hot water systems**.

Range

(AC4.4) **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

(AC4.4) **Pipework:**

- metal
- plastic

(AC4.5) **Flushing requirements:**

- cold
- hot
- disinfection

(AC4.5) **System additives:**

- neutralisers
- cleanser

- water softener (salt)

(AC4.7) **Operational checks:**

- temperature
- flow rate
- pressure
- operation of controls

(AC4.11) **Commissioning procedure:**

- visual inspection
- fill and vent
- soundness test
- flush
- operational checks
- commissioning documentation
- handover procedure

(AC4.11) **Hot water systems:**

- vented
- unvented

Learning outcome

The learner will:

- 5 Perform fault diagnosis and rectification procedures on hot water systems.

Assessment criteria

The learner can:

- 5.1 describe methods of obtaining **information** on system **faults**
- 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

Range

(AC5.1) **Information:**

- end user
- manufacturers' instruction
- fault diagnosis flow chart
- service history

(AC5.1) **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

(AC5.3) **Procedure:**

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

Learning outcome

The learner will:

- 6 Carry out service and maintenance of hot water systems.

Assessment criteria

The learner can:

- 6.1 identify how to use manufacturers' 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
- 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.

Range

(AC6.2) **Routine checks:**

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

- effective operation of 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

(AC6.5) **Service and maintenance:**

- unvented cylinder
- controls

Unit 307

Central heating systems

Unit level:	3
GLH:	180
Unit aim:	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.

Learning outcome

1. Install central heating systems.

Assessment criteria

- 1.1 Identify **types** and **layout** features of **heating systems**
- 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
- 1.4 Describe working principles of types of central heating systems, positioning fixing, connection and operation of **components**
- 1.5 Explain the importance of pump positioning
- 1.6 Identify **operating principles** for system control
- 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**
- 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
- 1.12 Describe procedures for filling and venting system types
- 1.13 State the operating principles of **heat-producing appliances**
- 1.14 **Install** central heating systems

Range

(AC1.1) **Types**

- pumped heating gravity hot water
- fully pumped, 2 x two port valves (S plan)
- fully pumped, 3 x two port valves (S plan+)
- fully pumped, 3 port valve (mid position/diverting) (Y/W plans)
- combination boiler
- system boiler

Layout

- one pipe
- two pipe

- manifold (micro and minibore)
- underfloor heating

Heating systems

- wet central heating
- warm air
- storage heaters
- district heating

(AC1.4) 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

(AC1.6) Operating principles

- 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

(AC1.9) Building fabric

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

(AC1.10) Sources of information

- regulations
- industry standards
- manufacturers' technical instructions

(AC1.13) Heat-producing appliances

- traditional boilers
- condensing boilers
- combination boilers
- freestanding boilers
- wall mounted boilers

(AC1.14) Install

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

Learning outcome

2. Decommission central heating systems.

Assessment criteria

- 2.1 Explain **procedures** for **decommissioning** systems
 - 2.2 Carry out decommissioning procedures
-

Range

(AC2.1) 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 source of heat or supplies as required

Decommissioning

- permanent
 - temporary
-

Learning outcome

3. Size and select central heating systems and components for dwellings.

Assessment criteria

- 3.1 Explain **factors** which affect the selection of central heating systems for dwellings
 - 3.2 Identify **information sources** required to size and select central heating systems and components
 - 3.3 Describe the principles of **heat loss and gain** and how this affects heating requirements
 - 3.4 Calculate central heating **system requirements** used in dwellings
 - 3.5 Select central heating system **components** in accordance with calculations from predetermined data
 - 3.6 Interpret information to complete a detailed **materials list**
 - 3.7 Present calculations and information in a suitable format for quotation and tender.
-

Range

(AC3.1) Factors

- customer needs
-

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

(AC3.2) Information sources

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

(AC3.3) Heat loss and gain

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

(AC3.4) System requirements

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

(AC3.5) Components

- emitter
- boiler
- pipe
- pump
- expansion vessel

(AC3.6) Materials list

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

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
- 4.5 State the **flushing requirements** including the use of **system additives** for new and existing central heating systems
- 4.6 Carry out a soundness test
- 4.7 Describe **operational checks** required during commissioning
- 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

Range

(AC4.4) 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

(AC4.5) Flushing requirements

- cold
- hot
- cleansing

System additives

- neutralisers
- cleanser
- inhibitor

- descaler

(AC4.7) **Operational checks**

- temperature
- flow rate
- pressure
- controls

(AC4.11) **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**
 - 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
-

Range

(AC5.1) **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

(AC5.3) **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 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
- 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

Range

(AC6.2) **Routine checks**

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

Unit 308

Rainwater systems

Unit level:	3
GLH:	30
Unit aim:	This unit covers the installation, decommissioning, commissioning and maintenance of rainwater systems on domestic dwellings/light commercial properties.

Learning outcome

The learner will:

- 1 Install rainwater systems.

Assessment criteria

The learner can:

- 1.1 identify types and layout features of **rainwater systems**: pipe (RWP) and gutter
- 1.2 state advantages and disadvantages of rainwater systems: pipe (RWP) and gutter
- 1.3 identify typical sizes and **materials** used in rainwater systems: pipe (RWP) and gutter
- 1.4 describe working principles of rainwater systems (positioning fixing, connection and operation of **components**)
- 1.5 explain expansion and contraction in rainwater systems and negative effects
- 1.6 explain **factors** affecting gutter bracket selection and fixing for buildings
- 1.7 identify **sources of information** required when undertaking work on rainwater systems
- 1.8 explain working principles of rainwater recycling systems
- 1.9 **install** rainwater systems.

Range

(AC1.1) **Rainwater systems:**

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

(AC1.3) **Materials:**

- PVC-U
- extruded aluminium
- cast iron
- specialist
- copper
- lead
- fusion welded

(AC1.4) **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

(AC1.6) **Factors:**

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

(AC1.9) **Install:**

- pipe (RWP)
 - offsets
 - shoes
 - clips
- gutter system
 - running outlets
 - gutter angles
 - gutter unions
 - stop ends
 - brackets

Learning outcome

The learner will:

- 2 Decommission rainwater systems.

Assessment criteria

The learner can:

- 2.1 explain **procedures** for decommissioning systems

2.2 carry out decommissioning procedures.

Range

(AC2.1) 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

The learner will:

3 Size and select rainwater systems components for dwellings.

Assessment criteria

The learner can:

- 3.1 explain **factors** which affect the selection of rainwater systems for dwellings
 - 3.2 identify **information sources** required to size and select rainwater systems components
 - 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**
 - 3.6 present calculations and information in a suitable format for quotation and tender.
-

Range

(AC3.1) Factors:

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

(AC3.2) Information sources:

- regulations
-

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

(AC3.5) **Materials list:**

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

Learning outcome

The learner will:

- 4 Perform a soundness test and commission rainwater systems.

Assessment criteria

The learner can:

- 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
- 4.3 describe a **soundness test** to industry requirements on rainwater, gutter systems pipework and components
- 4.4 describe **operational checks** required during commissioning
- 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**.

Range

(AC4.1) **Information sources:**

- regulations
 - industry standards
- manufacturers' technical instructions

(AC4.2) **Visual inspection:**

- checks
- leakage
- adequate support
- damage
- gutters are clear of debris
- signs of damp on the building surface

(AC4.3) **Soundness test:**

- visual inspection
- notify
- initial fill
- wet test
- check for leaks
- complete documentation and notify as required

(AC4.4) **Operational checks:**

- correct fall
- no spill over
- no leaks

(AC4.5) **Commissioning procedure:**

- visual inspection
 - soundness test
 - operational checks
 - commissioning documentation
 - handover procedure
-

Learning outcome

The learner will:

- 5 Perform fault diagnosis and rectification procedures on rainwater systems.

Assessment criteria

The learner can:

- 5.1 describe methods of obtaining **information** on system **faults**
- 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.
-

Range

(AC5.1) **Information:**

- end user
- manufacturers' instruction
- visual inspection

(AC5.2) **Faults:**

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

(AC5.3) **Procedure:**

- diagnose
-

- notify client
- decommission
- rectify
- re-commission
- handover

Unit 309

Sanitation systems

Unit level:	3
GLH:	106
Unit aim:	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.

Learning outcome

The learner will:

- 1 Install sanitary appliances and pipework systems.

Assessment criteria

The learner can:

- 1.1 identify types and **layout** features of sanitary appliances pipework **systems**
- 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 describe working principles of sanitary appliances pipework systems, positioning fixing, connection and operation of **components**
- 1.5 identify the positioning and fixing of pipework within the **building fabric**
- 1.6 explain expansion and contraction in sanitary appliances pipework systems and negative effects
- 1.7 identify **sources of information** required when undertaking work on sanitary appliances pipework systems
- 1.8 identify different types of **sanitary appliances** and components used in dwellings
- 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**
- 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
- 1.13 explain working principles of greywater recycling systems
- 1.14 **install** sanitary appliances, pipework systems and components.

Range

(AC1.1) **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

(AC1.1) **Systems:**

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

(AC1.4) **Components:**

- 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

- (AC1.5) **Building fabric:**
- suspended timber floors
 - solid floors
 - embedded in walls
 - in areas of the building subject to frost
 - underground
- (AC1.7) **Sources of information:**
- regulations
 - industry standards
 - manufacturers' technical instructions
- (AC1.8) **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
- (AC1.10) **Below ground drainage systems:**
- combined drainage systems
 - separate drainage systems
 - partially separate drainage systems
 - soakaway
 - cesspit
 - septic tanks
- (AC1.10) **Waste water:**
- foul
 - soil
 - waste
 - condensate water
- (AC1.12) **Jointing methods:**
- ring seal joints
 - solvent weld joints
 - compression joints
 - fusion welded
- (AC1.14) **Install:**
- bath
 - WHB
 - WC
 - primary ventilated stack

Learning outcome

The learner will:

- 2 Decommission sanitary appliances, pipework systems and components.

Assessment criteria

The learner can:

- 2.1 explain **procedures** for decommissioning **systems**
- 2.2 carry out decommissioning procedures.

Range

(AC2.1) **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

(AC2.1) **Systems:**

- permanent
- temporary

Learning outcome

The learner will:

- 3 Size and select sanitary appliances pipework systems and components for dwellings.

Assessment criteria

The learner can:

- 3.1 explain **factors** that affect the selection of sanitary appliances pipework systems for dwellings
- 3.2 identify **information sources** required to size and select sanitary appliances pipework system
- 3.3 **calculate** sanitary appliances pipework system requirements for dwellings
- 3.4 select sanitary system components in accordance with calculations from predetermined data
- 3.5 interpret information to complete a detailed **materials list**
- 3.6 present calculations and information in a suitable format for quotation and tender.

Range

(AC3.1) **Factors:**

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

(AC3.2) **Information sources:**

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

(AC3.3) **Calculate:**

- gradient
- diameter
- length
- material
- system type

(AC3.5) **Materials list:**

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

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 4.1 describe a **visual inspection** of sanitary appliances and pipework systems to confirm that it is ready to be soundness tested
 - 4.2 describe a **soundness test** to industry requirements on sanitary appliances, pipework systems and components
 - 4.3 describe **operational checks** required during commissioning
 - 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**.
-

Range

(AC4.1) **Visual inspection:**

- checks
- leakage
- adequate support
- damage
- signs of damp on the building surface

(AC4.2) **Soundness:**

- visual inspection
- notify
- air test
- initial fill
- wet test
- check for leaks
- complete documentation and notify as required

(AC4.3) **Operational checks:**

- correct fall
- no trap seal loss
- no leaks
- adequate support
- waste removed satisfactory

(AC4.6) **Commissioning procedure:**

- visual inspection
- soundness test
- operational checks
- commissioning documentation
- handover procedure

Learning outcome

The learner will:

- 5 Perform fault diagnosis and rectification procedures for sanitary appliances and pipework systems.

Assessment criteria

The learner can:

- 5.1 describe methods of obtaining **information** on system **faults**
- 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.

Range

(AC5.1) **Information:**

- end user
- manufacturers' instructions
- visual inspection

(AC5.2) **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

(AC5.3) **Procedure:**

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

Learning outcome

The learner will:

- 6 Service and maintain sanitary appliances and pipework systems.

Assessment criteria

The learner can:

- 6.1 identify how to use manufacturers' 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
 - 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.
-

Range

(AC6.2) **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

Unit 310

Environmental technology systems

Unit level:	3
GLH:	15
Unit aim:	This unit provides an introduction to micro-renewable energy and water conservation and the installation of environmental technologies.

Learning outcome

The learner will:

- 1 Know the basic operating principles of micro-renewable energy and water conservation technologies.

Assessment criteria

The learner can:

- 1.1 describe the basic operating principles of heat producing **micro-renewable energy** technologies
- 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.

Range

(AC1.1) **Micro-renewable energy:**

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

(AC1.3) **Water conservation:**

- rainwater harvesting
- greywater re-use

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 2.1 explain the suitability of **building location and features** when installing micro-renewable energy and water conservation systems
 - 2.2 identify **regulations** affecting installation of micro-renewable energy and water conservation systems
 - 2.3 describe what would be typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of technologies
 - 2.4 state which parts of the regulations apply in relation to the installation of **environmental technologies**
 - 2.5 state typical advantages and disadvantages associated with environmental technologies.
-

Range

(AC2.1) **Building location and features:**

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

(AC2.2) **Regulations:**

- building regulations
 - Part A
 - Part E
 - Part G
 - Part H
 - Part L
- town and country planning regulations

(AC2.4) **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

Unit 311

Domestic fuel systems

Unit level:	3
GLH:	30
Unit aim:	This unit covers factors affecting fuel selection, the combustion processes of fuel supply systems and the operating principles of chimney/flue systems.

Learning outcome

The learner will:

- 1 Understand factors affecting fuel selection.

Assessment criteria

The learner can:

- 1.1 identify the types of **fuels** used in appliances
- 1.2 describe the **factors** which affect the selection of fuels
- 1.3 state **sources of information** for fuel supply installation
- 1.4 define the **regulatory type bodies** which govern the installation of various fuel types
- 1.5 specify the storage requirements for fuels
- 1.6 compare **factors** which could affect storage requirements for fuels.

Range

(AC1.1) **Fuels:**

- natural gas
- LPG
- oil
- solid fuel
- sustainable sources

(AC1.2) **Factors:**

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

(AC1.3) **Sources of information:**

- British Standards
- regulations
- manufacturers' instructions
- guidance notes

(AC1.4) **Regulatory type bodies:**

- Gas Safe
- OFTEC
- HETAS

(AC1.6) **Factors:**

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

Learning outcome

The learner will:

- 2 Know combustion processes of fuel supply systems.

Assessment criteria

The learner can:

- 2.1 describe the combustion process
- 2.2 identify the main constituents of complete and incomplete combustion
- 2.3 identify **causes** of incomplete combustion
- 2.4 identify **signs** of incomplete combustion
- 2.5 describe the symptoms of CO poisoning
- 2.6 describe the purpose of CO detectors
- 2.7 explain the **requirements** for ventilation
- 2.8 identify the different **types** of ventilation
- 2.9 explain **installation practices** for ventilation.

Range

(AC2.3) **Causes:**

- lack of oxygen
- too much fuel
- vitiated air
- flame impingement

(AC2.4) **Signs:**

- yellow flame

- floppy flame
- sooting
- staining

(AC2.7) **Requirements:**

- combustion air
- cooling air

(AC2.8) **Types:**

- natural
- mechanical

(AC2.9) **Installation practices:**

- adequately sized
- continuous size
- sleeved
- permanently open
- fly screen removed
- correctly positioned

Learning outcome

The learner will:

3 Know principles of chimney/flue systems.

Assessment criteria

The learner can:

- 3.1 explain the **operating principles** of chimney/flue systems
- 3.2 identify **types** of chimney/flue systems
- 3.3 identify the **components** within chimney/flue systems
- 3.4 explain the **effects** of layout on chimney/flue systems
- 3.5 state the layout and features of **chimney and flue construction**
- 3.6 reference termination requirements for chimney/flue systems from relevant **documents**
- 3.7 list basic **inspection and testing** procedures for chimney/flue systems.

Range

(AC3.1) **Operating principles:**

- remove combustion products
- draw in combustion air

(AC3.2) **Types:**

- open flued
- room sealed

(AC3.3) **Components:**

- primary flue
- draught diverter
- secondary flue

- terminal

(AC3.4) Effects:

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

(AC3.5) Chimney and flue construction:

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

(AC3.6) Documents:

- British Standards
- manufacturers' instructions

(AC3.7) Inspection and testing:

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

Unit 312

Electrical work and the control of plumbing and domestic heating systems

Unit level:	3
GLH:	70
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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**
- 1.3 identify the applications, advantages and limitations of different **electrical equipment, cables/wiring** and **components** in relation to the **working environment**
- 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
- 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)**
- 1.8 confirm the **status** of the electrical supply
- 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.
-

Range

(AC1.2) Electrical supplies:

- extra low voltage and/or low voltage single and/or multi-phase provision for:
 - control
 - communication
 - heating
 - lighting
 - power

(AC1.3) Electrical equipment:

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

(AC1.3) Cables/wiring:

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

(AC1.3) Components:

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

(AC1.3) **Working environment (internal and/or external):**

- commercial
- industrial
- domestic
- agricultural
- horticultural
- leisure and entertainment residential
- medical and care facilities public services establishments
- pre-1919 traditional/historic buildings

(AC1.5) **Plant:**

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

(AC1.6) **Organisational procedures:**

- information management
- project management
- risk assessment and management
- implementing and monitoring health and safety requirements and issues
- implementing and monitoring issues relating to the natural environment
- customer service
- accident reporting
- emergencies
- communication with relevant people
 - customers/clients
 - client representatives
 - supervisors sit/contract manager
 - other contractors/trades
 - members of the public
 - work colleagues

(AC1.7) **Personal protective equipment (PPE):**

- clothing protection including high visibility
- eye protection
- hand protection
- head protection
- foot protection
- hearing protection
- respiratory protection
- vibration protection
- harnesses

(AC1.8) **Status:**

- live
- dead

Learning outcome

The learner will:

- 2 Apply industry standard safe isolation procedures.

Assessment criteria

The learner can:

- 2.1 identify the correct means of electrical isolation prior to commencing **work**
 - 2.2 carry out the safe-isolation of **electrical equipment** and **components** associated with the **electrical supply** of the plumbing and domestic heating system.
-

Range

(AC2.1) **Work:**

- disconnection
- installation
- connection

(AC2.2) **Electrical equipment:**

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

(AC2.2) **Components:**

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

(AC2.2) **Components:**

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

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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:
 - a industry recognised methods and procedures
 - b manufacturers' instructions
 - 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
 - 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.
-

Range

(AC3.1) **Work:**

- disconnection
- installation
- connection

(AC3.1) **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
-

(AC3.1) **Cables/wiring:**

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

(AC3.1) **Electrical supply:**

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

(AC3.1) **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

(AC3.3) **Construction:**

- insulation
- mechanical strength
- protection

Learning outcome

The learner will:

- 4 Carry out the identification of faults and safe repair of electrical work.

Assessment criteria

The learner can:

- 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.
-

Range

(AC4.1) **Faults and deficiencies:**

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

Unit 312

Electrical work and the control of plumbing and domestic heating systems

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

Unit 313

Install, commission, service and maintain domestic plumbing and heating systems

Unit level:	3
Credit value:	60
Unit aim:	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.

Learning outcome

The learner will:

- 1 Apply health and safety and welfare in the workplace.

Assessment criteria

The learner can:

- 1.1 use personal protective equipment
- 1.2 ensure appropriate provision for **first aid** and **fire safety** is in place
- 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 verify **appropriate access and exit routes** to and from the work location
- 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 **use access equipment** in the workplace.

Range

(AC1.2) **First aid:**

- first-aid kit

- accident book
- nominated person

(AC1.2) **Fire safety:**

- fire extinguisher
- evacuation procedure
- muster points

(AC1.7) **Appropriate access and exit routes:**

- candidates must be assessed on three of the following:
 - adequate lighting
 - routes free from obstruction
 - follow safety signs and notices
 - emergency exit routes in place
 - appropriate barriers

(AC1.13) **Use access equipment:**

- candidates must be assessed on two of the following:
 - ladder
 - tower scaffold
 - stepladder
 - platform (MEWP)

Learning outcome

The learner will:

- 2 Prepare for the installation of plumbing and heating systems and components.

Assessment criteria

The learner can:

- 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 comply with **health and safety requirements**
- 2.4 carry out **preparatory work**
- 2.5 comply with organisational procedures for completing **documentation** that is required during work operations.

Range

(AC2.3) **Health and safety requirements:**

- candidates must be assessed on **two** of the following:
 - risk assessment
 - method statements
 - work permits

(AC2.4) **Preparatory work:**

- candidates must be assessed on **all** of the following:
 - safe and unobstructed access to work areas
 - safe storage of materials tools and equipment
 - reporting pre-existing damage

- protecting the building fabric
- candidates must be assessed on:
 - drilling walls or floors
 - cutting holes and notches in timber floor joists
 - cutting chases in wall or floor surfaces.

(AC2.5) **Documentation:**

- candidates must be assessed on **three** of the following:
 - variation order
 - timesheets
 - work programme
 - requisitions
 - delivery note

Learning outcome

The learner will:

3 Install plumbing and heating systems and components in the workplace.

Assessment criteria

The learner can:

- 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
- 3.3 complete installation work on a range of plumbing and heating systems
- 3.4 position and fix **pipework** and **components**
- 3.5 connect pipework to system controls and main components
- 3.6 complete a range of **jointing methods** during pipework installation
- 3.7 carry out a **soundness test** to industry requirements on systems pipework and components.

Range

(AC3.3) **Systems:**

- candidates must be assessed on cold and hot water systems and then **one** from the remaining three:
 - cold water systems
 - hot water systems
 - central heating systems
 - sanitation systems
 - gravity rainwater systems

(AC3.4) **Pipework:**

- candidates must be assessed on **three** of the following:
 - copper
 - plastic pressure pipe
 - steel (screwed or pressed)
 - stainless steel
 - plastic (sanitary)

- rainwater

(AC3.4) Components:

- candidates must be assessed on **six** components from **Group A** with at least **three** on more than one occasion and **three** unique components from Group B:
- Group A
 - bath
 - WC
 - wash hand basin
 - sink
 - shower and tray
 - cylinder
 - boiler (connections)
 - soil stack system
 - rain water/guttering system
 - F&E/CWSC cistern
 - pump
 - motorised valves
 - radiator
 - water conditioners/filters
- Group B:
 - urinal
 - bidet
 - booster pump/shower pump
 - accumulators/expansion vessels
 - fan convector
 - low loss header
 - macerator or waste water lifter/pump
 - greywater/rainwater station
 - water softener/filter
 - refrigerator cold connection
 - washing machine/dishwasher
 - underfloor heating circuit and underfloor manifold
 - outside tap installation
 - backflow protection components (e.g. EA, EB, EC or ED)

(AC3.6) Jointing methods:

- candidates must be assessed on **four** of the following
 - compression
 - push fit plastic pressure
 - push fit waste
 - threaded/screwed
 - soft soldered
 - crimped
 - glued/adhesives
 - fusion welded

(AC3.7) Soundness test:

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

- complete documentation and notify as required
-

Learning outcome

The learner will:

- 4 Perform fault diagnosis and rectification procedures.

Assessment criteria

The learner can:

- 4.1 obtain **information** on system **faults**
 - 4.2 carry out diagnostic checks for a range of **faults**
 - 4.3 carry out **decommissioning procedures**
 - 4.4 carry out fault repair or replace system component
 - 4.5 re-commission and handover to the client.
-

Range

(AC4.1) Information:

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

(AC4.1) Faults:

- candidates must be assessed on **three** from Group A (common faults) and **three** from Group B (system faults)
 - Group A
 - system debris
 - pump failure
 - leakage
 - trap seal loss
 - expansion and contraction
 - cistern failure
 - pumping over/persistent venting
 - emitter cold spots
 - TRV/valve
 - tap/valve failure
 - Group B
 - accumulator expansion vessel failure
 - motorised valves not operating
 - heat exchanger failure
 - expansion valve
 - WC macerators/waste water lifter
 - sink waste disposal units
 - control failure
 - pressure relief valve
 - thermostat
 - programmer
-

- air admittance valves
- condensing boiler condensate
- component failure

(AC4.3) **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

The learner will:

5 Commission plumbing and heating systems in the workplace.

Assessment criteria

The learner can:

- 5.1 carry out a visual inspection of the system
- 5.2 charge the **system** to normal operating pressure and check for leakage
- 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.

Range

(AC5.2) **System:**

- candidates must be assessed on **two** of the following systems on **two** occasions:
 - hot and cold water systems
 - central heating systems
 - sanitation and drainage systems

Unit 313

Install, commission, service and maintain domestic plumbing and heating systems

Evidence requirements

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

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

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

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

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

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

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

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

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

Unit 314

Air source heat pump systems

Unit level:	3
GLH:	160
Unit aim:	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 pumps.

Learning outcome

The learner will:

- 1 Understand health and safety risks and legislation associated with air source heat pump systems.

Assessment criteria

The learner can:

- 1.1 state which aspects of installation work pose health and safety **risks**
- 1.2 describe safe systems of work for installation work
- 1.3 state **legislation** relevant to installation, testing and commissioning.

Range

(AC1.1) **Risks:**

- electrocution/electric shock
- burns
- toxic poisoning
- personal injury through component/equipment handling

(AC1.3) **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

The learner will:

- 2 Understand different types of air source heat pump systems.

Assessment criteria

The learner can:

- 2.1 state the purpose and operation of heat pump system **components**
 - 2.2 describe how the vapour compression refrigerant circuit within a heat pump unit operates
 - 2.3 identify different **types** of heat pump system
 - 2.4 state the meaning of monovalent system and bivalent system
 - 2.5 identify the **monovalent hydraulic emitter circuits**
 - 2.6 identify the **parallel bivalent hydraulic emitter circuits** incorporating secondary heat sources.
-

Range

(AC2.1) **Components:**

- evaporator
- low pressure switch
- compressor
- high pressure switch
- condenser
- dryer/receiver
- sight glass
- expansion valve
- expansion valve phial
- refrigerant four way valve
- emitter circuit electro-mechanical valves
- fan coil
- buffer tanks (integrated, series and parallel)

(AC2.3) **Types:**

- external air, packaged (indoor)
- external air, packaged (outdoor)
- external air, internal heat pump unit with circuit between fan coil unit and heat pump unit

(AC2.5) **Monovalent hydraulic emitter circuits:**

- heating only
 - heating with buffer tank
 - heating with buffer tank and indirect stored domestic hot water
-

- heating with buffer tank and indirect stored domestic hot water with solar coil
- heating with thermal store

(AC2.6) **Parallel bivalent hydraulic emitter circuits:**

- heating with buffer tank
- heating with buffer tank and indirect stored domestic hot water
- heating with buffer tank and indirect stored domestic hot water with solar coil
- heating with buffer tank and thermal store

Learning outcome

The learner will:

- 3 Know how to design air source heat pump systems.

Assessment criteria

The learner can:

- 3.1 confirm the meaning of the **coefficient of performance (COP)** and its relationship with input and emitter temperatures
- 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
- 3.9 state how heat pump **output capacity** is affected
- 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
- 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
- 3.15 state why heat pump annual operating hours vary
- 3.16 explain factors to be considered in selecting and positioning air source heat pumps 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.

Range

(AC3.1) **COP:**

- heat pump input temperature
- heat pump emitter temperature

(AC3.8) **Manufacturers' data:**

- output charts (including bivalent points)
- other data

(AC3.9) **Output capacity:**

- heat pump input/output temperature

(AC3.10) **Hydraulic heating system emitters:**

- underfloor heating
- fan assisted convector heaters
- panel radiators
- bivalent points/auxiliary heat requirements
- mean water temperatures

(AC3.14) **Operating hours:**

- heat only
 - heating and DHW
 - type of building
 - geographic location
-

Learning outcome

The learner will:

- 4 Install air source heat pump systems.

Assessment criteria

The learner can:

- 4.1 state the **pre-installation checks** for air source heat pump systems connected to hydraulic emitter circuits
- 4.2 state the pre-installation checks that are specific to the positioning of fan coil units
- 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
- 4.5 **install** the heat pump to the hydraulic emitter circuit.
-

Range

(AC4.1) **Pre-installation checks:**

- tools, materials and equipment are safe and suitable
 - building structure
 - authorisation
 - access
-

- collation of relevant information
- location of fan coil unit, heat pump unit and internal system components
- confirm design-heat pump rating, emitter circuit, buffer tank, electrical input

(AC4.4) **Installation requirements:**

- heat transfer fluid circuit passes through external building fabric
- provision of movement
- protect against freezing
- prevent water ingress

Install – see on-site assessment requirements

Learning outcome

The learner will:

5 Service and maintenance of air source heat pump systems.

Assessment criteria

The learner can:

- 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.
-

Range

(AC5.4) **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

Service – see on-site assessment requirements

Learning outcome

The learner will:

- 6 Carry out fault diagnosis and rectification of defects and malfunctions on air source heat pump systems.

Assessment criteria

The learner can:

- 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
 - 6.3 identify the cause of **faults** on heat pump systems and carry out remedial work
 - 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.
-

Range

(AC6.1) **Sequence of actions:**

- diagnose
- notify client
- safe isolation
- decommission
- rectify
- re-commission
- handover

(AC6.2) **Information:**

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

(AC6.3) **Faults:**

- heat pump high/ low pressure trip/alarm activated by an emitter circuit malfunction
- insufficient heat output to emitter circuit
- domestic hot water heat up is satisfactory but space heating is not operating
- system noise and/or vibration

Find and rectify faults – see on-site assessment requirements

Learning outcome

The learner will:

- 7 Perform a test, commission and handover of air source heat pump systems.

Assessment criteria

The learner can:

- 7.1 **prepare** a heat pump system for testing and commissioning
- 7.2 describe the requirements for **charging, flushing** and treating hydraulic heat emitter circuits
- 7.3 **commission** the system in accordance with manufacturers' instructions, design specification, clients' and statutory requirements and industry recognised procedures
- 7.4 undertake final **checks** to ensure that the system is ready for handover to client
- 7.5 explain and demonstrate to the client the operation and use of the heat pump system using manufacturers'/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 manufacturers' instructions.
-

Range

(AC7.1) **Prepare:**

- system design and specification
- system/component manufacturer requirements
- suitability of the electrical supply circuit
- system is ready for flushing of installation debris
- system is ready for filling and venting the hydraulic circuits
- system is ready for adding protection against freezing
- client requirements are met
- system is compliant with statutory regulations and/or industry recognised procedures
- conditions required for dynamic commissioning

(AC7.2) **Charging and flushing:**

- equipment required
- purging air and debris

(AC7.3) **Commission:**

- visual check
-

- fill and vent
- test
- flush
- operational checks
- commissioning documentation
- handover procedure

(AC7.4) **Checks:**

- mechanical controls
- electrical controls/ temperature sensors
- functional tests

(AC7.7) **Handover:**

- provision of written/diagrammatic/verbal information
- demonstration of system operation and use

Test, commission and handover – see on-site assessment requirements

Unit 315

Rainwater harvesting and greywater reuse systems

Unit level:	3
GLH:	130
Unit aim:	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

Learning outcome

The learner will:

- 1 Understand rainwater harvesting and greywater reuse systems.

Assessment criteria

The learner can:

- 1.1 identify the **health and safety risks** and safe systems of work
- 1.2 interpret **building regulations** and **water regulations** guidance documentation
- 1.3 state the advantages and disadvantages of rainwater harvesting and greywater reuse systems
- 1.4 describe the **design requirements** for types and layouts of rainwater harvesting systems
- 1.5 describe the **design requirements** for types and layouts of greywater reuse systems
- 1.6 confirm **backflow prevention** arrangements for wholesome back-up water supplies
- 1.7 identify the purpose of **components** used within rainwater harvesting and greywater reuse systems.

Range

(AC1.1) **Health and safety risks:**

- electrocution/electric shock
- infection
- toxic poisoning
- asphyxiation
- drowning
- personal injury through component/equipment handling

(AC1.2) **Building regulations:**

- 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

(AC1.2) **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

(AC1.4) **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

(AC1.5) **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

(AC1.6) **Backflow prevention:**

- type AB air gap
- type AA
- air gap gravity supply

(AC1.7) **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

The learner will:

- 2 Install rainwater harvesting and greywater reuse system components.

Assessment criteria

The learner can:

- 2.1 identify the **information requirements** used to select, size and position components
- 2.2 confirm the **pre-installation design requirements**
- 2.3 state the **preparatory work** required for system installation work
- 2.4 install rainwater harvesting and greywater reuse **components**.

Range

(AC2.1) 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

(AC2.2) 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

(AC2.3) 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

(AC2.4) **Components:**

- storage tank (connection to tank only)
- system control unit (water connections only)
- pump

Install – see on-site assessment requirements

Learning outcome

The learner will:

3 Test, commission and handover rainwater harvesting and greywater reuse systems.

Assessment criteria

The learner can:

- 3.1 identify statutory **regulations** and recognise procedures
 - 3.2 identify marking and labelling to system pipework and components as per regulations
 - 3.3 describe the **requirements** to test and commission rainwater harvesting and greywater re-use system installations
 - 3.4 **test and commission** rainwater and greywater systems
 - 3.5 **hand over** to end user.
-

Range

(AC3.1) **Regulations:**

- building regulations
- water regulations

(AC3.3) **Requirements:**

- compliance with system design and specification
- compliance with system component/manufacture requirements
- suitability of electrical supply circuit arrangements

(AC3.4) **Test and commission:**

- 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

(AC3.5) **Handover:**

- provision of written/diagrammatic/verbal information
 - demonstration of system
-

Test, commission and handover – see on-site assessment requirements

Learning outcome

The learner will:

- 4 Carry out fault diagnosis, rectification and maintenance on rainwater harvesting and greywater reuse systems.

Assessment criteria

The learner can:

- 4.1 identify **information** to service and maintain systems
 - 4.2 describe types and rectification of possible **faults** or suspected failure of **components**
 - 4.3 **inspect, service and maintain** systems in accordance with **British Standards**
 - 4.4 carry out diagnosis and rectification **procedure** on faults.
-

Range

(AC4.1) **Information:**

- manufacturers' instructions
- statutory regulations
- service records
- fault finding flow charts

(AC4.2) **Faults:**

- poor or no flow into storage tank
- system pump fails to operate
- back-up water supply fails to operate
- water quality is unacceptable

(AC4.3) **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

(AC4.4) **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)
- 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
- cleaning of components
- functional tests

(AC4.4) **British Standards:**

- BS 8515
- BS 7592

(AC4.5) **Procedure:**

- diagnose
- notify client
- safe isolation
- decommission
- rectify
- re-commission
- handover

Find and rectify faults – see on-site assessment requirements.

Service – see on-site assessment requirements.

Unit 316

Solar thermal hot water systems

Unit level:	3
GLH:	160
Unit aim:	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.

Learning outcome

The learner will:

- 1 Understand health and safety and relevant legislation, regulations and standards.

Assessment criteria

The learner can:

- 1.1 state industry recognised **legislation, regulations and standards** relevant to solar thermal hot water systems
- 1.2 define safe systems of work for dealing with **hazards**
- 1.3 state **risks** associated with solar thermal collectors.

Range

(AC1.1) **Legislation, regulations and standards:**

- building regulations
- town and country planning
- water regulations
- British Standards
- European standards

(AC1.2) **Hazards:**

- working at height
- electrocution/electric shock
- burns
- toxic poisoning
- injury through flash to steam of system heat transfer fluid
- personal injury through component/equipment handling

(AC1.3) **Risks:**

- size
- weight

- fragility
 - wind
 - thermal properties and outputs
-

Learning outcome

The learner will:

- 2 Understand fundamental design principles for solar thermal hot water systems.

Assessment criteria

The learner can:

- 2.1 identify system **information requirements**
 - 2.2 state how to determine typical domestic **hot water storage vessel requirements**
 - 2.3 determine hot water storage vessel requirements
 - 2.4 state **collector area requirements**
 - 2.5 state system **annual irradiation yield requirements**
 - 2.6 identify system **primary circuit pipe size requirements**
 - 2.7 state system **expansion vessel size requirements**
 - 2.8 identify system **pump size requirements**
 - 2.9 state **factors** affecting solar thermal collector installation
 - 2.10 define the considerations of solar fraction.
-

Range

(AC2.1) **Information requirements:**

- building design
- building dimensions/angles
- building location and orientation
- building fabric/material details
- existing input services
- existing hot water/heating systems
- building occupancy
- required hot water usage pattern

(AC2.2) **Hot water storage vessel requirements:**

- daily demand (vd) (litres/day per person or litres/day per m² of floor area)
- boiler volume (vb)
- dedicated solar volume (vs) (litres per m² of collector area or as a % or vd)
- total cylinder volume (vt)
- solar heat exchange coil surface area (m² of surface area in relation to collector flow rate and collector surface area)

(AC2.4) **Collector area requirements:**

- building occupancy
 - proposed angle of collector
 - installation
-

- proposed orientation of collector installation
- shading that may affect
- collector performance

(AC2.5) **Annual irradiation yield requirements:**

- collector orientation
- collector angle
- collector over shading
- circulation rates

(AC2.6) **Primary circuit pipe size requirements:**

- primary circuit circulation rates
- collector area
- primary circuit pipework length
- primary circuit water content volume

(AC2.7) **Expansion vessel size requirements:**

- primary circuit water content
- volume
- collector height above cylinder
- typical sizing requirements for drainback vessel:
 - net collector area
 - total volume of the system

(AC2.8) **Pump size requirements:**

- fully filled systems
- drainback systems

(AC2.9) **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

Learning outcome

The learner will:

- 3 Install solar thermal hot water systems.

Assessment criteria

The learner can:

- 3.1 describe system **components** and placement
 - 3.2 confirm the key operating principles of **collectors** and their efficiency
 - 3.3 describe **system types** and efficiencies
 - 3.4 describe **weathering requirements**
 - 3.5 state pre-installation **checks** and **documentation** for the installation of solar thermal hot water
 - 3.6 **install** systems.
-

Range

(AC3.1) **Components:**

- solar collector
- differential temperature controller
- cylinder sensor(s)
- solar collector sensor
- drain back vessel
- flow meter
- flow regulator (mechanical)
- expansion vessel

(AC3.2) **Collectors:**

- unglazed collector
- flat plate glazed collector
- roof integrated glazed collector
- evacuated tube collector – direct flow
- evacuated tube collector – heat pipe

(AC3.3) **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

(AC3.4) **Weathering requirements:**

- flat plate, surface mounted, inclined roof with single lap roof covering
 - flat plate, surface mounted, inclined roof with double lap roof covering
 - flat plate, integrated, inclined single lap roof covering
 - flat plate, integrated, inclined double lap roof covering
 - evacuated tube, inclined single lap roof covering
 - evacuated tube, inclined double lap roof covering
-

- frame mounted, inclined (roof, wall or ground)
- frame mounted, horizontal (roof or ground)

(AC3.5) **Checks:**

- authorisation for the work to proceed
- verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load
- availability of appropriate access to all required work areas
- inspection of existing domestic hot water/heating system installations
- availability of a suitable electrical input service
- proposed siting of key internal system components
- suitability of the building structure in relation to the proposed installation
- suitability of the proposed location and position of the solar collector panel(s) for optimum collection capacity
- suitability of the building fabric in relation to the installation of the solar collector panel(s)

(AC3.5) **Documentation:**

- drawings
- specifications
- schedules
- method statements
- risk assessments
- manufacturers' information
- regulations governing buildings

(AC3.6) **Install:**

- fully-filled systems
- solar collector
- connections to existing systems
- expansion vessel
- solar circulating pump
- pipework
- insulation

Install – see on-site assessment requirements

Learning outcome

The learner will:

- 4 Test, commission and handover of solar thermal hot water systems.

Assessment criteria

The learner can:

- 4.1 state the requirements for **testing and commissioning** a system
- 4.2 state the requirements for **handover** of a system
- 4.3 **test, commission and handover** of a system.

Range

(AC4.1) 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

(AC4.2) Requirements for handover:

- provision of written/diagrammatic/verbal information
- demonstration of system operation and use

(AC4.3) Test, commission and handover:

- hydraulic test
- setting of the expansion vessel
- charge pressure
- setting of the system fluid level
- setting of mechanical controls
- setting of electrical controls and temperature sensors
- system functional tests
- the system is ready for handover
- written/diagrammatic/verbal information supplied
- system operation and use demonstrated

Test, commission and handover – see on-site assessment requirements

Learning outcome

The learner will:

- 5 Service and maintain, and diagnose and rectify faults of, a solar thermal hot water installation.

Assessment criteria

The learner can:

- 5.1 state the **requirements** for service and maintenance and the diagnosis of faults
- 5.2 **service and maintain** a system
- 5.3 diagnose and rectify **faults**.
-

Range

(AC5.1) 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

(AC5.2) **Service and maintain:**

- checking the system water levels
- checking provision for the expansion of system water
- checking for protection of the system water against freezing
- cleaning of system components
- adjustment of system controls
- safe operation
- efficient operation
- the correct functioning of system components/controls
- complete documentation

(AC5.3) **Faults:**

- loss of system pressure without evidence of discharge
- discharge from pressure relief valve on the solar primary circuit
- insulation melting on solar collector circuit pipework
- overheating of solar collector circuit
- lack of circulation within the solar collector circuit
- poor or no system performance
- system noise and/or vibration

Service – see on-site assessment requirements.

Find and rectify faults – see on-site assessment requirements.

Unit 317

Specific domestic core safety for natural gas

Unit level:	3
GLH:	190
Unit aim	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.

Learning outcome

The learner will:

- 1 Know the natural gas supply network and LPG supplies.

Assessment criteria

The learner can:

- 1.1 describe the key features of a natural gas **network**
- 1.2 state the operating pressure **ranges**.

Range

(AC1.1) **Network:**

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

(AC1.2) **Ranges:**

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

Learning outcome

The learner will:

- 2 Know the operation pressure regulators.

Assessment criteria

The learner can:

- 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

The learner will:

- 3 Know the characteristics of the combustion processes with natural gas.

Assessment criteria

The learner can:

- 3.1 define the different **types of gases** used to supply appliances in domestic dwellings
- 3.2 identify the **combustion process** with gases used in dwellings
- 3.3 identify the potential **effects of carbon monoxide** when incomplete combustion takes place
- 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 or is minimised
- 3.6 **identify incomplete combustion** in an open flue 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**.

Range

(AC3.1) **Types of gases:**

- chemical symbols
 - Methane (CH₄)
 - Propane (C₃H₈)
 - Butane (C₄H₁₀)
- gas characteristics
- viscosity

- families of gas
 - 1st, 2nd and 3rd families
- relative density of gases compared to air
- explosive mixtures

(AC3.3) **Combustion process:**

- 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 (BTUs)
 - kilowatts (kW)
 - use of conversion charts
- Wobbe number of gases

(AC3.3) **Potential effects:**

- 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

(AC3.5) **Measures:**

- primary measures – correct appliance installation and maintenance
- secondary measures – use of CO detectors
- types of CO detectors available and standards of manufacture
- positioning requirements for CO detectors
- associated maintenance requirements of CO detectors
- other sources of CO and CO₂ in dwellings
- causes of activation of CO detectors and indicators

(AC3.6) **Incomplete combustion:**

- around appliance location
- in appliance

(AC3.10) **Detectors:**

- audible
- readable
- visual

Learning outcome

The learner will:

- 4 Know the types of burners used with natural gas.

Assessment criteria

The learner can:

- 4.1 define the layout features and operating principles of gas appliance **burners**
- 4.2 define the key **terms** related to gas appliance burners
- 4.3 identify how to diagnose **faults** in gas appliance burners
- 4.4 clarify the **reasons for burner faults** that result in incomplete combustion
- 4.5 inspect the flame picture of burners visually and identify complete and incomplete combustion.

Range

(AC4.1) **Burners:**

- pre- and post-aerated burners
- premix burners
- forced draught burners
- radiant burners

(AC4.2) **Terms:**

- flame speed
- ignition temperature
- venturi
- burner head
- burner (flame) retention

(AC4.3) **Faults:**

- flame picture
- sooting
- discolouration
- flame chilling
- linting
- condition of the burner
- air supply faults
- condition and size of injectors

(AC4.4) **Reasons for burner faults:**

- gas rate/pressure settings
- effects of excessive pressure at the appliance (flame lift)
- aeration
- vitiation
- light back
- flame chilling

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 5.1 clarify the materials suitable for **gas pipework** and fittings
- 5.2 identify the acceptable **jointing methods** for pipework used for domestic gas supplies
- 5.3 explain the industry practices and methods of **bending pipe materials** suitable for carrying gas
- 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
- 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
- 5.9 specify the **installation requirements** for gas supply pipework
- 5.10 specify the provision of **safety and control measures** to gas supply pipework
- 5.11 specify the requirements for **pipework to multi-occupancy dwellings**
- 5.12 produce a plan showing the **positioning, protection and fixing methods**
- 5.13 state the precautions to be taken when making **new connections** into an existing gas pipework system
- 5.14 state the precautions to be taken when using an exposed flame for soldering joints on existing gas pipework systems.

Range

(AC5.1) Gas pipework:

- up to 35mm 1¼ diameter
- standards for pipework and fittings
- materials used
 - copper
 - low carbon steel
 - steel semi-rigid
- actions to take with existing lead pipe

(AC5.2) Jointing methods:

- cleansing agents
- jointing methods
 - copper to copper
 - mild steel to mild steel
 - copper to mild steel

- steel semi-rigid pipework and termination
- restrictions and application of unions and compression fittings
- movable appliance hoses
- hoses
- safety precautions to take when jointing materials and fittings - including COSHH

(AC5.3) **Bending pipe materials:**

- 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)

(AC5.6) **Pipe sizes:**

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

(AC5.8) **Positioning, support and fixing requirements:**

- 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

(AC5.9) **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
- 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
 - passing through cavity 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

(AC5.10) **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

(AC5.11) **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

(AC5.12) **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 and Use) Regulations
 - British Standards
 - building regulations
- sleeving, purposed designed channels, fire stops, purposed designed shafts

(AC5.13) **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

Learning outcome

The learner will:

- 6 Know how domestic natural gas supplies are metered, regulated and controlled.

Assessment criteria

The learner can:

- 6.1 describe the installation, operation and positioning requirements for **emergency control valves (ECV)**
- 6.2 explain the installation, operation and positioning requirements for appliance isolation valves (AIV)

- 6.3 describe the associated labels required for ECVs
 - 6.4 define the methods of **entry and layout features** of natural gas service pipework to domestic dwellings
 - 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
 - 6.10 define the operating principles of **domestic regulators and governors**.
-

Range

(AC6.1) **Emergency control valves:**

- natural gas/LPG meter installations
- remote meter installations
- multiple occupancy meter installations
- Additional Emergency Control Valves (AECV)
- Meter Inlet Valves (MIV)

(AC6.4) **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

(AC6.9) **Meters:**

- U6
- E6
- semi-concealed
- inferential
- rotary
- positive displacement

(AC6.10) **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

The learner will:

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

Assessment criteria

The learner can:

- 7.1 specify the procedures for taking **pressure readings** in domestic gas supply systems
- 7.2 identify the methods of determining and/or setting gas appliance **working pressures**
- 7.3 identify the methods of **determining gas rates** at appliances
- 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
- 7.6 describe the process for setting **regulators**
- 7.7 state the procedures to take when incorrect pressure readings are encountered in gas supply systems.

Range

(AC7.1) 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

(AC7.2) Working pressures:

- fixed rated appliances
- range rated appliances

(AC7.3) Determining gas rates:

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

(AC7.5) Factors:

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

(AC7.6) Regulators:

- meter regulators low and medium pressure

Learning outcome

The learner will:

- 8 Understand how to tightness test and purge gas pipework in small natural gas installations.

Assessment criteria

The learner can:

- 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
- 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
- 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
- 8.8 specify the actions to take to **investigate and repair** suspected leakage from gas supplies and components
- 8.9 state the industry practices and procedures for tracing and repairing gas escapes
- 8.10 specify the **actions** to be taken when a smell of gas persists following a gas tightness test
- 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.

Range

(AC8.3) **Tightness testing:**

- before work commences on existing systems
- on completion of work on new and existing gas systems
- following the report of a gas escape

(AC8.5) **System types and configurations:**

- maximum installation volume for individual tightness tests (0.035m³)
- calculating volume:
 - pipe
 - fittings
 - meter
- pipe diameter (up to 35mm)
- inlet pressure exceeds 75mbar without meter inlet valve

- different meter types:
 - diaphragm U6/G4/U16/G10
 - Ultrasonic E6
 - single dwellings
 - multiple dwellings with emergency control valves only
- anti-tamper devices

(AC8.7) Procedures:

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

(AC8.8) Investigate and repair:

- use of gas detection equipment
- use of leak detection fluid

(AC8.10) Actions:

- when the emergency control valve/additional emergency control valve/meter inlet valve is turned off
- when a leaking installation cannot be repaired

Learning outcome

The learner will:

- 9 Know how to re-establish gas supplies and relight appliances.

Assessment criteria

The learner can:

- 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

The learner will:

- 10 Know industry-specific legislation and standards.

Assessment criteria

The learner can:

- 10.1 state the key points of gas industry **legislation**

10.2 describe the **Gas Safety (Installation and Use) Regulations**.

Range

(AC10.1) Legislation:

- Gas Safety (Installation and Use) Regulations applied to work activities
- relevant building regulations and standards
- precautionary actions required to prevent use of unsafe installations

(AC10.2) Regulations:

- Reg. 2 General interpretation and application 2 (1),(2),(3),(4),(5) c (iii),(6),(7) & (8)
- Reg. 3 Qualification and supervision 3 (1),(2),(3),(5),(6),(7) & (8)
- Reg. 4 Duty on employer
- Reg. 5 Materials and workmanship 5 (1) to (3)
- Reg. 6 General safety precautions 6 (1) to (6)
- Reg. 7 Protection against damage 7 (1) to (3)
- Reg. 8 Existing gas fittings 8 (1) to (3)
- Reg. 9 (1) to (4)
- Reg. 10 Maintaining electrical continuity
- Reg. 14 Regulators 14(1), (5), (6), (7)
- Reg. 18 Safe use of pipes 18 (1) and (2)
- Reg. 19 Enclosed pipes 19 (1) to (6)
- Reg. 20 Protection of buildings
- Reg. 22 Testing and purging of pipes 22 (1) t (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

The learner will:

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

Assessment criteria

The learner can:

- 11.1 define the types of **gas control devices** used for gas appliances and their operating principles
11.2 define the types and operating principles of **flame protection devices** used in gas appliances
-

- 11.3 define the types and operating principles of **thermostats** used to control heat emitted from gas appliances
 - 11.4 safely diagnose correct, unsafe or ineffective operation of gas control devices, flame protection devices and thermostats
 - 11.5 demonstrate actions to be taken when defective or unsafe control operation is identified.
-

Range

(AC11.1) **Gas control devices:**

- pressure regulators
- low pressure cut-off valves
- thermal cut-off valves
- gas cocks/valves
- cooker hotplate lid control valves
- electric solenoid valves
- excess flow valves

(AC11.2) **Flame protection devices:**

- vapour pressure devices
- thermoelectric valves
- flame conduction and rectification systems
- interrupter devices
- atmosphere sensing devices
- spillage detection devices
- multifunctional control valves

(AC11.3) **Thermostats:**

- bimetallic
 - liquid expansion
 - vapour pressure
 - electrical control
 - electrical overheat/limit
 - thermistors
-

Learning outcome

The learner will:

- 12 Know the ventilation requirements of gas appliances installed in dwellings.

Assessment criteria

The learner can:

- 12.1 calculate the ventilation **requirements** for open flued and flueless gas appliances
 - 12.2 calculate the ventilation required for **appliances** located in compartments
 - 12.3 identify the types of labels and notices available for ventilation
 - 12.4 identify the types of **grilles and vents** available for ventilation
 - 12.5 calculate the free area of unmarked grilles and vents
-

- 12.6 specify the **acceptable locations** for ventilation to appliances
- 12.7 clarify the effect that other **heat producing appliances** and **other types of extraction** have on the requirement for ventilation of gas appliances
- 12.8 specify the ventilation requirements of open flued and flueless **decorative fuel effect space heaters**
- 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.
-

Range

(AC12.1) 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

(AC12.2) Appliances:

- open flued
- room sealed

(AC12.4) Grilles and vents:

- types of grilles and vents
- sizing of grilles and vents (free area availability)
- in tumescent air vents

(AC12.6) 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)

(AC12.7) Heat producing appliances:

- oil or solid fuel appliances and flue systems

(AC12.7) Other types of extraction:

- passive stack ventilation
- extractor fans
- cooker hoods
- tumble driers
- effects of double glazing/cavity insulation/draught proofing

(AC12.8) DFE space heaters:

- single appliances
 - DFEs in adjoining rooms
 - in rooms with multiple appliances
-

- oil and solid fuel appliances
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 13.1 interpret the **legislation** that applies to chimneys and flues that serve gas appliances
 - 13.2 state how gas appliances are classified according to the **type of chimney or flue** used
 - 13.3 identify the **working principles** of flue systems serving gas appliances
 - 13.4 state the types and general layout features **of chimney and flue construction**
 - 13.5 specify the requirements for new and existing chimney and flue **installation**
 - 13.6 define the **design requirements** of chimney and flue systems used with gas appliances
 - 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
 - 13.9 specify the requirements for installing **chimney fans** to open flues and chimney systems
 - 13.10 specify the flueing requirements for **balanced compartments** used with open flued appliances.
-

Range

(AC13.1) **Legislation:**

- gas safety legislation
- exchange of information and planning requirements for chimneys

(AC13.2) **Type of chimney or flue:**

- flueless
- open flued
 - natural draught
 - forced (fanned) draught
- room sealed
 - natural draught
 - forced (fanned) draught
 - vertex type appliances

(AC13.3) **Working principles:**

- open flued chimneys
- room sealed - natural draught
- room sealed – fanned draught
- vertex type flues

(AC13.4) **Chimney and flue construction:**

- rigid chimney types
 - brick/masonry
 - pre-cast flue blocks
-

- metallic (single and double wall flues)
- flexible metallic liner installation
- use of flue box systems
- shared (common) chimney systems – SE&U ducts

(AC13.5) 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
 - 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
- balanced compartments for open flue appliances
 - ducted air positioning
 - cross sectional areas of air inlet ducts
 - compartment construction
- room sealed appliances for shared chimneys (SE-ducts, U-ducts and CFS)
 - construction and operation of SE-ducts, U-ducts and CFS
 - categories of appliances suitable for installation
 - chimney outlet positions for roof terminals
 - labelling air inlet ducts
 - labelling replacement appliances
 - maintenance of shared flue systems
 - requirements for replacement appliances
 - NRV requirements for appliance/exhaust ducts for CFS
- condensing flues
 - condensate disposal position termination for appliances of heat input ≤ 4 Kw
 - plume management kits
 - differing air inlet duct and terminal positions
 - terminal guards for plume kit air inlets
- chimneys for vertex appliances
 - construction and operation of vertex chimney
 - minimum height of appliance draught break above roof insulation
- room sealed positive pressure combustion chamber appliances
 - types
 - causes of leakage of products of combustion
 - checks prior to fitting case, to include:
 - back plate inspection
 - appliance case
 - screws
 - case seals

- installation and spillage testing new or used appliances when MIs are not available
- alternative methods of compliance when inspection hatches are not available for flues in voids
- actions required where fumes, smells or spillage have been reported/encountered

(AC13.6) 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

(AC13.8) 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

(AC13.9) 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

(AC13.10) Balanced compartments:

- compartment construction
- ducted air positioning
- cross sectional areas of air inlet ducts

Learning outcome

The learner will:

- 14 Carry out chimney performance checks.

Assessment criteria

The learner can:

- 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
- 14.2 state the factors that can affect **flue system performance**

- 14.3 carry out the **testing procedures** to check the correct operation of an existing chimney flue/gas appliance
 - 14.4 carry out the testing procedures for **room-sealed fanned draught** flue installations
 - 14.5 carry out **checks** on **open chimney systems**
 - 14.6 identify correct and incorrect **open chimney installations**
 - 14.7 carry out **checks** on **room-sealed chimney systems**
 - 14.8 identify correct and incorrect **room-sealed chimney installations**.
-

Range

(AC14.1) Visual inspection:

- open flue systems
- room sealed flue systems – natural draught and fan assisted
- vertex type appliances

(AC14.2) Flue system performance:

- downdraught conditions
- wind effects at the appliance termination
- passive stack ventilation
- extraction fans sited in the vicinity of open flued appliances

(AC14.3) 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

(AC14.4) Room-sealed fanned draught:

- checking case seals/case integrity
- checking flue pipe/air inlet connections for leakage
- checking/testing of positive pressure case appliances

(AC14.5) Checks:

- 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 fitted

(AC14.5) Open chimney systems:

- natural draught chimneys
- metallic flexible flue liners
- plastic flue pipe systems

(AC14.6) 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

(AC14.7) Room-sealed chimney systems:

- natural draught
- fan assisted
- vertex flue appliances
- balanced compartments for open flue appliances
- SE-ducts, U-ducts and CFS
- condensing flues

(AC14.8) 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

The learner will:

- 15 Use the Gas Industry Unsafe Situations Procedure.

Assessment criteria

The learner can:

- 15.1 explain the purpose and scope of the Gas Industry Unsafe Situations Procedure

- 15.2 explain the criteria for dealing with each of the **unsafe situations** categories
 - 15.3 explain how the unsafe situations procedure is applied
 - 15.4 identify unsafe situations
 - 15.5 classify unsafe situations
 - 15.6 explain the purpose and use of the associated warning **notices** and labels
 - 15.7 demonstrate the procedure for each unsafe situation
 - 15.8 select and issue appropriate warning/advisory notices
 - 15.9 state the types of RIDDOR reportable work/incidents.
-

Range

(AC15.2) **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

(AC15.6) **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
 - Un-commissioned Appliance Label
 - Balanced Compartment Label
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 16.1 state the **responsibilities and appropriate actions** to be taken in the event of a gas emergency
 - 16.2 state the Gas Emergency **Priorities**.
-

Range

(AC16.1) Responsibilities and appropriate actions:

- reporting gas escapes
- responsibilities of the gas user
- responsibilities of the gas operative to give gas users advice and safety information
- responsibilities of the gas engineer
- turning off at emergency controls
- elimination of ignition sources
- reduction of gas concentrations via ventilation
- action by the gas transporter
- action by the LPG supplier
- action if gas continues to escape after turning off supply
- action to stop a gas escape downstream of ECV/AECV

(AC16.2) Priorities:

- protect life
- protect property
- secure the escape
- leave the site safe

Learning outcome

The learner will:

17 Use of combustion and atmosphere sampling analysers.

Assessment criteria

The learner can:

- 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
- 17.4 state the action levels for gas appliances
- 17.5 explain the actions if CO/CO₂ ratio remains above suitable performance levels after adjustment
- 17.6 identify the unsafe situation category for flued/flueless appliance that fails test
- 17.7 demonstrate the correct use of a combustion performance analysers and atmosphere sampling analysers **interpreting readings**
- 17.8 visually and by the use of combustion performance analysis identify complete and incomplete combustion for Type A, B and C gas appliances
- 17.9 complete the required checks using a combustion/atmosphere analyser in the event of CO detector activation.

Range

(AC17.3) Analysis:

- flue gas samples to be taken during the commissioning process
- sources of information required to determine correct flue gas products and ratios

(AC17.7) Interpreting readings:

- CO, CO₂, O₂ readings, CO/CO₂ ratios in a flueway
 - CO, CO₂, O₂ readings in the atmosphere
-

Learning outcome

The learner will:

18 Install and commission a small domestic gas installation.

Assessment criteria

The learner can:

- 18.1 **install** a domestic gas meter, pipework and domestic appliance
 - 18.2 identify installation **pipework safety defects**
 - 18.3 demonstrate **tightness testing, purging and commissioning procedures**
 - 18.4 demonstrate the **procedures** for taking pressure readings in domestic gas supply systems
 - 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
 - 18.9 identify and rectify **faults** discovered during testing
 - 18.10 demonstrate the correct **method of removal** of domestic meters and regulators
 - 18.11 demonstrate the procedures for **re-establishing gas supplies and relighting appliances**
 - 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.
-

Range

(AC18.1) Install:

- 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
-

(AC18.3) Tightness testing, purging:

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

(AC18.4) 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

(AC18.8) Calculate the gas consumption:

- imperial rated meters
- metric rated meters

(AC18.9) Faults:

- excessive pressure loss at the appliance
- incorrect gas consumption rates at appliances
- effects of meter pressure absorption under full load conditions

(AC18.10) Method of removal:

- permanent
- temporary

(AC18.11) Re-establishing gas supplies and relighting appliances:

- purge system and appliances of air
- re-light appliance(s)
- confirm satisfactory operation of user controls
- visually inspect appliance installation(s) for unsafe situations

(AC18.14) Main equipotential bonding requirements:

- method of bonding connection
- positioning of bond
- sizing of bond

Unit 318

Install and maintain gas water heating and wet central heating appliances

Unit level:	3
GLH:	260
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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
- 1.3 identify the different types of **gas water heating appliances** used in dwellings.

Range

(AC1.2) **Wet central heating appliances:**

- system boiler
- heat only boiler
- combi boiler

(AC1.3) **Gas water heating appliances:**

- multi point
- circulator
- single point

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 2.1 identify the **working principles of wet central heating** appliances
- 2.2 identify the **working principles of water heating** appliances
- 2.3 state the general operating principles of **gas fired heat producing appliances** systems in dwellings
- 2.4 state the operating principles of wet central heating and hot water appliance **control components**.

Range

(AC2.1) Working principles of wet central heating:

- system boiler
- heat only boiler
- combi boiler

(AC2.2) Working principles of water heating:

- multi-point
- circulator
- single point

(AC2.3) Gas fired heat producing appliances:

- open flued appliances
- room sealed appliances
- freestanding appliances
- wall mounted appliances
- fan assisted appliances
- flueless water heaters

(AC2.4) 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
 - PCBs
 - condensate requirements
 - internal/external user controls
 - timing devices – clocks and programmers
 - room thermostats
 - hot water thermostats
 - smart controls
 - frost thermostats
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 3.1 state the **positioning and fixing requirements** of gas water heating and wet central heating appliances
 - 3.2 identify and record the customer's job **requirements**
 - 3.3 compare the customer's job requirements with statutory and industry requirements and identify any conflicting issues
 - 3.4 **survey** the work site
 - 3.5 check that the proposed positioning of the appliance meets the manufacturers' and industry standards' requirements
 - 3.6 check that the availability of input services meet the appliance manufacturers' and industry standards' **requirements for the appliance installation**
 - 3.7 apply changes to customer job requirements and obtain customer agreement to those changes
 - 3.8 check and ensure the design of the proposed installation is **compliant**
 - 3.9 check proposed location of condensate disposal is compliant.
-

Range

(AC3.1) **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
-

(AC3.2) **Requirements:**

- location
- siting
- clearances

(AC3.4) **Survey:**

- key structural features that could affect the installation
- record details

(AC3.6) **Requirements for appliance installation:**

- gas supply
- electricity supply
- chimney suitability
- the provision of ventilation

(AC3.8) **Compliant:**

- appliance manufacturers' instructions
 - industry standards
-

Learning outcome

The learner will:

- 4 Prepare work activities for installing and maintaining domestic gas water heaters and wet central heating appliances.

Assessment criteria

The learner can:

- 4.1 carry out a **risk assessment**
 - 4.2 survey the work site **recording details** of any features that may affect the activity
 - 4.3 advise the property occupier of any defects found
 - 4.4 protect the work site and the building fabric against possible damage being caused during the **activity**
 - 4.5 obtain confirmation from the customer before the job starts to ensure that they agree the planned work
 - 4.6 check and confirm all materials, tools and equipment necessary for the activity are available and are fit for purpose
 - 4.7 carry out all necessary checks and tests to confirm the **installation** meets the manufacturers' and industry requirements
 - 4.8 confirm that the siting of the gas supply meets industry standards' requirements in relation to **other services**
 - 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
 - 4.12 select and use the correct tools and equipment for the planned activity.
-

Range

- (AC4.1) **Risk assessment:**
- safety provisions
 - access at the work site
 - movement of people on site
 - movement and safe storage of installation materials, tools and equipment
- (AC4.2) **Recording details:**
- any pre-installation damage
 - any pre-maintenance damage
 - defects to existing building features
- (AC4.4) **Activity:**
- tightness testing process
 - direct purging process
 - de-commissioning
 - installation
 - maintenance
 - commissioning
- (AC4.7) **Installation:**
- gas supply
 - electricity supply
 - the chimney system
 - the provision of ventilation
- (AC4.8) **Other services:**
- electricity
 - water supply
-

Learning outcome

The learner will:

- 5 Decommission domestic gas water heaters and wet central heating appliances.

Assessment criteria

The learner can:

- 5.1 explain procedures for **decommissioning** systems
- 5.2 carry out decommissioning **procedures**.
-

Range

- (AC5.1) **Decommissioning:**
- permanent
 - temporary
- (AC5.2) **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
-

Learning outcome

The learner will:

6 Install, exchange and remove gas pipework to industry standards.

Assessment criteria

The learner can:

- 6.1 explain the **industry practices and work standards** for fabricating and installing gas pipework, valves, systems and components to ensure they comply
 - 6.2 carry out the **installation processes** minimising damage to customer property and building features
 - 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 to 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.
-

Range

(AC6.1) **Industry practices and work standards:**

- manufacturers' specification
- industry standards
- Gas Safety (Installation and Use) Regulations
- British Standards
- Building Regulations

(AC6.2) **Installation processes**

Assessments must be carried out as documented in the table below.

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	RWE	Workplace Assessment	Work Experience
<p>Primary range:</p> <ul style="list-style-type: none"> • copper tube • steel tube • corrugated stainless steel tube (CSST) • polyethylene (PE) tube <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 (link with Unit 317 learning outcome 18)</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 five¹ separate installation occasions must occur with the learner demonstrating experience across the assessment criteria on each occasion.</p> <p>At least three¹ of the installation occasions must be from the workplace.</p>
<p>Table Notes:</p> <p>¹ The numbers required to be evidenced include the assessment occasions.</p>			

Learning outcome

The learner will:

- 7 Tightness testing and direct purging of gas systems and components.

Assessment criteria

The learner can:

- 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
- 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
- 7.10 where the **installation fails** the tightness test follow industry procedures and apply the Gas Industry Unsafe Situations Procedure as required
- 7.11 use purging procedures to confirm the safe supply of gas to the installed gas system and appliances.

Range

(AC7.6) Tightness testing and direct purging process

Assessments must be carried out as documented in the table below.

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	RWE	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 	<p>One successful assessment (link with Unit 317 learning outcome 18)</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 five¹ separate installation occasions must occur with the learner demonstrating experience across the assessment criteria on each occasion.</p> <p>At least three¹ 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.

(AC7.9) 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

(AC7.10) Installation fails:

- trace and repair the escape and retest installation
- isolate unsafe gas appliances, gas system and components

Learning outcome

The learner will:

- 8 Install domestic gas water heaters and wet central heating appliances.

Assessment criteria

The learner can:

- 8.1 carry out the **installation processes**
- 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
- 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**
- 8.14 carry out the handover procedure.

Range

(AC8.1) Installation processes

Assessments must be carried out as documented in the table below.

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	RWE	Workplace Assessment	Work Experience
Primary range: Traditional Boiler ¹ System Boiler ² Combination Boiler ³	One successful assessment	One successful assessment ⁴	Evidence of experience undertaking the satisfactory installation of gas fired boilers

Unit Components	RWE	Workplace Assessment	Work Experience
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			is required across the documented ranges.
Secondary range: Room Sealed Fanned Draught Appliance (Horizontal Chimney) (Appliance Type C12 or C13)			At least five ⁵ separate installation occasions must occur with the Learner demonstrating experience across the assessment criteria on each occasion.
Room Sealed Fanned Draught Appliance (Vertical Chimney) (Appliance Type C32 or C33)			At least three ⁵ of the installation occasions must be from the workplace.
Condensing Appliance New Installation Installation Exchange			

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 appliance must be of a different 'Primary Range' type than that the one utilised as part of the RWE Assessment.			
⁵ The documented numbers required to be evidenced do include the assessment occasions.			

(AC8.9) Electrical testing procedures:

- polarity
- earth continuity
- insulation resistance

(AC8.13) Documentation and records:

- gas testing and purging – domestic (NG) certificate
- benchmark logbook
- landlord/home owner gas safety record
- chimney/hearth notice plate
- notification of completed works (building regulations)

Learning outcome

The learner will:

- 9 Maintain domestic water heating and wet central heating appliances.

Assessment criteria

The learner can:

- 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
- 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
- 9.8 carry out the **maintenance process** in accordance with the manufacturers' specification and industry standards
- 9.9 carry out the maintenance processes minimising damage to customer property and building features
- 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.

Range

(AC9.7) Procedures for checking:

- pressure
- flow rate
- temperature

(AC9.8) Maintenance process:

- visual inspection
- ensure appliance is correctly located, level and stable
- dismantle and clean appliance operational gas safety components
 - burners
 - primary air ports
 - combustion chambers
 - flue ways
- operation of control components
- effective operation of thermostats
- effective operation of safety controls
- operation/adjustment
- check and adjust the hot water flow rate
- check air gas ratio
- carry out a flue gas analysis
- use appropriate cleaning methods and agents
- follow manufacturers' instructions

Assessments must be carried out as documented in the table below.

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	RWE	Workplace Assessment	Work Experience
<p>Routine full service of a gas fired boiler</p> <p>Primary range:</p> <ul style="list-style-type: none"> • Traditional Boiler¹ • System Boiler² • Combination Boiler³ • Gas Fire and Back Boiler⁴ <p>Secondary range:</p> <ul style="list-style-type: none"> • Open-Flued Natural Draught Appliance (incl. Draught Diverter) (Appliance Type B₁₁) • Room Sealed Natural Draught Appliance (Appliance Type C₁₁) • Room Sealed Fanned Draught Appliance (Appliance Type C₁₂) • Condensing Appliance Non Condensing Appliance 	<p>One successful assessment</p>	<p>One successful assessment⁵</p>	<p>Evidence of experience undertaking the satisfactory full servicing of gas fired boilers is required across the documented ranges.</p> <p>At least five⁶ separate servicing occasions must occur with the learner demonstrating experience across the assessment criteria on each occasion.</p> <p>At least three⁶ of the servicing occasions must be from the workplace.</p>

<p>Routine full service of a gas fired instantaneous water heater</p> <p>Primary range:</p> <ul style="list-style-type: none"> • Multipoint Water Heater 	<p>One successful assessment</p>	<p>N/A</p>	<p>N/A</p>
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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 and 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 appliance must be of a different 'Primary Range' type than the one utilised as part of the RWE Assessment.

⁶ The documented numbers required to be evidenced include the assessment occasions.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 10.1 use job information to plan the fault diagnosis work
- 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 and gas system in a safe condition
- 10.6 isolate the component from the supply source or outgoing service
- 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
- 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.

Range

(AC10.5) **Isolate:**

- isolate the gas supply to the component
- turn off electricity and water supply to the component
- prevent the use of the uncommissioned appliances

Fault diagnosis

Assessments must be carried out as documented in the table below.

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	RWE	Workplace Assessment	Work Experience
<p>Primary range:</p> <ul style="list-style-type: none"> Traditional Boiler¹ System Boiler² Combination Boiler³ Multipoint Water Heater <p>Secondary range:</p> <ul style="list-style-type: none"> Open-Flued or Room Sealed Natural Draught Appliance (Appliance Type B₁₁ or C₁₁) Open-Flued or Room Sealed Fanned Draught Appliance (Appliance Type B₁₂ or B₁₂ or B₁₄ or C₁₂ or C₁₃ or C₃₂ or C₃₃) Gas Safety Control Defect⁴ Electrical Control Defect⁴ Water Control Defect⁴ 	<p>One successful assessment</p>	<p>N/A</p>	<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 four⁵ separate fault rectification occasions must occur with the learner demonstrating experience the assessment criteria on each occasion.</p> <p>At least two⁵ of the fault rectification occasions must be from the workplace.</p>

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

Learning outcome

The learner will:

- 11 Commission domestic gas water heaters and wet central heating appliances.

Assessment criteria

The learner can:

- 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**
- 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
- 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
- 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
- 11.19 check the hot water performance of water heating gas appliances and combination boilers complies with the manufacturers' specification
- 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 uncommissioned, gas appliances, gas systems, electrical systems and components.

Range

(AC11.2) **Relevant requirements:**

- manufacturers' specifications
- Industry standards, Gas Safety (Installation & Use) Regulations
- British Standards
- Building Regulations

(AC11.7) **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

(AC11.10) **Combustion performance:**

- visual inspection
- conducting flue gas analysis using an electronic flue gas analyser
- air/gas ratio setting is correct

(AC11.18) **Hot water performance:**

- sufficient pressure and flow rate
- correct temperatures are achieved

Unit 319

Core principles of oil fuel systems for dwellings (safety and efficiency)

Unit level:	3
GLH:	170
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 1.1 state the characteristics of **oil fuels**
- 1.2 identify the health **hazards** relating to petroleum products and bio-fuels
- 1.3 identify the **dangers** and the safety precautions to be taken when working with petroleum products
- 1.4 outline the safe **working procedures** regarding boiler and furnace maintenance
- 1.5 state the **environmental aspects** of petroleum products.

Range

(AC1.1) **Oil fuels:**

- paraffin
- kerosene
- gas oil
- light fuel oil
- medium fuel oil
- heavy fuel oil
- bio liquids

(AC1.2) **Hazards:**

- hygiene precautions
- inhalation

- skin contact
- eye contact
- ingestion and aspiration

(AC1.3) **Dangers:**

- 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

(AC1.4) **Working procedures:**

- removal of combustion products
- residual oil deposits
- pressurised oil lines
- oil ash

(AC1.5) **Environmental aspects:**

- environmental hazards
- product disposal

Learning outcome

The learner will:

- 2 Demonstrate the procedure to be followed in the case of oil spills.

Assessment criteria

The learner can:

- 2.1 follow the correct **course of action** in the event of an oil spill
- 2.2 state the possible **implications** of an oil spill.

Range

(AC2.1) **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

(AC2.2) **Implications:**

- structural damage
- health effects

- legislation
 - environmental hazard
-

Learning outcome

The learner will:

- 3 Know the oil supply legislation, regulations and guidance.

Assessment criteria

The learner can:

- 3.1 identify the **statutory legislation and guidance** that applies to oil installation and maintenance work
 - 3.2 state the recommended **responsibilities** of key personnel relating to the installation and maintenance of oil fired equipment
 - 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
 - 3.6 explain the procedure for **notifying works** carried out to the relevant building control body
 - 3.7 state the **regional variations** to oil supply legislation, regulations and guidance.
-

Range

(AC3.1) **Statutory legislation and guidance:**

- building regulations
- industry standards
- manufacturers' installation and service/maintenance instructions

(AC3.2) **Responsibilities:**

- business registration and competence
- personnel registration and competence
- consumers – private householders and tenants

(AC3.5) **Commissioning record:**

- oil storage tank and supply pipework
- oil fired appliances

(AC3.6) **Notifying works:**

- notification to the building control body
- self-certification via a competent persons scheme

(AC3.7) **Regional variations:**

- England and Wales
 - Building Regulations England and Wales
 - Statutory Instruments
 - Competent Persons
 - work notification
-

- oil storage tank installation
 - underground pipework
 - contact details
 - Scotland
 - Building (Scotland) Regulations 2004
-

Learning outcome

The learner will:

- 4 Understand actual and potential risks relating to oil tanks and associated pipework.

Assessment criteria

The learner can:

- 4.1 identify potential **safety risks**
- 4.2 identify potential **environmental risks**
- 4.3 identify **immediate risks**
- 4.4 explain the key factors to consider when undertaking a risk assessment of existing oil tank installations.
-

Range

(AC4.1) **Safety risks:**

- location of oil tank
- size and structure of oil tank base
- location of fire valve

(AC4.2) **Environmental risks:**

- capacity of single skin oil storage tank
- location of oil storage tank
- condition of oil storage tank

(AC4.3) **Immediate risks:**

- location of flue terminal
 - oil storage tank support
 - leakages
 - inadequate oil storage tank fill point
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 5.1 describe the main features of oil **storage tanks**
-

- 5.2 describe oil storage tank **location** requirements
 - 5.3 explain the **installation requirements** for oil storage tanks
 - 5.4 explain the purpose of oil **tank fittings**
 - 5.5 explain the installation requirements of oil tank fittings
 - 5.6 specify **environmental protection** for domestic oil storage tanks
 - 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
 - 5.8 specify types of **secondary containment** that can be provided to oil storage tanks
 - 5.9 describe the **main features** when constructing a bund to act as secondary containment to an oil storage tank
 - 5.10 state the recommended capacity of storage tanks relevant to appliance rated output
 - 5.11 state the typical size of oil storage tanks.
-

Range

(AC5.1) **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

(AC5.2) **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

(AC5.3) **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

(AC5.4) **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

(AC5.6) **Environmental protection:**

- secondary containment
- masonry and concrete bunds
- multiple oil storage tank installations

(AC5.7) **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

(AC5.8) **Secondary containment:**

- integrally bunded storage tanks
- use of bunds (catchpits)

(AC5.9) **Main features:**

- bund holding capacity
- bund base
- bund walls
- bund surface sealant materials
- pipework projection through bund via puddle flange

(AC5.10) **Connections:**

- standard vent size
- standard fill pipe size

Learning outcome

The learner will:

- 6 Know the requirements for the installation of non-domestic oil storage tanks.

Assessment criteria

The learner can:

- 6.1 describe the main features of non-domestic **storage tanks**

- 6.2 describe oil non-domestic storage tank **location** requirements
 - 6.3 explain the **installation requirements** for non-domestic oil storage tanks
 - 6.4 state the installation requirements for **internal** oil tank installations
 - 6.5 explain the purpose of oil **tank fittings**
 - 6.6 explain the installation requirements of oil tank fittings
 - 6.7 specify **environmental protection** for non-domestic oil storage tanks
 - 6.8 state the recommended capacity of storage tanks relevant to appliance rated output
 - 6.9 state the typical size of oil storage tanks.
-

Range

(AC6.1) **Storage tanks:**

- steel oil storage tanks (OFS T200)
- steel integrally banded oil storage tanks (OFS T200)
- polyethylene oil storage tanks (OFS T100)
- polyethylene integrally banded oil storage tanks
- underground oil storage tanks
- service tanks (BS 5410: Part 2)
- rooftop tanks (BS 5410: Part 2)
- maintenance of oil storage tanks

(AC6.2) **Location:**

- 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

(AC6.3) **Installation requirements:**

- steel oil storage tanks
 - polyethylene oil storage tanks
 - single skin oil storage tanks
 - double skin oil storage tanks
 - integrally banded 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
-

(AC6.4) **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

(AC6.5) **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

(AC6.7) **Environmental protection:**

- standards
- secondary containment

Learning outcome

The learner will:

7 Install oil storage tanks.

Assessment criteria

The learner can:

- 7.1 state the points that need to be considered when **positioning the base** of a storage tank for height
- 7.2 identify appropriate types of **base support** to oil storage tanks
- 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)
- 7.4 describe the features of **fire protection barriers** applied to oil storage tanks

- 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
- 7.7 describe the features of oil storage tanks **sited underground**
- 7.8 **install** domestic oil storage tanks.
-

Range

(AC7.1) **Positioning the base:**

- access to maintain a connected oil filter
- vertical distance between base and oil control valve/ pump in gravity feed systems

(AC7.2) **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

(AC7.3) **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

(AC7.4) **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

(AC7.6) **Internally sited:**

- fire protection chamber
- bunding requirements
- chamber ventilation requirements
- tank maintenance requirements
- filling methods
- via chamber access door
- extended fill line

(AC7.7) **Sited underground:**

- type of tank to be used
- chamber requirements

- fire protection requirements

(AC7.8) **Install**

Install an oil storage tank (see table below)

Task	Direct observation requirements	Evidence
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 five separate jobs must be included in the work log. At least three of the jobs must be evidenced in 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.

Learning outcome

The learner will:

- 8 Install oil supply pipelines.

Assessment criteria

The learner can:

- 8.1 specify the **layout features** of oil supply pipeline systems
- 8.2 explain the function of oil supply **pipeline components**
- 8.3 state the correct procedure to select, locate and install **fire valves**
- 8.4 specify the **pipework materials** and jointing processes suitable for oil supply lines
- 8.5 describe the support and fixing **requirements** for oil supply pipework
- 8.6 state the installation requirements of underground **oil supply lines**
- 8.7 describe the installation requirements of **oil filters**
- 8.8 explain the installation requirements of **de-aerator devices**
- 8.9 define the installation requirements of **oil lifters**

- 8.10 state the installation requirements of oil **supply line components**
- 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**
- 8.13 **calculate** the size of sub gravity oil supply pipework
- 8.14 describe **sizing methods** for gravity supply pipework
- 8.15 describe earth bonding requirements of oil supply pipework systems and components
- 8.16 **install** oil supply pipework and components in accordance with manufacturer's and regulatory requirements.
-

Range

(AC8.1) **Layout features:**

- entry to buildings
- component layout
- gravity
- sub gravity

(AC8.2) **Pipeline components:**

- service/isolation valves
- oil filters
- de-aerators – internal and external
- oil lifters
- fire valves
- anti-syphon valves
- pressure reducing valves

(AC8.3) **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

(AC8.4) **Pipework materials:**

- R220 copper
- low carbon steel
- plastic
- compression fittings with internal support
- manipulative (type b) flared fittings
- flexible oil line

(AC8.5) **Requirements:**

- requirements for sleeving
-

- external and internal surface mounted installation pipework
 - copper
 - low carbon steel
 - plastic
- pipework protection against corrosion

(AC8.6) **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

(AC8.6) **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

(AC8.7) **Oil filters:**

- oil filter positioning
 - storage tank
 - oil fired appliances
- oil filter clearance requirements for maintenance

(AC8.8) **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 de-aerator installations

(AC8.9) **Oil lifters:**

- types of oil fired appliance used with oil lifters
- lifter positioning

(AC8.10) **Supply line components:**

- anti-syphon valves
- pressure reducing valves

(AC8.11) **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

(AC8.13) **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

(AC8.14) **Methods:**

- bottom outlet tanks
- maximum head pressure
- minimum head pressure
- multiple appliance installations
- multiple oil storage tank installations

(AC8.15) **Install:**

- oil supply pipework
 - components
-

Learning outcome

The learner will:

9 Test oil pipework for soundness

Assessment criteria

The learner can:

- 9.1 describe a soundness test to industry requirements
 - 9.2 explain the soundness test **requirements** for new and existing oil supply pipework
 - 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
 - 9.7 fill and purge oil supply pipes.
-

Range

(AC9.2) **Requirements:**

- minimise oil pollution
- visual inspection
- test medium
- test equipment
- test holding times

(AC9.6) **Test**

Install and test for soundness oil supply pipework and components in accordance with manufacturer's and regulatory requirements (see table below).

Task	Direct observation requirements	Evidence
<p>Primary range:</p> <ul style="list-style-type: none"> plastic copper <p>Secondary range:</p> <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) 	<p>One installation directly observed (by a competent witness or assessor) in the workplace.</p>	<p>To demonstrate satisfactory installation of an oil fuel 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 in the workplace.</p>
<p>Notes:</p> <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. 		

Learning outcome

The learner will:

10 Diagnose and rectify faults for oil supply systems.

Assessment criteria

The learner can:

- 10.1 describe methods of obtaining details of oil supply system faults from users
- 10.2 follow manufacturer 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
- 10.4 **inspect** existing oil supply systems.

Range

(AC10.3) **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

(AC10.4) **Inspect:**

- steel
 - plastic
-

Learning outcome

The learner will:

11 Know how to safely decommission oil storage tanks.

Assessment criteria

The learner can:

11.1 outline the correct **procedures** for the decommissioning of oil storage tanks.

Range

(AC11.1) **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

Unit 320

Install, commission, maintain and service oil systems and appliances in the workplace

Unit level:	3
GLH:	230
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 1.1 explain the uses of **heating oils** to supply oil fired appliances
- 1.2 define the **key properties** of heating oils
- 1.3 describe the **combustion process** of heating oils
- 1.4 describe the **potential effects** of carbon monoxide when incomplete combustion takes place
- 1.5 describe the **effects** of excess carbon monoxide in the atmosphere
- 1.6 explain the **measures** necessary to ensure that exposure to carbon monoxide does not take place
- 1.7 describe the layout features of **burners** to oil fired appliances
- 1.8 describe the basic operating principles of burners to oil fired appliances
- 1.9 identify the **components** of an oil pressure jet burner
- 1.10 identify the **characteristics** of atomising nozzles.

Range

(AC1.1) **Heating oils:**

- Class C2 – kerosene
- Class D – gas oil

(AC1.2) **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

(AC1.3) **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

(AC1.4) **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

(AC1.5) **Effects:**

- air pollution
- global warming and climate change

(AC1.6) **Measures:**

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

(AC1.7) **Burners:**

- pressure jet
- vaporising

(AC1.9) **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

(AC1.10) **Characteristics:**

- general
- handling
- functions
- spray angles and spray patterns
- capacities
- nozzle definition points
- calculating nozzle size and throughput pressures

Learning outcome

The learner will:

- 2 Know ventilation requirements of oil fired appliances.

Assessment criteria

The learner can:

- 2.1 **calculate** the ventilation requirements for open flued oil fired appliances
- 2.2 explain the **requirement** for excess combustion air
- 2.3 state the maximum permissible extract rates for fans sited in the same space as an open flued **oil fired appliance**
- 2.4 calculate the ventilation required for **appliances** located in compartments
- 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
- 2.8 explain the effect that other **heat producing appliances** have on the requirement for ventilation of oil fired appliances
- 2.9 explain the effect that other **types of extraction** have on the requirement for ventilation of oil fired appliances.

Range

(AC2.1) **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

(AC2.2) **Excess combustion air:**

- excess air requirement
- excess air measurement
- why excess combustion air must be carefully controlled

(AC2.3) **Oil fired appliance:**

- pressure jet
- vaporising

(AC2.4) **Appliances:**

- open flued
- room sealed

(AC2.7) **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
- siting of ventilation
 - wall
 - window
 - floor/ceiling (ducted and un-ducted)

(AC2.8) **Heat producing appliances:**

- gas
- solid fuel

(AC2.9) **Types of extraction:**

- passive stack ventilation
- extractor fans
- cooker hoods
- tumble driers

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 3.1 explain the requirements of the **British Standards**
- 3.2 explain how oil fired appliances are **classified** according to the type of chimney or flue used
- 3.3 describe components and working principles of **flue systems** serving oil fired appliances
- 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
- 3.5 describe the types and general layout features of chimney and **flue construction**
- 3.6 describe the requirements for **new and existing** chimney/flue installation

- 3.7 explain the **design requirements** of flues used with oil fired appliances
- 3.8 state the requirements for the **provision of hearths** to oil fired appliances
- 3.9 describe the requirements for the **termination of flue systems** serving oil fired appliances
- 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.
-

Range

(AC3.1) **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

(AC3.2) **Classified:**

- open flued
 - natural draught
 - forced (fanned) draught
- room sealed

(AC3.3) **Flue systems:**

- open flued chimneys
- room sealed – natural draught

(AC3.4) **Flue gas temperature:**

- appliances with a flue gas temperature above 250°C
- appliances with a flue gas temperature below 250°C

(AC3.5) **Flue construction:**

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

(AC3.6) **New and existing:**

- minimum cross-sectional area of new chimney installations to serve appliances and 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 and support requirements for flexible flue liners in chimneys/flexible liner components/termination of flue liners

(AC3.7) **Design requirements:**

- requirements of designer, builder, provider or installer when installing chimneys
- requirements for hearths – flue/hearth data plate
- 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

(AC3.8) **Provision of hearths:**

- appliances with base temperature below 100°C
- appliances with base temperature above 100°C

(AC3.9) **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

(AC3.11) **Chimney fans:**

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

Learning outcome

The learner will:

- 4 Test oil fired appliance flue systems for effective operation.

Assessment criteria

The learner can:

- 4.1 carry out a visual inspection of a **flue system** prior to undertaking commissioning of the oil fired appliance/ flue system
- 4.2 describe **factors** that can affect flue system performance
- 4.3 use testing **procedures** to check the correct operation of chimney/flue system and installations.

Range

(AC4.1) Flue system:

- open
- room-sealed

(AC4.2) Factors:

- draught 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

(AC4.3) 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

The learner will:

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

Assessment criteria

The learner can:

- 5.1 identify **types** of unsafe situation that may be found with appliances and supply system installations
- 5.2 describe the use of general **notices and warning labels** to avoid the occurrence of unsafe situations.

Range

(AC5.1) 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

(AC5.2) **Notices and warning labels:**

- oil-fired installation commissioning certificates
 - oil-fired service certificates
 - landlord safety certificates
 - hearth certificates
-

Learning outcome

The learner will:

- 6 Know the types of pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 6.1 identify types of pressure jet oil fired **appliances**
- 6.2 outline the operating principles of oil fired appliances that contain a pressure jet oil burner.
-

Range

(AC6.1) **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

The learner will:

- 7 Know condensate disposal requirements of condensing oil fired appliances.

Assessment criteria

The learner can:

- 7.1 state the properties of condensate water discharged from condensing boilers
- 7.2 explain the main **installation requirements** of condensate pipework
- 7.3 identify the **layout features** of condensate waste disposal systems.
-

Range

(AC7.2) Installation requirements:

- acceptable pipework materials
- fall required
- maximum recommended length of run
- recommended pipe sizes
- trapping requirement
- insulation requirement (external pipework)
- condensate pumps

(AC7.3) 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

The learner will:

- 8 Know energy efficiency legislation applicable to pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 8.1 describe types of oil fired boiler that must be installed to meet the **requirements** of energy efficiency legislation
- 8.2 describe ErP 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.
-

Range

(AC8.1) Requirements:

- new
 - replacement
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 9.1 explain the **criteria** used when selecting oil fired pressure jet appliances
 - 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.
-

Range

(AC9.1) **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
-

Learning outcome

The learner will:

- 10 Install pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 10.1 carry out a **pre-installation inspection** to determine that the pressure jet appliance can be correctly installed
 - 10.2 **install** pressure jet oil fired appliances.
-

Range

(AC10.1) **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

(AC10.2) **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

(AC10.2) **Install**

Install an oil fuel boiler in accordance with manufacturers' and regulatory requirements (see table below).

Task	Direct observation requirements	Evidence
<p>Primary range:</p> <ul style="list-style-type: none"> • traditional boilers • condensing boilers • system boilers • combination boilers 	<p>One installation directly observed (by a competent witness or assessor) in the workplace.</p>	<p>To demonstrate satisfactory installation of an oil fuel 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 in the workplace.</p>
<p>Secondary range:</p> <ul style="list-style-type: none"> • open flued boilers • room sealed boilers • external independent boilers • open flued cookers • central heating pressure jet cookers 		

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.

Learning outcome

The learner will:

- 11 Commission pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 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
- 11.3 apply **pre-operational tests** to be carried out prior to appliance light up
- 11.4 carry out operational tests on initial **appliance light up**
- 11.5 carry out tests to determine the **appliance combustion** and adjust/fine tune the burner accordingly
- 11.6 carry out checks to ensure that the appliance temperature controls are **operating correctly**
- 11.7 carry out checks to ensure that connected **water heating** systems are functioning correctly
- 11.8 describe the actions to take in the event that the **appliance/component** cannot be correctly commissioned
- 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.

Range

(AC11.2) **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

(AC11.3) **Pre-operational tests:**

- flue flow test (where required)

(AC11.4) **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 (where required)

(AC11.5) **Appliance combustion:**

- 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

(AC11.6) **Operating correctly:**

- appliance control thermostat
- appliance energy cut-out device

(AC11.7) **Water heating:**

- hot water systems
- central heating systems

(AC11.8) **Appliance/component:**

- use of the unsafe situations procedure
- provision of suitable warning notices

Test, commission and handover

Test, commission and handover an oil fuel boiler installation in accordance with manufacturer's requirements (see table below).

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 in the work log.

Task	Direct observation requirements	Evidence
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At least **three** of the jobs must be evidenced in 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.

Learning outcome

The learner will:

- 12 Decommission pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 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
- 12.5 safely **drain and dispose** of system contents
- 12.6 advise other persons that the appliance has been successfully decommissioned.

Range

(AC12.4) **Decommission:**

- permanent
- temporary
- 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

(AC12.5) **Drain and dispose:**

- central heating/ hot water system
 - fuel supply system
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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
 - 13.3 state the checks to be carried out on the **components** of a pressure jet oil fired system and appliance
 - 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
 - 13.7 complete a servicing and maintenance report.
-

Range

(AC13.2) **Activities:**

- requirements
- planned procedure
- safety
- safe electrical isolation
- cleanliness
- observation

(AC13.3) **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 time clocks
 - TRVs
 - non-electrical hot water thermostats (if fitted)

(AC13.6) **Service**

Service an oil fuel boiler/system in accordance with manufacturers' requirements.

Task	Direct observation requirements	Evidence
<p>Range:</p> <ul style="list-style-type: none"> ● oil storage ● oil pipework ● air supply ● flues/chimneys ● heat exchanger ● combustion chamber ● burner ● safety controls ● system controls 	<p>One service directly observed (by a competent witness or assessor) in the workplace.</p>	<p>To demonstrate satisfactory servicing of an oil fuel system required across the documented ranges.</p> <p>At least five separate jobs must be included in the work log.</p>

Task	Direct observation requirements	Evidence
------	---------------------------------	----------

At least **three** of the jobs must be evidenced in 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.

Learning outcome

The learner will:

- 14 Carry out fault diagnosis of pressure jet oil fired appliances.

Assessment criteria

The learner can:

- 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 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
- 14.6 state methods of identifying and repairing **faults** in oil fired pressure jet burners
- 14.7 carry out fault diagnosis and rectification on oil fired pressure jet appliances
- 14.8 state the **actions to take** in the event that the appliance/ component fault cannot be rectified
- 14.9 outline procedures to re-commission appliances following completion of fault repair activities.

Range

(AC14.5) 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

(AC14.6) 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

(AC14.8) Actions to take:

- use of the unsafe situations procedure
- provision of suitable warning notices

Fault diagnosis and rectification

Find and rectify faults on an oil fuel boiler/system (see table below).

Task	Direct observation requirements	Evidence
<p>Range:</p> <ul style="list-style-type: none"> • oil pump defects • solenoid defects • motor/fan defects • incorrect air shutter settings • nozzle defects, • blast tube assembly defects • ignition electrodes defects/positioning • ignition transformer defects • photoresistor defects • control 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 in the work log.</p> <p>At least two of the jobs must be evidenced in the workplace.</p> <p>At least three faults in the range must be covered</p>

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.

Unit 321

Safety principles (solid mineral fuel and biomass combustion)

Unit level:	3
GLH:	170
Unit aim:	This unit provides learning in operating principles linked to legislation covering energy efficiency and installation requirements for solid mineral fuel and biomass appliances.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 1.1 identify types of statutory **legislation** and guidance information that applies to installation and maintenance work in the industry
- 1.2 define the **recommended responsibilities** of key personnel relating to the installation and maintenance of equipment
- 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.

Range

(AC1.1) **Legislation:**

- building regulations
- industry standards
- manufacturers' installation and service/maintenance instructions

(AC1.2) **Recommended responsibilities:**

- business registration and competence
- personnel registration and competence
- consumers – private householders and tenants

(AC1.5) **Notifying works:**

- notification to the building control body
- self-certification via a competent persons' scheme

Learning outcome

The learner will:

- 2 Understand the types of solid fuels and the factors affecting fuel selection.

Assessment criteria

The learner can:

- 2.1 identify types of **solid mineral fuels** burnt in solid fuel appliances
 - 2.2 list types of **wood** burnt in solid fuel appliances
 - 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.
-

Range

(AC2.1) **Solid mineral fuels:**

- bituminous (house) coals
- bituminous coal briquettes
- natural smokeless fuels
- manufactured smokeless fuels

(AC2.2) **Wood:**

- wood logs
- wood chips
- wood briquettes
- wood pellets

(AC2.4) **Factors:**

- customer preference
 - appliance type
 - fuel storage requirements
 - smoke control legislation
-

Learning outcome

The learner will:

- 3 Understand the factors that affect the selection of solid fuel appliances.

Assessment criteria

The learner can:

- 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
 - 3.3 identify **fuel storage requirements** of solid fuel appliances burning solid mineral fuels
-

3.4 identify fuel storage requirements of solid fuel appliances burning wood.

Range

(AC3.1) **Smoke control legislation:**

- appliance fuel types restricted in smoke control areas
- use of exempted appliances

(AC3.3) **Fuel storage requirements:**

- 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
 - logs
 - chips
 - briquettes
 - pellets
-

Learning outcome

The learner will:

- 4 Know the combustion process and the principles of safe combustion of solid fuels.

Assessment criteria

The learner can:

- 4.1 define the **terms** related to solid fuel composition
- 4.2 clarify the **combustion process** with solid fuels used in dwellings
- 4.3 explain the main causes of **incomplete combustion** with solid fuels
- 4.4 identify the production of carbon monoxide as a possible by-product of incomplete combustion
- 4.5 identify the potential **effects** of CO when incomplete combustion takes place
- 4.6 explain **measures** necessary to ensure that exposure to CO does not take place
- 4.7 demonstrate the use of **CO analysers** in measuring CO concentrations in ambient air
- 4.8 requirements to install a CO monitor in dwelling.
-

Range

(AC4.1) **Terms:**

- calorific value
- moisture content
- volatile content

(AC4.2) **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

(AC4.3) **Incomplete combustion:**

- inadequate air supply
- incorrect fuel
- inadequate flue/ chimney performance

(AC4.5) **Effects:**

- symptoms of CO poisoning
- advice to give to a person who describes symptoms of being affected by products of combustion

(AC4.6) **Measures:**

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

(AC4.7) **CO analysers:**

- test procedure for measuring CO in ambient air
- response required based on CO in ambient air levels (action levels)

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 5.1 identify dwelling construction and the impact where additional combustion air is required
- 5.2 **calculate** the ventilation requirements for open flued appliances
- 5.3 identify types of **grilles and vents** available for ventilation
- 5.4 calculate the free area of unmarked grilles and vents
- 5.5 identify acceptable **locations for ventilation** to appliances
- 5.6 explain the **effect** that other heat producing appliances and extractor fans have on the requirement for ventilation of appliances
- 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.

Range

(AC5.2) 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

(AC5.3) Grilles and vents:

- types of grilles and vents
- restrictions on the use of flyscreens
- sizing of grilles and vents (free area availability)

(AC5.5) 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)

(AC5.6) Effect:

- gas or solid fuel appliances and flue systems
 - passive stack ventilation
 - extractor fans
 - cooker hoods
 - tumble driers
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 6.1 explain the function of an open flue/chimney system
 - 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**
 - 6.4 explain the **requirements** for new and existing chimney/flue installation
 - 6.5 explain the **design requirements** of flues used with appliances
 - 6.6 define the requirements for the **termination** of flue systems serving appliances
 - 6.7 identify methods of making correct **appliance connection** to the flue system
 - 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
 - 6.10 explain the procedure for re-lining existing chimneys.
-

Range

(AC6.1) **Function:**

- clearing the products of combustion
- inducing combustion air into the appliance

(AC6.3) **Flue construction:**

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

(AC6.4) **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 and 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

(AC6.5) **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

(AC6.6) 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

(AC6.7) Appliance connection:

- forming chimney gathers – open fires
- throats to open fires
- use, positioning and sizing of canopies to open fires
- flue connection to freestanding appliances (open fire, cooker, room heater and boiler)
- freestanding appliance (open fire, cooker, room heater and boiler) connection to rigid metallic flue pipe systems
- inset room heater connection to flue systems

(AC6.9) Chimney fans:

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

(AC6.10) 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 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

The learner will:

- 7 Understand methods of diagnosing problems with flue/chimney performance.

Assessment criteria

The learner can:

- 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

The learner will:

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

Assessment criteria

The learner can:

- 8.1 state the requirements for the **provision of hearths** to appliances
 - 8.2 explain the **constructional features** of hearths to appliances (base temperatures above 100°C)
 - 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 data plate.
-

Range

(AC8.1) **Provision of hearths:**

- appliances with base temperature below 100°C
- appliances with base temperature above 100°C

(AC8.2) **Constructional features:**

- constructional hearth dimensions
 - superimposed hearth dimensions
-

- proximity of appliances on hearths to combustible materials
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 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
 - 9.5 specify the **testing procedures** that should be performed to check the correct operation of an existing chimney/flue system
 - 9.6 specify the testing procedures applied to **appliances**
 - 9.7 explain the procedures for using combustion analysis equipment to commission selected appliances.
-

Range

(AC9.4) **Factors:**

- draught conditions
- wind effects at the appliance termination
- passive stack ventilation
- extractor fans sited in the vicinity of open flued appliances

(AC9.5) **Testing procedures:**

- coring ball test
- smoke test
- flue testing procedures with appliances sited in the vicinity of extraction fans
- flue flow test

(AC9.6) **Appliances:**

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

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 10.1 clarify the types of **unsafe situation** that may be found with appliances and flue systems
- 10.2 explain the use of **general notices** and warning labels to avoid the occurrence of unsafe situations.

Range

(AC10.1) **Unsafe situation:**

- types of risk
- actions to take
- 'do not use' notices and labels
- warning notice forms

(AC10.2) **General notices:**

- commissioning certificates
- service certificates

Unit 322

Plan, install, commission, service and maintain solid mineral fuel and biomass combustion appliances

Unit level:	3
GLH:	230
Unit aim:	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.

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 1.1 identify **types of appliances**
- 1.2 define the **operating principles** of appliances
- 1.3 define the purpose of **components** of appliances.

Range

(AC1.1) **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

(AC1.2) 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

(AC1.3) 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

- biomass
 - 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

The learner will:

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

Assessment criteria

The learner can:

- 2.1 specify the types of solid mineral and biomass fuel appliances that must be installed to meet the requirements of **energy efficiency legislation**
- 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
- 2.4 describe the effects of excess CO₂ in the atmosphere.

Range

(AC2.1) **Energy efficiency legislation:**

- new properties
- replacement of boilers in existing

(AC2.3) **Central heating controls:**

- new properties

- when carrying out replacement of existing fossil fuel burning
-

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- 3.1 explain the **criteria** used when selecting appliances
 - 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.
-

Range

(AC3.1) **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)
-

Learning outcome

The learner will:

- 4 Install solid mineral fuel and biomass combustion appliances.
-

Assessment criteria

The learner can:

- 4.1 carry out **pre-installation inspection** to determine that appliances can be correctly installed
- 4.2 position, fix and connect appliances to **manufacturers' requirements**
- 4.3 take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Range

(AC4.1) 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

(AC4.2) Manufacturers' requirements:

- 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

Install

Install **one** of the following in accordance with regulatory requirements and manufacturer's instructions:

- solid mineral fuel system
- biomass fuel system (see table below).

Task	Direct observation requirements	Evidence
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 must be included in the work log. At least three of the jobs must be evidenced in the workplace.

Task	Direct observation requirements	Evidence
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Notes:

- as a minimum, learners must complete each assessment task with reference to one of the above systems.
- 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.

Learning outcome

The learner will:

- 5 Commission solid mineral fuel and biomass combustion appliances.

Assessment criteria

The learner can:

- 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 and maintenance and calibration requirements
- 5.3 carry out **a visual inspections** of appliances to confirm that they are ready to be commissioned
- 5.4 carry out **operational tests** prior to appliance light up
- 5.5 carry out operational tests on initial **appliance light up**
- 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**
- 5.9 define **actions** to take in the event that the appliance/component cannot be correctly commissioned
- 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.

Range

(AC5.2) **Equipment:**

- draught gauge
- electronic test equipment

(AC5.3) **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

(AC5.4) **Operational tests:**

- flue flow test (where required)

(AC5.5) **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)

(AC5.8) **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

(AC5.8) **Actions:**

- use of the unsafe situations procedure
- provision of suitable warning notices

(AC5.12) **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

Test, commission and handover in accordance with the manufacturer's instructions one of the following:

- solid mineral fuel system
- biomass fuel system (see table below).

Task	Direct observation requirements	Evidence
<p>Primary range:</p> <ol style="list-style-type: none"> Reading equipment (draught gauge or electronic test equipment) Visual inspections (all points in range) Flue flow test Appliance light up (all points in range) Functioning correctly (all points in range) 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 must be included in the work log.</p> <p>At least three of the jobs must be evidenced in the workplace.</p>

Notes:

- as a minimum, learners must complete each assessment task with reference to one of the above systems.
- 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.

Learning outcome

The learner will:

- Decommission solid mineral fuel and biomass combustion appliances.

Assessment criteria

The learner can:

- liaise with other persons to determine the decommissioning work to be carried out
- provide information to other persons before decommissioning work takes place
- use methods that reduce the periods during which appliances are not available to building users and provide temporary heating as appropriate
- explain the importance of arranging temporary heating to be available (if required) for the duration of decommissioning work
- isolate** the appliance from the supply source
- safely drain** and dispose of system contents
- temporarily decommission appliances
- permanently decommission appliances

- 6.9 take **precautions** to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
- 6.10 advise other persons that the appliance has been successfully decommissioned.
-

Range

(AC6.5) **Isolate:**

- turn off the electricity supply and make safe
- turn off the water supply to the system

(AC6.6) **Safely drain:**

- central heating
- hot water system
- fuel and ash system

(AC6.9) **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
-

Learning outcome

The learner will:

- 7 Carry out service, fault diagnosis and maintenance of solid mineral fuel and biomass combustion appliances.

Assessment criteria

The learner can:

- 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
- 7.4 carry out **periodic servicing** of appliances
- 7.5 perform safety checks and complete maintenance records relating to appliances
- 7.6 identify **faults** in appliances
- 7.7 interpret manufacturer 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.

Range

(AC7.4) Periodic servicing:

- visual inspection of the installation for compliance with regulation requirements
- checking of system water content
- cleaning system components
- checking for blockages
 - 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

(AC7.6) Faults:

- 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

(AC7.10) Actions:

- use of the unsafe situations procedure
- provision of suitable warning notices
- isolate appliances where appropriate
- review error codes

Fault finding

Find and rectify faults on one of the following:

- solid mineral fuel system
- biomass fuel system (see table below).

Task	Direct observation requirements	Evidence
<p>Primary range:</p> <ul style="list-style-type: none"> a. Defective firebars b. Defective thermostatic controls c. Flue performance problems d. Inadequate appliance ventilation e. Defective fans/combustion controls f. Defective door seals g. Defects in flue performance h. Defective fuel supply system i. Failure in the heat exchanger/flue cleaning system j. Failure of the ignition system k. Sensor/microprocessor faults l. Inadequate flow rate through the appliance 	<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 in the workplace.</p>

Notes:

- as a minimum, learners must complete each assessment task with reference to one of the above systems
- 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.

Service

Service in accordance with the manufacturer’s instructions one of the following:

- solid mineral fuel system
- biomass fuel system .

Task	Direct observation requirements	Evidence
<p>Primary range</p> <p>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 in the work log.</p> <p>At least three of the jobs must be evidenced in the workplace.</p>

Notes:

- as a minimum, learners must complete each assessment task with reference to one of the above systems.
- 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.

6 Summary of on-site assessment requirements

9189-04 Environmental Technologies

This specialism covers:

- solar thermal hot water systems
- rainwater harvesting and greywater reuse systems
- air source heat pump systems.

As a minimum, learners must complete each assessment task with reference to one of the above systems.

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.

Task	Direct observation requirements	Evidence
1. Install one of the following: <ul style="list-style-type: none"> • solar thermal hot water system • rainwater harvesting and greywater reuse system • 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.
2. Test, commission and handover one of the following: <ul style="list-style-type: none"> • solar thermal hot water system • rainwater harvesting and greywater reuse system • air source heat pump system. 	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.

Task	Direct observation requirements	Evidence
<p>3. Find and rectify faults on one of the following:</p> <ul style="list-style-type: none"> • solar thermal hot water system • rainwater harvesting and greywater reuse system • air source heat pump system. 	<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>
<p>4. Service one of the following:</p> <ul style="list-style-type: none"> • solar thermal hot water system • rainwater harvesting and greywater reuse system • air source heat pump system. 	<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 in the work log.</p> <p>At least three of the jobs must be evidenced from the workplace.</p>

Please refer to the range items in the relevant units for further information.

9189-05 Natural Gas

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.

Task	Direct observation requirements	Evidence
1. Install a gas system	One installation directly observed (by a competent witness or assessor) in the workplace.	To demonstrate satisfactory installation of a gas 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.
2. Test, commission and handover a gas system	One test and commission directly observed (by a competent witness or assessor) in the workplace.	To demonstrate satisfactory testing and commissioning of a gas 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.
3. Find and rectify faults on a gas system	Due to the nature of this task, no direct observation is required.	To demonstrate satisfactory fault finding and rectification on a gas 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.
4. Service a gas system	One service directly observed (by a competent witness or assessor) in the workplace.	To demonstrate satisfactory servicing of a gas 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.

Task	Direct observation requirements	Evidence
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Please refer to the range items in the relevant units for further information.

9189-06 Solid Fuel

This specialism covers:

- solid mineral fuel systems
- biomass fuel systems.

As a minimum, learners must complete each assessment task with reference to one of the above systems.

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.

Task	Direct observation requirements	Evidence
1. Install one of the following: <ul style="list-style-type: none"> • solid mineral fuel system • biomass fuel 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.
2. Test, commission and handover one of the following: <ul style="list-style-type: none"> • solid mineral fuel system • biomass fuel system. 	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.
3. Find and rectify faults on one of the following: <ul style="list-style-type: none"> • solid mineral fuel 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.

Task	Direct observation requirements	Evidence
<ul style="list-style-type: none"> biomass fuel system. 		<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>
<p>4. Service one of the following:</p> <ul style="list-style-type: none"> solid mineral fuel system biomass fuel system. 	<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 in the work log.</p> <p>At least three of the jobs must be evidenced from the workplace.</p>

Please refer to the range items in the relevant units for further information.

9189-07 Oil

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.

Task	Direct observation requirements	Evidence
1. Install an oil fuel system	<p>One installation directly observed (by a competent witness or assessor) in the workplace.</p>	<p>To demonstrate satisfactory installation of an oil fuel 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>
2. Test, commission and handover an oil fuel system	<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 an oil fuel system required across the documented ranges.</p> <p>At least five separate jobs must be included in the work log.</p>

Task	Direct observation requirements	Evidence
		At least three of the jobs must be evidenced from the workplace.
3. Find and rectify faults on an oil fuel system	Due to the nature of this task, no direct observation is required.	To demonstrate satisfactory fault finding and rectification on an oil fuel 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.
4. Service an oil fuel system	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 in the work log. At least three of the jobs must be evidenced from the workplace.

Please refer to the range items in the relevant units for further information.

Appendix 1 Relationships to other qualifications

Links to other qualifications

City & Guilds offers a series of qualifications within the Plumbing & Heating industries for qualified learners to progress onto upon completion of this qualification.

This qualification has connections to the following within the Plumbing & Heating suite offered by City & Guilds:

- 3345-21 Level 3 Award in Water Supply (Water Fittings) Regulations and Water Byelaws in the UK
- 3345-31 Level 3 Award in the Installation, Commissioning and Safety Aspects of Hot Water Systems for Domestic Use in Accordance With UK Building Regulations

3345 Water Regulations & Unvented Hot Water Systems

3345-21

To gain certification for the Level 3 Award in Water Supply (Water Fittings) Regulations and Water Byelaws in the UK candidates must have achieved a full certificate within the Level 3 6189 or 9189 suite of qualifications.

Centres can then register the learners on 3345-21 and claim the certification module 3345-820 which will then generate this certificate.

3345-31

To gain certification for the Level 3 Award in the Installation, Commissioning and Safety Aspects of Hot Water Systems for Domestic Use in Accordance With UK Building Regulations candidates must have achieved a full certificate within the Level 3 6189 or 9189 suite of qualifications.

Centres can then register the learners on 3345-31 and claim the certification module 3345-830 which will then generate this certificate.