NVQ Level 2 Diploma in Plumbing & Heating (6189-11)

Diploma in Installing and Maintaining Domestic Heating Systems (6189-21)

Qualification handbook for centres
501/1981/3
501/2102/9

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Qualification handbook for centres

Qualification title	Number	QAN
Level 2 NVQ Diploma in Plumbing and Heating	6189-11	501/1981/3
Level 2 NVQ Diploma in Installing and Maintaining Domestic Heating Systems	6189-21	501/2102/9

Version and date	Change detail	Section
2.0 November 2012	Permitted material for Unit 008 amended from CIBSE Domestic Heating Design Guide, published by CIBSE, 2007 to ISBN 1 903287 40 5 CIBSE Domestic Heating Design Guide, revised 2011	Appendix 2
3.0 October 2013	Replaced references to BS 6700 with BS EN 806	Appendix 2
3.1 November 2013	Added additional wording re BS EN 806	Test Specifications
3.2 June 2016	Changed Group statement, removed 0844 numbers. Removed references to GOLA Amended Assessment method for 6189-003	Various Assessment
3.3 September 2017	Added TQT and GLH details Deleted QCF	Introduction to the qualification Appendix

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Contents

1 Introduction to the qualifications

This document contains the information that centres need to offer the following qualifications:

Qualification title and level	GLH	TQT	City & Guilds qualification number	Qualification accreditation number	Last registration date	Last certification date
Level 2 NVQ Diploma in Installing and Maintaining Domestic Heating Systems	522	660	6189-21	501/2102/9	31/07/2015	31/07/2017
Level 2 NVQ in Plumbing and Heating	596	760	6189-11	501/1981/3	31/07/2015	31/07/2017

These qualifications allow learners to become competent to industry standards in either plumbing and heating or domestic heating. Learners are required to demonstrate the ability to perform the necessary skills and the knowledge required to be assessed against the National Occupational Standards.

These qualifications form the core element of the apprenticeship for the sector.

1.1 Qualification structure

To achieve the Level 2 NVQ Diploma in Installing and Maintaining Domestic Heating Systems, learners must achieve 66 credits from the mandatory units.

The table below illustrates the unit titles and the credit value of each unit for the above qualification, awarded to candidates successfully completing the required combination(s) of units and/or credits.

Unit reference	City & Guilds unit	Unit title	Mandatory/ optional for full qualification	Credit value	Assessment method
J/602/2479	Unit 001/201	Understand and carry out safe working practices in building services engineering	Mandatory	10	Combination
J/602/2482	Unit 002	Understand how to communicate with others within building services engineering	Mandatory	3	Knowledge

D/602/2486	Unit 003	Understand how to apply environmental protection measures within building services engineering	Mandatory	4	Knowledge
J/602/2496	Unit 004	Understand how to apply scientific principles within mechanical engineering services	Mandatory	7	Knowledge
D/602/2682	Unit 005/205	Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems.	Mandatory	10	Combination
H/602/2697	Unit 006/206	Understand and apply domestic cold water system installation and maintenance techniques	Mandatory	8	Combination
F/602/2884	Unit 007/207	Understand and apply domestic hot water system installation and maintenance techniques	Mandatory	8	Combination
Y/602/2888	Unit 008/208	Understand and apply domestic central heating system installation and maintenance techniques	Mandatory	10	Combination
T/602/2493	Unit 019	Apply safe working practices in building services engineering working environment	Mandatory	2	Performance
R/602/2971	Unit 022	Install and maintain domestic heating systems	Mandatory	4	Performance

To achieve the Level 2 NVQ Diploma in Plumbing and Heating, learners must achieve 76 credits from the mandatory units.

The table below illustrates the unit titles and the credit value of each unit for the above qualification, awarded to candidates successfully completing the required combination(s) of units and/or credits.

Unit reference	City & Guilds unit	Unit title	Mandatory/ optional for full qualification	Credit value	Assessment method
J/602/2479	Unit 001/201	Understand and carry out safe working practices in building services engineering	Mandatory	10	Combination
J/602/2482	Unit 002	Understand how to communicate with others within building services	Mandatory	3	Knowledge

		engineering			
D/602/2486	Unit 003	Understand how to apply environmental protection measures within building services engineering	Mandatory	4	Knowledge
J/602/2496	Unit 004	Understand how to apply scientific principles within mechanical engineering services	Mandatory	7	Knowledge
D/602/2682	Unit 005/205	Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems.	Mandatory	10	Combination
H/602/2697	Unit 006/206	Understand and apply domestic cold water system installation and maintenance techniques	Mandatory	8	Combination
F/602/2884	Unit 007/207	Understand and apply domestic hot water system installation and maintenance techniques	Mandatory	8	Combination
Y/602/2888	Unit 008/208	Understand and apply domestic central heating system installation and maintenance techniques	Mandatory	10	Combination
F/602/2917	Unit 009/209	Understand and apply domestic rainwater system installation and maintenance techniques	Mandatory	4	Combination
J/602/2921	Unit 010/210	Understand and apply domestic above ground drainage system installation and maintenance techniques	Mandatory	6	Combination
T/602/2493	Unit 019	Apply safe working practices in building services engineering working environment	Mandatory	2	Performance
D/602/2939	Unit 020	Install and maintain domestic plumbing and heating systems	Mandatory	4	Performance

Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
Level 2 NVQ Diploma in Installing and Maintaining Domestic Heating Systems	522	660
Level 2 NVQ in Plumbing and Heating	596	760

1.2 Opportunities for progression

Learners who have taken this qualification will be able to progress into the following qualifications:

- NVQ Level 3 Diploma in Domestic Plumbing and Heating (either gas option, oil option, solid fuel option, or environmental technologies)
- NVQ Level 3 Diploma in Domestic Heating (either gas option, oil option, solid fuel option, or environmental technologies)

1.3 Qualification support materials

City & Guilds also provides the following publications and resources specifically for these qualifications:

Description	Delivery date
Logbooks (available through Publications)	January 2011
Textbook (available through Publications)	Spring 2011
Exam Success (available through Publications)	Spring/Winter 2011
Assessment guidance delivered by APHC (available through website)	October 2010
SmartScreen (**www.smartscreen.co.uk**)	Spring/Winter 2011

2 Centre requirements

This section outlines the approval processes for Centres to offer these qualifications and any resources that Centres will need in place to offer the qualifications including qualification-specific requirements for Centre staff.

2.1 Approval process

The 6189 Level 2 NVQ Diploma in Plumbing and Heating and the Level 2 NVQ Diploma in Domestic Heating will go live in November 2010. Please note that those centres who are currently delivering both the 6089 and 6129 Level 2 schemes and have been active during the last two years will be granted automatic approval for registration.

The 6189 Level 3 NVQ Diploma in Plumbing and Heating and the Level 3 NVQ Diploma in Domestic Heating will go live in February 2011. Full approval process will apply.

2.2 Physical resources and site agreements

It is acceptable for centres to use specially designated areas within a centre to teach practical skills and to assess the simulated practical assignments within the combination units. The equipment, systems and machinery must meet current industrial standards and be capable of being used under normal working conditions,

Practical Workshop Resources – Combination Units

A General layout

The workshop should be adequate in size for the number of candidates and not constitute a hazard to health and safety whilst practical task activities are being carried out.

B Position of equipment

Benches and fixed equipment should be positioned to provide a clear and unobstructed working area, which will permit easy access in case of emergency. A passageway of one metre minimum width should be maintained between rows of benches; but where persons are working back to back between benches the space should not be less than 1.5 metres.

C Cleanliness

It is important that the workshop is kept clean and tidy; if sited upon a concrete floor, this should be sealed against dust.

D Storage facilities

The materials store should be adjacent to the workshop. This must be suitably fitted out with shelving and racks, which should ensure that tools and materials are stored in a safe and organised manner with adequate stock available and in good condition.

Note: Centres using flammable liquids and low-pressure gases must take particular account of the special requirements needed to store these items safely.

E Electrical supplies

Supplies up to and including mains voltages are permitted in the training area where these are essential for the purpose of energising training circuits. The installation of these supplies shall comply with the following:

- The mains supply shall be terminated in each cubicle using a consumer unit supplied via a lockable isolator, fixed to the wall, at a suitable height from the floor.
- Each will be fed via an individual MCB contained within a distribution board, which has a lockable lid.
- All circuits will have the protection of a 30mA residual current device.
- All supplies within the training area will be protected by an emergency stop circuit. This will be operated by suitably placed self-latching stop buttons. All emergency stop buttons will be identified using a British Standard sign. (General lighting circuits are excluded from the emergency stop circuit).
- Suitable 'Power on' visual indication is required to clearly show when individual cubicle supplies are energised.
- When workshop areas are split between locations, an audible alarm system should be installed which will bring the operation of an emergency stop button to the assessors attention. This alarm should also identify the location of the operated button.

F Reduced voltage supplies

A 110-volt supply is also required for portable electrical tools; it is desirable that this be provided via permanently wired industrial sockets placed adjacent to the point of usage. Trailing leads are not permitted in the workshop area.

G Sheet leadwork (additional unit)

Sheet lead welding must be conducted on benches which incorporate a mechanical extraction ventilation system to minimise to the lowest possible level the risk of lead fume inhalation, or alternatively sheet lead welding activities must be carried out external to the building.

H Workshop equipment

The approved centre must provide full resources to permit all the practical assignments to be completed including:

- Material & fittings
- Plumbing equipment (to a commercially acceptable standard)
- Tools and equipment

Safety

The need for candidates to wear appropriate clothing whilst in workshops or project areas cannot be over-emphasised. Candidates should wear overalls and safety shoes. Safety hats should be worn when working in any site simulation area; these areas should be designated as hard hat areas and appropriate signs displayed. All other items of Personal Protective Equipment (PPE) shall be provided and worn as appropriate. It is the responsibility of the centre to ensure that PPE is provided and worn.

A Risk assessments

The centre shall have conducted suitable and sufficient risk assessments to permit safe working on the full range of practical assignments.

B Statutory notices

Adequate wall space must be provided within the workshop to ensure that all necessary statutory and advisory notices are prominently displayed adjacent to items/locations to which they refer.

C Safety equipment

Guards shall be fitted and used on all workshop machines. They must be regularly inspected for damage and replaced when necessary. Safety glasses shall be provided adjacent to every drilling machine and threading machine used by candidates. These should be kept in a protective container, to prevent the lenses becoming scratched and dirty.

D Trained First Aiders

Should always be readily available when candidates are present in the workshop. Their names and locations should be prominently displayed in the workshop area.

E First aid boxes

These must be provided in the workshop and their contents should comply with the Health and Safety at Work legislation requirements and the current British Standard. A list of contents and an accident record book should be included in, or adjacent to, the box.

F Fire appliances

A number of fire appliances of the appropriate type must be placed in strategic positions within the workshop and should be suitable for their intended use. It is important that the centre ensures that these are regularly checked by the proper authority and that evidence of inspection is recorded on each appliance.

G Fire exits

Adequate provision must be made to allow occupants of the workshop to escape in the case of fire. All escape routes must be well lit clearly posted and always remains free from obstruction. All fire exits shall be fitted with proprietary quick release mechanisms and shall, wherever possible, open with the 'outward flow' of personnel.

H Induction

It is a mandatory awarding body requirement that a full health & safety induction is provided prior to commencing practical activities (either training or assessment) in the practical workshop.

Full detail of the workshop, material and equipment requirements and method of carrying out the assessment activities is detailed in the assessor guide to undertaking the in-centre practical assignments.

For the performance units evidence must be generated from an environment in which real work activities take place under real working conditions in keeping with real commercial situations. A specification for the minimum evidence requirements for each of the on-site performance only units is attached to the unit specification in this document.

Simulation can take place in those rare circumstances where the opportunities to collect naturally occurring evidence are limited or absent and the learner lacks evidence for completion of the unit. However, this scenario is anticipated to be rare in relation to the qualifications and the units to which this strategy applies given the inherent flexibility of the evidence-gathering process. Where simulation does take place it must be in a realistic working environment. Where it is proposed to utlilise simulation in a performance only unit approval must be initially sought from the external verifier for the approved centre.

A simulated environment such as those specified in the in-centre combination units must replicate a real working environment. The criteria for which must be to supply fit-for-purpose tools, equipment, full-size components, realistic deadlines and other commercial requirements, realistic deadlines and other commercial requirements.

Simulation **must** take place for industry identified key-safety critical aspects of the qualification. A key safety-critical aspect is defined by SummitSkills as any 'technical' activity with the potential to harm/damage personnel/property if carried out incorrectly The activities that will be undertaken to demonstrate competence in these areas are contained within each industry's 'Assessment of Occupational Competence' arrangement and this must **not** be undertaken until they are deemed ready to be assessed as competent. This underpins the assumption that the learner has sufficient technical expertise, knowledge, skill and maturity.

Key safety-critical aspects are listed below:

- Pressure testing
- Thermal pipe joining methods – welding; brazing; soldering activities
- As relevant, the installation, connection and servicing/maintenance of hot/cold water systems and equipment – backflow prevention

2.3 Human resources

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

- be technically competent in the area(s) for which they are delivering training and/or have experience of providing training. This knowledge must be at least to the same level as the training being delivered
- hold the appropriate qualifications detailed in this handbook
- have recent relevant experience in the specific area they will be assessing
- be occupationally knowledgeable in the area(s) of Plumbing and Heating for which they are delivering training. This knowledge must be at least to the same level as the training being delivered and must include up-to-date knowledge of each industry (for which the assessment is taking place), its settings, legislative and regulatory requirements, codes of practice and guidance.
- have credible experience of providing training.

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

Assessors must:

- be working towards or have achieved A1 or A2 Standards and continue to practice to those standards, or
- have achieved D32 or D33 or TQFE/TQSE **and** possess CPD evidence of practicing to A1 or A2 Standards, or
- have other suitable 'equivalent assessor qualifications' endorsed by SummitSkills, which apply the principles of the A1/A2 Standards.

Assessor occupational competence

Have verifiable relevant industry experience and current knowledge of industry working practices and techniques relevant to the occupational working area. This verifiable evidence must be **at or above the level being assessed** and include one or more of the following:

- A relevant qualification. Assessors must either be able to demonstrate that they are registered and up-to-date with their registration with an appropriate approved industry registration body or have one or more of a relevant occupational qualification to ensure

that they can be regarded as occupational competent in terms of assessing or verifying the relevant qualifications, and units therein.

- NVQs/SVQs at Level 2 as a minimum or their equivalents in the Qualifications and Credit Framework:
    - Plumbing
    - Plumbing (Domestic) (SVQ)
    - Heating and Ventilating Installation (Domestic)

If older forerunner qualifications are held such as the City & Guilds Craft Certificate in Plumbing, then the assessor must have completed CPD updating as outlined under assessor continuing professional development.

Assessment of competence-based units/qualifications for mechanical services occupations will require assessors to have the relevant qualification that certifies their competence in key technical areas pertinent to the completion of the unit/qualification.

This occupational competence must include up-to-date knowledge of each industry (for which the assessment is taking place), its settings, legislative and regulatory requirements, codes of practice and guidance.

Note:

1. In order for a domestic heating qualified assessor to assess the 009/209 rainwater unit and the 010/210 above ground sanitation unit, it must be clearly demonstrated that the qualification held fully covers rainwater and above ground sanitation systems or alternatively completion of the appropriate 6189 scheme units will be required.
2. In order for a domestic heating qualified assessor to assess the sheet lead additional units either the sheet lead 6189 scheme additional units must be held or module 1 of the City & Guilds 6055 leadworkers certificate.

Assessor continuing professional development

The occupational competence of assessors must be updated on a regular basis and be periodically reconfirmed via continuing professional development (CPD) via the assessment centres and quality assured by City & Guilds.

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

In addition where older non-6189 qualifications are held, the assessor must have demonstrable evidence of CPD updating in the following unit areas

Unit	Essential CPD updating required
001/201 & 019	Achievement of these 6189 scheme units or CSCS Card from a recognised scheme provider, IOSH Working or Managing Safely award, NEBOSH certificate
006/206	Achievement of this 6189 scheme unit or Water Regulations certification from a recognised provider
007/207	Achievement of this 6189 scheme unit or Water Regulations certification

	from a recognised provider
008/208	Achievement of this 6189 scheme unit or Building Regulations Part L1 certification from a recognised course provider

Internal verifiers

Internal verifiers role and responsibilities

The Sector Skills Council, SummitSkills, considers the main focus of IVs to be the quality assurance of assessment procedures. The IV is also required to have a minimum of occupational experience evidenced by having a Building Services Engineering sector related qualification or proven sector competence/experience plus access to relevant 'occupational expertise' to enable them to conduct their role as internal verifier appropriately. This evidence and access to 'occupational expertise' is quality assured by City & Guilds.

Internal verifiers must

- be working towards or have achieved the V1 Standard and continue to practice to that standard, or
- have achieved D34 and possess CPD evidence of practicing to the V1 Standard and
- demonstrate an understanding of the assessment process.

Internal verifiers continuing professional development

The occupational experience of IVs must be updated on a regular basis and be periodically reconfirmed via continuing professional development (CPD) via the assessment centres and quality assured by City & Guilds.

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

It is imperative that records are kept of all such CPD opportunities/occasions.

Expert witnesses

Where expert witnesses are used in the assessment process identified above they must be sector competent individuals who can attest to the learner's performance in the workplace. It is not necessary for expert witnesses to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by an expert witness. Evidence from expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency.

Expert witnesses will need to demonstrate:

- they have relevant current knowledge of industry working practices and techniques
- that they have no conflict of interest in the outcome of their evidence

2.4 Candidate entry requirements

Candidates should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

There are no formal entry requirements for candidates undertaking these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualification(s) successfully.

Age restrictions

These qualifications are not approved for use by candidates under the age of 16, and City & Guilds cannot accept any registrations for candidates in this age group.

Other legal considerations

All legal requirements related to the subject matter must be met by candidates and centres.

3 Course design and delivery

3.1 Initial assessment and induction

Centres will need to make an initial assessment of each candidate prior to the start of their programme to ensure they are entered for an appropriate type and level of qualification.

The initial assessment should identify:

- any specific training needs the candidate has, and the support and guidance they may require when working towards their qualification(s). This is sometimes referred to as diagnostic testing.
- any units the candidate has already completed, or credit they have accumulated which is relevant to the qualification(s) they are about to begin.

City & Guilds recommends that centres provide an induction programme to ensure the candidate fully understands the requirements of the qualification(s) they will work towards, their responsibilities as a candidate, and the responsibilities of the centre. It may be helpful to record the information on a learning contract.

3.2 Recommended delivery strategies

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

The SSC SummitSkills expect knowledge only and combination units to be completed before performance only units are undertaken by the candidate. Please see the Notes for Guidance section in each performance unit for more details.

Centres may design course programmes of study in any way which:

- best meets the needs and capabilities of their candidates
- satisfies the requirements of the qualification(s).

When designing and delivering the course programme, centres might wish to incorporate other teaching and learning that is not assessed as part of the qualifications. This might include the following:

- literacy, language and/or numeracy
- personal learning and thinking
- personal and social development
- employability

Where applicable, this could involve enabling the candidate to access relevant qualifications covering these skills.

For further information to assist with the planning and development of the programme, please refer to the following:

- City & Guilds log books

- Smartscreen.

4 Assessment

4.1 Summary of assessment methods

For these units/qualifications, candidates will be required to complete the following assessments:

Unit	Title	Assessment method	Where to obtain assessment materials
001/201	Understand and carry out safe working practices in building services engineering	City & Guilds e-volve Online multiple choice test (6189-001) – closed book Assignments (6189-201) for this unit 01 – Health & safety. The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to cityandguilds.com/plumbing and navigate to the 6189 webpage. Password available on Walled Garden.
002	Understand how to communicate with others within building services engineering	City & Guilds e-volve Online multiple choice test (6189-002) – closed book The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit.	Examinations provided on e-volve.
003	Understand how to apply environmental protection measures within building services engineering	City & Guilds e-volve Online multiple choice test (6189-003 – closed book The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit.	Examinations provided on e-volve.
004	Understand how to apply scientific principles within mechanical service engineering	City & Guilds e-volve Online multiple choice test (6189-004) – closed book The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit.	Examinations provided on e-volve.

Unit	Title	Assessment method	Where to obtain assessment materials
005/205	Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems	City & Guilds e-volve Online multiple choice test (6189-005) – closed book Assignments (6189-205). The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to cityandguilds.com/plumbing and navigate to the 6189 webpage. Password available on Walled Garden.
006/206	Understand and apply domestic cold water system installation and maintenance techniques	City & Guilds e-volve Online multiple choice test (6189-006) – open book .See Appendix 2 for list of approved materials for use in open book examinations. Assignment (6189-206). The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to cityandguilds.com/plumbing and navigate to the 6189 webpage. Password available on Walled Garden.
007/207	Understand and apply domestic hot water system installation and maintenance techniques	City & Guilds e-volve Online multiple choice test (6189-007) – open book. See Appendix 2 for list of approved materials for use in open book examinations. Assignments (6189-207). The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to cityandguilds.com/plumbing and navigate to the 6189 webpage. Password available on Walled Garden.

Unit	Title	Assessment method	Where to obtain assessment materials
008/208	Understand and apply domestic central heating system installation and maintenance techniques	City & Guilds e-volve Online multiple choice test (6189-008) – open book. See **Appendix 2** for list of approved materials for use in open book examinations. Assignment (6189-208). The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to **cityandguilds.com/plumbing** and navigate to the 6189 webpage. Password available on Walled Garden.
009/209	Understand and apply domestic rainwater system installation and maintenance techniques	City & Guilds e-volve Online multiple choice test (6189-009) – open book. See **Appendix 2** for list of approved materials for use in open book examinations. Assignment (6189-209) The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to **cityandguilds.com/plumbing** and navigate to the 6189 webpage. Password available on Walled Garden.
010/210	Understand and apply domestic above ground drainage system installation and maintenance techniques	City & Guilds e-volve Online multiple choice test (6189-010) – open book. See **Appendix 2** for list of approved materials for use in open book examinations. Assignment (6189-210). The assessment covers the knowledge requirement of the unit and assesses all learning outcomes to verify coverage of the unit. Externally set assignment, locally marked and externally verified.	Examinations provided on e-volve. Go to **cityandguilds.com/plumbing** and navigate to the 6189 webpage. Password available on Walled Garden.

Unit	Title	Assessment method	Where to obtain assessment materials
019	Apply safe working practices in building services engineering working environment	This unit will be assessed via observation and the development of a portfolio in a working environment and will be assessed to the assessment criteria set out in the unit.	The City & Guilds 6189 logbook can be purchased from the Walled Garden. More details are contained here: www.cityandguilds.com/publications Alternatively centres may wish to use approved e-portfolios, with more details available at www.cityandguilds.com/eportfolio
020	Install and maintain domestic plumbing and heating systems	This unit will be assessed via observation and the development of a portfolio in a working environment and will be assessed to the assessment criteria set out in the unit.	The City & Guilds 6189 logbook can be purchased from the Walled Garden. More details are contained here: www.cityandguilds.com/publications Alternatively centres may wish to use approved e-portfolios, with more details available at www.cityandguilds.com/eportfolio
022	Install and maintain domestic heating systems	This unit will be assessed via observation and the development of a portfolio in a working environment and will be assessed to the assessment criteria set out in the unit.	The City & Guilds 6189 logbook can be purchased from the Walled Garden. More details are contained here: www.cityandguilds.com/publications Alternatively centres may wish to use approved e-portfolios, with more details available at www.cityandguilds.com/eportfolio.

4.2 Assignments

Evidence requirements

The evidence requirements and City & Guilds assessment strategy for these qualifications has been designed within the confines of the SSC SummitSkills 'Consolidated Assessment Strategy for units and Qualifications of 'Occupational Competence' in the Qualifications and Credit Framework (England, Northern Ireland and Wales) for the Building Services Engineering Sector' (April 2010 v2.1a 06.10).

There are three types of units within these qualifications:

Knowledge unit A unit that gives the learner the opportunity to demonstrate

	their knowledge and understanding of identified topics and subject areas.
Performance unit	A unit that gives the learner the opportunity to demonstrate they have the practical skills that are in keeping with the relevant National Occupational Standards for identified activities.
Combination unit	A unit that gives the learner the opportunity to demonstrate their understanding and application of specific knowledge, and is assessed in simulated conditions using particularly identified "relevant practical activities".

'Knowledge' units must be undertaken in line with the City & Guilds assessment strategy for each unit as detailed in this handbook. All knowledge only units for the award are assessed by e-volve multiple choice tests.

The environment in which the evidence and the quantity of evidence for Performance units must be assessed, ie sourced from the real working environment is detailed in the 'Additional Requirements' for each Performance Unit. This could be applicable to all the Learning Outcomes in the unit or particular Learning Outcomes.

Evidence that is sourced from the real working environment for Performance units must be naturally occurring and can be generated by:

- Direct observation of performance in the workplace by a qualified assessor and/or testimony from an expert witness subject to the activity being assessed. This will be the primary source of evidence.
- Candidate's reflective account of performance.
- Work plans and work based products, eg diagrams, drawings, specifications, customer testimony, authorised and authenticated photographs/images and audiovisual records of work completed.
- Evidence from prior achievements that demonstrably match the requirements of the Performance unit.
- Witness testimony.

The notes for guidance attached to each of the performance units identify the types of evidence that will be suitable to support assessment in each of the learning outcomes. These notes also detail the minimum requirements for direct observation of performance by a qualified assessor that must be provided for specific learning outcomes.

Meeting the assessment requirements of Performance units will need initial discussions and assessment planning between the learner and Assessor, as an essential activity to identify opportunities to assess real working environment evidence, gaps that need to be filled or opportunities to recognise the prior achievement of the learner.

Competence must be demonstrated consistently over a period of time and on more than one occasion. Unless specifically stated otherwise within the unit, there is no stipulation what that period of time might be as this is a decision for the Assessor. Based on their own professional judgement Assessors must be capable of identifying when competence has been demonstrated by the learner.

4.3 Test specifications

The test specifications for the units) are below:

Test 1: Unit 001/201– Understand and carry out safe working practices in building services engineering

Duration: 110 minutes

Unit number	Outcome	No. of questions	%
001/201	1. Know the health and safety legislation that applies to the building services industry	6	11
	2. Know how to recognise and respond to hazardous situations while working in the building services industry	10	25
	3. Know the safe personal protection measures while working in the building services industry	3	5
	4. Know how to respond to accidents that occur while working in the building services industry	6	11
	5. Know the procedures for electrical safety when working in building services industry	6	11
	6. Know the methods of working safely with heat producing equipment in the building services industry	8	15
	7. Know the methods of safely using access equipment in the building services industry	7	13
	8. Know the methods of working safely in excavations and confined spaces in the building services industry	5	9
	Total	51	100

Test 2: Unit 002 Understand how to communicate with others within building services engineering

Duration: 40 minutes

Unit number	Outcome	No. of questions	%
002	1. Know the members of the construction team and their role within the building services industry	5	25
	2. Know how to apply information sources in the building services industry	9	45
	3. Know how to communicate with others in the building services industry	6	30
	Total	20	100

Test 3: Unit 003 Understand how to apply environmental protection measures within building services engineering

Duration: 50 minutes

Unit number	Outcome	No. of questions	%
003	1. Know the energy conservation legislation that applies to the building services industry	2	8
	2. Know the applications of energy sources used in building services industry	7	28
	3. Know the importance of energy conservation when commissioning building services systems	2	8
	4. Know the methods of reducing waste and conserving energy while working in the building services industry	3	12
	5. Know how to safely dispose of materials used in the building services industry	5	20
	6. Know the methods of conserving and reducing wastage of water within the building services industry	6	24
	Total	25	100

Test 4: Unit 004 MES 01 – Understand how to apply scientific principles within MES

Duration: 80 minutes

Unit number	Outcome	No. of questions	%
004	1. Know the standard units of measurement used in the mechanical services industry	3	7
	2. Know the properties of materials used in the mechanical services industry	17	43
	3. Know the relationship between energy heat and power in mechanical services industry	6	15
	4. Know the principles of force and pressure and their application in the mechanical services industry	8	20
	5. Know simple mechanical principles and their application in the mechanical services industry	2	5
	6. Know the principles of electricity as they relate to the mechanical services industry	4	10
	Total	40	100

Test 5: Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Duration: 110 minutes

Unit number	Outcome	No. of questions	%
005/205	1. Know the types of hand and power tools used for domestic plumbing and heating work	9	18
	2. Know the types of domestic plumbing and heating pipework and their jointing principles	14	23
	3. Know the general site preparation techniques for plumbing and heating work	11	24
	4. Know how to use clips and brackets to support domestic plumbing and heating pipework and components	5	11
	5. Know the installation requirements of domestic plumbing and heating pipework	8	18
	6. Know the inspection and soundness testing requirements of domestic plumbing and heating pipework	3	6
	Total	50	100

Test 6: Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Duration: 110 minutes

Unit number	Outcome	No. of questions	%
006/206	1. Know the cold water supply route to dwellings	5	9
	2. Know the types of cold system and their layout requirements	15	27
	3. Know the site preparation techniques for cold water systems and components	6	11
	4. Know the installation requirements of cold water systems and components	13	24
	5. Know the service and maintenance requirements of cold water systems and components	6	11
	6. Know the decommissioning requirements of cold water systems and components	5	9
	7. Know the inspection and soundness testing requirements of cold water systems and components	5	9
	Total	55	100

Test 7: Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Duration: 120 minutes

Unit number	Outcome	No. of questions	%
007/207	1. Know the types of hot water system and their layout requirements	22	37
	2. Know the site preparation techniques for hot water systems and components	6	9
	3. Know the installation requirements of hot water systems and components	14	25
	4. Know the service and maintenance requirements of hot water systems and components	7	11
	5. Know the decommissioning requirements of hot water systems and components	5	9
	6. Know the inspection and soundness testing requirements of hot water systems and components	6	9
	Total	60	100

Test 8: Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Duration: 120 minutes

Unit number	Outcome	No. of questions	%
008/208	1. Know the uses of central heating systems in dwellings	3	5
	2. Know the types of central heating system and their layout requirements	20	33
	3. Know the site preparation techniques for central heating systems and components	6	10
	4. Know the installation requirements of central heating systems and components	15	25
	5. Know the service and maintenance requirements of central heating systems and components	6	10
	6. Know the decommissioning requirements of central heating systems and components	6	10
	7. Know the inspection and soundness testing requirements of central heating systems and components	4	7
	Total	60	100

Test 9: Unit 009/209 Understand and apply domestic rain water system installation and maintenance techniques

Duration: 70 minutes

Unit number	Outcome	No. of questions	%
009	1. Know the general principles of gravity rain water systems	5	14
	2. Know the layout requirements of gravity rain water systems	9	25
	3. Know the site preparation techniques for gravity rain water systems	7	20
	4. Know the installation requirements of gravity rain water systems	8	23
	5. Know the service and maintenance requirements of gravity rain water systems	3	9
	6. Know the inspection and testing requirements of gravity rain water systems	3	9
	Total	35	100

Test 10: Unit 010/210 Understand and apply domestic above ground drainage systems installation and maintenance techniques

Duration: 100 minutes

Unit number	Outcome	No. of questions	%
010	1. Know the uses of sanitary appliances and their operating principles	4	8
	2. Know the types of sanitary pipe work system and system layout requirements	17	34
	3. Know the site preparation techniques for sanitary appliances and connecting pipe work systems	6	12
	4. Know the installation requirements of sanitary appliances and connecting pipe work systems	9	18
	5. Know the service and maintenance requirements of sanitary appliances and connecting pipe work systems	5	10
	6. Know the decommissioning requirements of sanitary appliances and connecting pipe work systems	6	12
	7. Know the inspection and soundness testing requirements of sanitary appliances and connecting pipe work systems	3	6
	Total	50	100

All questions reflect BS EN 806 with the exception of those relating to pressure testing which are in relation to Water Regulations.

4.4 Recording forms

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

City & Guilds endorses several ePortfolio systems. 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.

N/SVQ Recording forms are available on the City & Guilds website.

Although it is expected that new centres will 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.

Recognition of prior learning (RPL)

Recognition of Prior Learning (RPL) recognises the contribution a person's previous experience could contribute to a qualification.

City & Guilds will recognise achievement of unit/qualifications through other awarding organisations which have the same content and assessment.

5 Units

Availability of units

The units for this qualification follow.

The learning outcomes and assessment criteria are also viewable on The Register of Regulated Qualifications, **www.accreditedqualifications.org.uk**

Structure of units

The units in this qualification are written in a standard format and comprise the following:

- City & Guilds reference number
- SummitSkills unit reference number (in brackets)
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by the Sector Skills Council, SummitSkills
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Level: 2
Credit value: 10
UAN: J/602/2479

Unit aim

The combination unit provides learning in the essential health & safety job knowledge required to work safely in the Building Services Engineering Industries. The essential job knowledge covered relates to work on new-build construction sites (dwellings and industrial/commercial buildings) and refurbishment work in occupied and unoccupied properties (dwellings and industrial/commercial buildings).

The unit also provides learning in the practical application of a range of key health & safety requirements under simulated conditions.

Learning outcomes

There are **twelve** learning outcomes to this unit. The learner will:

1. Know the health and safety legislation that applies to the building services industry
2. Know how to recognise and respond to hazardous situations while working in the building services industry
3. Know the safe personal protection measures while working in the building services industry
4. Be able to apply manual handling techniques
5. Know how to respond to accidents that occur while working in the building services industry
6. Know the procedures for electrical safety when working in the building services industry
7. Be able to apply basic electrical safety measures in the building services industry
8. Know the methods of working safely with heat producing equipment in the building services industry
9. Be able to safely work with gas heating equipment in the building services industry
10. Know the methods of safely using access equipment in the building services industry
11. Be able to safely use access equipment in the building services industry
12. Know the methods of working safely in excavations and confined spaces in the building services industry

Guided learning hours

It is recommended that **88** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M1

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- e-volve on-line knowledge assessment and externally set assignment.

Unit 001/201 Understand and carry out safe working practices in building services engineering

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

Assessment Criteria

The learner can:

1. State the aims of health and safety legislation in protecting the workforce and members of the public:
   - General legislation.
   - Construction specific legislation.
   - Building services specific legislation.
2. Identify the responsibilities of members of the construction team under health and safety legislation:
   - Employers (including employer representatives).
   - Designers.
   - Main contractors.
   - Sub-contractors.
   - Employees.
   - Self-employed (labour only)
   - Clients (customers).
3. State the legal status of health and safety guidance materials:
   - Acts of Parliament.
   - Regulations.
   - Approved Codes of Practice.
   - HSE Guidance Notes.
4. State the role of enforcing authorities under health and safety legislation:
   - Health and Safety Executive.
   - Local Authority.
5. Identify the powers of inspectors under Health and Safety legislation:
   - Improvement notice.
   - Prohibition notice.
   - Powers of prosecution.
   - Role in providing advice and guidance.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 2 Know how to recognise and respond to hazardous situations while working in the building services industry

Assessment Criteria

The learner can:

1. Identify the types of general site hazards that may be encountered while at work:
   - Site/work area cleanliness:
     - Tripping hazards.
     - Slipping hazards.
   - Using equipment:
     - Inadequate or lack of personal protective equipment.
     - Defective (unsafe) equipment.
   - Personal conduct:
     - Manual handling.
     - Working at heights.
2. State the potential dangers to the workforce and members of the public when work is carried out:
   - on construction sites (all property types)
   - in industrial commercial premises (occupied and unoccupied refurbishment)
   - in dwellings (occupied and unoccupied refurbishment)
3. Identify the methods that can be used to prevent accidents or dangerous situations occurring during work activities:
   - Working practices (use and understanding of):
     - Method statements.
     - Permit to work systems.
     - Risk assessments.
   - Safety notices (use and understanding of):
     - Mandatory signs.
     - Prohibition signs.
     - Hazard signs.
     - Fire fighting signs.
     - Safe condition signs.
     - Combination signs.
4. Identify how hazardous substance legislation classifies substances and the direct precautions to be taken while working with those substances:
   - Toxic.
   - Harmful.
   - Corrosive.
   - Irritant.
   - Oxidising.
   - Extremely flammable.

5. Identify the general precautions necessary for working with commonly encountered substances:
    - Lead - solid and fume.
    - Solvents and lubricants.
    - Fluxes.
    - Jointing compounds.
    - Sealants.
    - Gases – LPG, oxy-acetylene and carbon dioxide.
    - Cleaning agents.
6. State the range of common building materials and services components that may contain asbestos
7. Identify the types of asbestos that may be encountered in the workplace:
    - White asbestos (Chrysotile).
    - Brown or grey asbestos (Amosite).
    - Blue asbestos (Crocidolite).
    - Asbestos cement materials.
8. State the procedures that must be used to safely work with asbestos cement based materials:
    - Flue, soil, rainwater pipes and gutters.
    - Tanks and cisterns.
    - Artex.
    - Small gaskets and seals.
9. Identify the actions to be taken when asbestos is encountered while undertaking work activities:
    - Protection of the workforce and members of the public.
    - Licensing requirements for asbestos removal organisations.
    - Safe disposal requirements.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 3 Know the safe personal protection measures while working in the building services industry

Assessment Criteria

The learner can:

1. State the purpose of, and application of protective equipment:
   - Clothing protection including high visibility.
   - Eye protection.
   - Hand protection.
   - Head protection.
   - Foot protection.
   - Hearing protection.
   - Respiratory protection.
2. Identify the procedures for manually handling heavy and bulky items:
   - Assessment of a safe load that a person can lift.
   - Application of safe kinetic lifting technique.
   - Use of simple mechanical lifting aids – sack trolley.
   - Application and use of mechanical lifting aids on large construction sites.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 4 Be able to apply manual handling techniques

Assessment Criteria

The learner can:

1. Perform manual handling of heavy and bulky items:
   - Plan the lift.
   - Safely move the load.
   - Assist in a two-person lift.
2. Manually handle loads using mechanical lifting aids.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 5 Know how to respond to accidents that occur while working in the building services industry

Assessment Criteria

The learner can:

1. Identify the requirements for first aid provision while working:
   - in small occupied properties
   - on construction sites (new-build and refurbishment)
2. Identify the actions that should be taken when an accident or emergency is discovered:
   - Raising the alarm.
   - The role of the emergency services and contact methods.
   - Typical emergency evacuation procedures.
3. State the procedures for dealing with minor injuries that can occur while working:
   - Cuts.
   - Minor burns.
   - Objects in the eye.
   - Exposure to fumes.
4. State the procedures for dealing with major injuries that can occur while working:
   - Bone fractures.
   - Unconscious co-workers:
     - Placing the casualty in the recovery position.
     - Concussion.
   - Electric shock:
     - Removal from the supply.
     - CPR method.
5. State the procedures for recording accidents and near misses at work:
   - Statutory requirements for the reporting of accidents/serious occurrences.
   - The use of company accident books.
   - The details to be recorded on a simple accident/incident report form.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 6 Know the procedures for electrical safety when working in the building services industry

Assessment Criteria

The learner can:

1. Identify the common electrical dangers encountered on construction sites and in private dwellings:
   - Faulty electrical equipment.
   - Signs of damaged or worn electrical cables – power tools and property hard wiring system.
   - Trailing cables.
   - Proximity of cables to services pipework.
   - Buried/hidden cables.
   - Inadequate over-current protection devices.
2. Identify the methods of safely using electrical tools and equipment on site:
   - Battery powered supplies.
   - 110 volt supplies.
   - 230 volt supplies.
3. Identify how to conduct a visual inspection of a power tool for safe condition before use:
   - Checking for a valid PAT test.
   - Inspection for general condition.
4. State the procedure that should be applied for tools and equipment that fail safety checks
5. State the electrical industry safe isolation procedure that should be applied to building services equipment before carrying out work on them
6. State the use of temporary continuity bonding when working on pipework components.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 7 Be able to apply basic electrical safety measures in the building services industry

Assessment Criteria

The learner can:

1. Demonstrate the electrical industry safe isolation procedure to safely isolate an item of fixed mechanical or electrical plant or equipment
2. Carry out a visual safety inspection of power tools before use and report on their condition
3. Demonstrate the application of temporary continuity bonding when cutting into a fixed metallic pipework system.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 8 Know the methods of working safely with heat producing equipment in the building services industry

Assessment Criteria

The learner can:

1. Identify the various types of gases used in pipe and sheet jointing processes:
   - Bottle colours.
   - Properties of the gases used.
   - Uses within the industry.
2. Identify how bottled gases and equipment should be safely transported and stored
3. Identify the various types of heat producing equipment and how to check them for safety
   - Hoses:
     - Colours used.
     - Thread directions.
     - Flashback arrestors.
   - Control valves.
   - Gauges.
   - Blowpipes.
   - Direct connecting combined units (aeration in the nozzle).
4. Identify how gas heating equipment is safely assembled and used:
   - Bottle location and position.
   - Equipment assembly sequence.
   - Leak detection procedures.
   - Safe purging procedure.
   - Safe lighting and extinguishing procedure.
   - Actions in the event of leakage.
5. Identify the three elements of the fire triangle and how combustion takes place
6. State the dangers of working with heat producing equipment and how to prevent fires occurring
7. State the method for fighting small localised fires that can occur in the workplace:
   - When to avoid tackling fires.
   - Types of extinguisher.
   - Selection of extinguisher by fire type.
   - Method of use.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 9 Be able to safely work with gas heating equipment in the building services industry

Assessment Criteria

The learner can:

1. Perform a safety check of gas heating equipment:
   - Transportation of gas bottles to the work area.
   - Assess components and equipment for safety.
2. Perform the safe assembly of gas heating equipment for use:
   - Hose and blowpipe or combined unit attachment.
   - Leak detection procedures.
   - Purging procedures.
   - Lighting and extinguishing procedures.
3. Demonstrate the use of a fire extinguisher in extinguishing a small solid fuel fire.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 10 Know the methods of safely using access equipment in the building services industry

Assessment Criteria

The learner can:

1. Identify the situations where it may be necessary to work at height
2. Identify the types of equipment used to permit work at heights in the building services industry:
   - Step ladders.
   - Ladders.
   - Mobile mini towers/scaffolds.
   - Roof ladders and crawling boards.
   - Mobile tower scaffolds.
   - Fixed scaffolds and edge protection.
   - Mobile elevated work platforms including scissor lifts and cherry pickers.
3. Identify how to select suitable equipment for carrying out work at heights based on the work being carried out
4. State the range of safety checks to be carried out on access equipment before it is used:
   - Step ladders.
   - Ladders.
   - Mobile mini towers/scaffold.
   - Roof ladders and crawling boards.
   - Mobile tower scaffolds.
   - Fixed scaffolds and edge protection (appreciation only).
5. State the method of assembly and use of access equipment:
   - Step ladders.
   - Ladders.
   - Roof ladders.
   - Mobile tower scaffolds.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 11 Be able to safely use access equipment in the building services industry

Assessment Criteria

The learner can:

1. Demonstrate the safe method of assembly and use of:
   - Step ladders
   - Ladders
2. Demonstrate the safe method of assembly and use of mobile tower scaffolds.

Unit 001/201 Understand and carry out safe working practices in building services engineering

Outcome 12 Know the methods of working safely in excavations and confined spaces in the building services industry

Assessment Criteria

The learner can:

1. Identify the situations in which it may be necessary to work in excavations
2. State how excavations should be prepared for safe working:
   - Safe access into the excavation.
   - Trench support systems.
3. State the measures that need to be applied to prevent persons or equipment falling into excavations:
   - Use of warning signs.
   - Use of barriers for pedestrians.
   - Vehicle proximity to excavation edges.
4. Identify where work in confined spaces may be required
5. State the potential dangers when working in confined spaces:
   - Drainage systems.
   - Plant rooms.
   - Main service duct-rooms.
   - In tanks, cylinders, boilers or cisterns.
   - Under suspended timber floors.
   - In roof spaces.

Unit 002 Understand how to communicate with others within Building Services Engineering

Level: 2
Credit value: 3
UAN: J/602/2482

Unit aim

This knowledge unit provides learning in the development and continued maintenance of effective working relationships in the building services industry associated with work in dwellings, industrial and commercial premises and for private and contract type clients.

Learning outcomes

There are three learning outcomes to this unit. The learner will:

1. Know the members of the construction team and their role within the building services industry
2. Know how to apply information sources in the building services industry
3. Know how to communicate with others in the building services industry

Guided learning hours

It is recommended that 28 hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M3

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- a e-volve on-line knowledge assessment.

Unit 002 Understand how to communicate with others within Building Services Engineering

Outcome 1 Know the members of the construction team and their role within the building services industry

Assessment Criteria

The learner can:

1. Identify the key roles of the site management team:
   - Architect.
   - Project manager/Clerk of Works.
   - Structural engineer.
   - Surveyor.
   - Building services engineer.
   - Quantity surveyor.
   - Buyer.
   - Estimator.
   - Contracts manager.
   - Construction manager.
2. Identify the key roles of the individuals that report to the site management team:
   - Sub contractors.
   - Site supervisor.
   - Trade supervisor.
   - Trades:
     - Bricklayer.
     - Joiner.
     - Plasterer.
     - Tiler.
     - Electrician.
     - H&V fitter.
     - Gas fitter.
     - Decorator.
     - Groundworkers.
3. Identify the key roles of site visitors:
   - Building control inspector.
   - Water inspector.
   - HSE inspector.
   - Electrical services inspector.

Unit 002 Understand how to communicate with others within Building Services Engineering

Outcome 2 Know how to apply information sources in the building services industry

Assessment Criteria

The learner can:

1. Identify the types of statutory legislation and guidance information that applies to working in the industry:
   - Legislation:
     - Data protection.
     - Equal opportunities.
     - Health & safety.
     - Employment.
   - Regulations.
   - British standards.
   - Codes of practice.
   - Manufacturer guidance:
     - Installation instructions.
     - Service & maintenance instructions.
     - User instructions.
2. Identify the purpose of information that is used in the workplace:
   - Job specifications.
   - Plans/drawings.
   - Work programmes.
   - Delivery notes.
   - Time sheets.
   - Policy documentation – Health and Safety, environmental, customer service.
3. Identify the purpose of information given to customers:
   - Quotations.
   - Estimates.
   - Invoices/statements.
   - Statutory cancellation rights.
   - Handover information.
4. State the importance of company policies and procedures that affect working relationships:
   - Company working policies/procedures:
     - Behaviour.
     - Timekeeping.
     - Dress code.
     - Contract of employment.
   - Limits to personal authority:
     - Apprentices.
     - Level 2 qualified staff.
     - Level 3 qualified staff.
   - Supervisor and management responsibilities.

Unit 002 Understand how to communicate with others within Building Services Engineering

Outcome 3 Know how to communicate with others in the building services industry

Assessment Criteria

The learner can:

1. Identify suitable communication methods for use in work situations:
   - Oral communication.
   - Written communication:
     - E-mail.
     - Fax.
     - Letter.
2. Define methods of effective communication for people with:
   - Physical disabilities
   - Learning difficulties
   - Language differences:
     - Dialects.
     - Accents.
     - Foreign and second language issues.
3. State the actions to take to deal with conflicts between:
   - Customers and operatives
   - Co-workers
   - Supervisors and operatives
4. State the effects that poor communication may have on an organisation:
   - Between operatives.
   - Between operatives and management.
   - Company to customer.

Unit 003 Understand how to apply environmental protection measures within BSE

Level: 2
Credit value: 4
UAN: D/602/2486

Unit aim

The knowledge unit provides learning in a range of basic measures associated with protection of the environment. Areas covered include the effective use of material resources, minimising wastage. The legislation surrounding the effective use of energy and water resources including an introduction to the use of environmental emerging technologies is also covered in the unit.

Learning outcomes

There are six learning outcomes to this unit. The learner will:

1. Know the energy conservation legislation that applies to the building services industry
2. Know the applications of energy sources used in the building services industry
3. Know the importance of energy conservation when commissioning building services systems
4. Know the methods of reducing waste and conserving energy while working in the building services industry
5. Know how to safely dispose of materials used in the building services industry
6. Know the methods of conserving and reducing wastage of water within the building services industry

Guided learning hours

It is recommended that 38 hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M2.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- a e-volve on-line assessment.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 1 Know the energy conservation legislation that applies to the building services industry

Assessment Criteria

The learner can:

1. State the aims of energy conservation legislation:
   - General legislation.
   - Construction specific legislation.
   - Building services specific legislation.
2. Identify the responsibilities of members of the construction team under energy conservation legislation:
   - Clients (customers).
   - Designers.
   - Employers.
   - Employees.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 2 Know the applications of energy sources used in the building services industry

Assessment Criteria

The learner can:

1. Identify the types of energy used in properties:
   - High carbon:
     - Natural Gas / LPG.
     - Fuel oils.
     - Solid fuels (coal and peat).
     - Electricity (from non-renewable sources).
   - Low carbon:
     - Solar thermal.
     - Solid fuel (biomass).
     - Hydrogen fuel cells.
     - Heat pumps.
     - Combined heat & power (CHP).
     - Combined cooling, heat & power (CCHP).
   - Zero Carbon:
     - Electricity – wind.
     - Electricity – tidal.
     - Hydroelectric.
     - Solar photovoltaic.
2. Identify the basic operating principles of installations containing environmental energy sources:
   - Solar thermal.
   - Solid fuel (biomass).
   - Heat pumps (water, air and ground source).
   - Combined heat & power (CHP).
   - Combined cooling, heat & power (CCHP).
   - Wind turbine.
   - Solar photovoltaic.
3. Identify organisations which give guidance and advice on energy saving and conservation techniques
4. Identify how to use energy rating tables and their effect on component selection
5. State where to find information on alternative energy sources.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 3 Know the importance of energy conservation when commissioning building services systems

Assessment Criteria

The learner can:

1. State the role of the commissioning process in conserving energy usage
2. State the actions to be covered during the system handover procedure to the customer that will contribute to conserving energy usage.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 4 Know the methods of reducing waste and conserving energy while working in the building services industry

Assessment Criteria

The learner can:

1. Identify the working practices that can be employed to conserve energy and protect the environment
2. State the methods used for reducing material wastage:
   - Planning work activities.
   - Accurate measurement and cutting.
3. Identify the methods of conserving material usage:
   - Reducing material over ordering.
   - Minimising damage to stored materials.
   - Prevention of loss/theft.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 5 Know how to safely dispose of materials used in the building services industry

Assessment Criteria

The learner can:

1. Identify the statutory legislation for waste management on construction sites
2. State the methods of safely disposing of waste materials:
   - Licensed waste disposal.
   - Waste carriers license.
   - Recycling.
   - Specialist disposal – asbestos and other forms of hazardous waste.
3. Specify the approved processes for recycling materials:
   - Metals.
   - Plastics.
   - Wood/cardboard.
4. Identify the disposal requirements of potentially hazardous materials:
   - Asbestos.
   - Electrical and electronic equipment.
   - Refrigerants (fluorinated gases).
5. Identify what action to take if work activities endanger the environment.

Unit 003 Understand how to apply environmental protection measures within BSE

Outcome 6 Know the methods of conserving and reducing wastage of water within the building services industry

Assessment Criteria

The learner can:

1. Identify the statutory legislation for water wastage and misuse
2. State the criteria for water efficiency calculations for new dwellings
3. State the methods for reducing water wastage:
   - Flow reducing valves.
   - Spray taps.
   - Low volume flush WC.
4. Identify the methods available for capturing surface water and recycling used water
5. Identify the uses of captured and recycled water in properties
6. State the basic working principles of captured and recycled water systems:
   - Rain water harvesting.
   - Grey water systems.

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Level: 2
Credit value: 7
UAN: J/602/2496

Unit aim

This knowledge unit provides learning in the essential scientific principles that underpin the installation, commissioning and maintenance requirements of systems and components in the Mechanical Engineering Services Industries. The unit also provides learning in a range of basic calculation methodologies underpinning system and component design.

Learning outcomes

There are six learning outcomes to this unit. The learner will:

1. Know the standard units of measurement used in the mechanical services industry
2. Know the properties of materials used in the mechanical services industry
3. Know the relationship between energy, heat and power in the mechanical services industry
4. Know the principles of force and pressure and their application in the mechanical services industry
5. Know simple mechanical principles and their application in the mechanical services industry
6. Know the principles of electricity as they relate to the mechanical services industry

Guided learning hours

It is recommended that 66 hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

N/A

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by:

- a e-volve on-line knowledge assessment.

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 1 Know the standard units of measurement used in the mechanical services industry

Assessment Criteria

The learner can:

1. State the application and use of internationally recognised (SI) units of measurement:
    - Metre (length) m.
    - Kilogram (mass) kg.
    - Second (time) s.
    - Kelvin (temperature) °K.
2. State the application and use of SI derived units:
    - Area (m^2).
    - Volume (m^3):
    - Litres (L).
    - Density (kg/m^3).
    - Velocity (m/s).

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 2 Know the properties of materials used in the mechanical services industry

Assessment Criteria

The learner can:

1. Calculate the relative densities of common materials:
    - Relative density to air.
    - Relative density to water.
2. State the principle applications of solid materials used in the mechanical services industry:
    - Metals:
        - Pure metals.
        - Ferrous metals.
        - Alloys including solders.
    - Plastics:
        - Thermo plastics.
        - Thermo-setting plastics.
    - Fireclays/ceramics.
3. Identify the detailed properties of solid materials:
    - Strength – tensile and compressive.
    - Hardness.
    - Ductility.
    - Malleability.
    - Conductivity – heat and electricity.
4. State the reasons why solid materials breakdown:
    - Atmospheric corrosion:
        - Oxidisation of metals.
    - UV damage to plastics.
    - Heat damage to plastics.
    - Electrolytic corrosion:
        - Electromotive series.
        - Dissimilar metals in the presence of an electrolyte (water).
    - Erosion corrosion.
    - Methods of preventing corrosion.
5. State the principle applications and basic properties of liquids used in the mechanical services industry:
    - Water.
    - Refrigerant.
    - Anti-freeze/glycol mixes.
    - Fuel oils.
    - Lubricants/greases.

6. Identify the detailed properties of 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.
7. State the principle applications of gases used in the mechanical services industry:
    - Air & steam.
    - LPG.
    - Natural gas.
    - Carbon dioxide.
    - Refrigerant gases.
8. Identify the detailed properties of gases:
    - Pressure exerted by a gas.
    - Volume occupied by a gas.
    - Temperature of gases found within the industry.
    - Gas Laws:
        - Charles's law.
        - Boyle's law.
    - Heat pump/refrigeration cycle.

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 3 Know the relationship between energy, heat and power in the mechanical services industry

Assessment Criteria

The learner can:

1. Identify the relationship between the Celsius and Kelvin temperature scales:
   - Units of temperature measurement.
   - Temperature measurement devices used.
2. Identify the terminology associated with a change of state:
   - Melting.
   - Freezing.
   - Boiling.
   - Evaporating.
   - Condensing.
3. Identify the terms latent and sensible heat as they apply to liquids and gases
4. Identify the methods of heat transfer:
   - Conduction in solids.
   - Convection in liquids and gases.
   - Radiation between two bodies.
5. State how units of energy and heat are related and derived:
   - Energy – Joules (J).
   - Specific heat capacity (kJ/kg/°C).
   - Power – Watts (W).
6. State how to carry out simple heat, energy and power calculations:
   - Simple temperature calculations.
   - Quantity of heat energy required to raise the temperature of a substance.
   - The amount of power required to heat a substance.

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 4 Know the principles of force and pressure and their application in the mechanical services industry

Assessment Criteria

The learner can:

1. State how units of force and pressure are derived from SI units:
   - Acceleration (m/s^2):
     - Force due to gravity.
   - Force - Newton (N).
   - Pressure (N/m^2):
     - Atmospheric pressure.
     - Principles of the siphon.
   - Flow rate (m^3/s).
2. State the application and use of units of measurement of pressure and flow rate:
   - Pressure:
     - Bar / millibar.
     - kPa.
     - Psi.
     - Metre head.
   - Flow rate:
     - M^3/s.
     - l/s.
     - kg/s.
3. State how to carry out simple force and pressure calculations:
   - Simple force calculations.
   - Pressure head.
   - Simple pressure calculations:
     - Static pressure.
     - Dynamic pressure.
4. Identify the relationship between velocity, pressure and flow rate in systems:
   - Effects of increasing/reducing pressure on velocity and flow rate.
   - Effects of increasing/reducing pipe size on velocity and flow rate at constant pressure.
5. Identify the reasons why pipework restricts the flow of liquids and gases:
   - Changes of direction, bends and tees.
   - Pipe size.
   - Pipe reductions.
   - Roughness of material surface.
   - Constrictions such as valves.

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 5 Know simple mechanical principles and their application in the mechanical services industry

Assessment Criteria

The learner can:

1. State the principles behind simple machines:
    - Mechanical advantage.
    - Velocity ratio:
        - Levers.
        - Wheel and axle.
        - Pulleys.
        - Screws.
2. Identify the principles of basic mechanics:
    - Theory of moments.
    - Action & reaction.
    - Centre of gravity.
    - Equilibrium

Unit 004 Understand how to apply scientific principles within mechanical services engineering

Outcome 6 Know the principles of electricity as they relate to the mechanical services industry

Assessment Criteria

The learner can:

1. State the basic principles of electron flow theory:
   - Measurements of electrical flow.
   - Material conductivity and resistance.
   - Direct and alternating current.
2. State the purpose and application of simple units of electrical measurement for use in the mechanical services industry:
   - Current (Amps).
   - Voltage (Volts).
   - Resistance (Ohms).
   - Power (Watts).
3. State how to carry out simple electrical calculations:
   - Ohm's law.
   - Power consumption of electrical circuits.
   - Basic over-current protection device size.
   - Voltage, current and resistance in series and parallel circuits.
4. Identify the requirements for earthing of electrical circuits.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Level: 2
Credit value: 10
UAN: D/602/2682

Unit aim

This combination unit provides learning in a range of basic pipework competences that underpin work on plumbing and heating systems. The unit also provides an introduction to the range of work activities carried out in plumbing and heating as well as methods of checking that pipework and plumbing and heating components are leak free.

Learning outcomes

There are ten learning outcomes to this unit. The learner will:

1. Know the types of hand and power tools used for domestic plumbing and heating work
2. Know the types of domestic plumbing and heating pipework and their jointing principles
3. Know the general site preparation techniques for plumbing and heating work
4. Be able to apply general site preparation techniques for domestic plumbing and heating work
5. Know how to use clips and brackets to support domestic plumbing and heating pipework and components
6. Be able to apply fixings and brackets to domestic plumbing and heating pipework and components
7. Know the installation requirements of domestic plumbing and heating pipework
8. Be able to install domestic plumbing and heating pipework
9. Know the inspection and soundness testing requirements of domestic plumbing and heating pipework
10. Be able to inspect and soundness test domestic plumbing and heating pipework

Guided learning hours

It is recommended that 88 hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by a e-volve on-line knowledge assessment and externally set assignments.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 1 Know the types of hand and power tools used for domestic plumbing and heating work

Assessment Criteria

The learner can:

1. State the purpose of hand and power tools used to carry out work on plumbing and heating systems
2. Identify the different types of hand and power tools used to carry out work on plumbing and heating systems
3. State how to safely use and maintain hand and power tools to carry out work on plumbing and heating systems:
   - Screwdrivers.
   - Hammers.
   - Chisels.
   - Grips.
   - Wrenches.
   - Spanners.
   - Spirit levels.
   - Manual pipe threaders.
   - Pipe cutters.
   - Hand saws.
   - Pliers.
   - Bending Tools.
   - Power drills.
   - Drill bits.
   - Circular saws.
   - Jig saws.
   - Portable pipe threading machines.
   - Hydraulic machine benders.
   - Portable pipe freezing kits.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 2 Know the types of domestic plumbing and heating pipework and their jointing principles

Assessment Criteria

The learner can:

1. Identify pipework materials used in domestic plumbing and heating work:
   - 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.
2. State the range of typical pipe material sizes available for use in dwellings:
   - Copper.
   - Low carbon steel.
   - MDPE.
   - Polybutylene.
   - PVC-u.
   - Polypropylene.
   - MUPVC.
   - ABS.
3. State the acceptable methods of jointing new hot and cold water pipe to existing lead pipework
4. Identify the general fitting types used in dwellings:
   - Couplers.
   - Elbows and bends.
   - Equal tees.
   - Reducing tees.
   - Reducers.
   - Tap connectors.
   - Flexible connectors.
   - Manifolds.
   - Specialist fittings such as tank connectors.

5. State the methods of jointing pipework used in dwellings:

- Copper pipe:
    - Solder ring.
    - End feed.
    - Compression (type A and B).
    - Push-fit.
    - Press-fit.
- Low Carbon steel (LCS) pipe:
    - Threaded.
    - Compression eg Viking.
- Plastic pipe (hot, cold and heating):
    - Push-fit.
    - Compression.
    - Proprietary (between lead and MDPE).
- Plastic pipe (sanitary):
    - Ring seal.
    - Solvent weld.
    - Compression.

6. State the methods of bending pipework used in dwellings:
    - Copper spring bending:
        - 90° bends.
        - Sets and offsets 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.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 3 Know the general site preparation techniques for plumbing and heating work

Assessment Criteria

The learner can:

1. Define the typical range of activities to be carried out when working on plumbing and heating systems:
   - Preparing work sites.
   - Designing and selecting materials and equipment.
   - Installing systems and components.
   - Maintaining and dealing with faults on systems and components.
   - Decommissioning systems and components – temporary and permanent.
   - Soundness testing systems and components.
   - Commissioning systems and components.
2. State what information should be passed on to the customer when carrying out work on domestic pipework systems
3. Identify how to check for pre-existing damage to the building fabric or customer property before the work commences
4. Identify how to protect the building fabric or customer property before the work commences:
   - Use of dust sheets.
   - Protection from flame damage.
   - Use of walking boards – lawns/flower beds.
   - Application of packaging to protect components during partially completed works.
   - Circumstances in which furniture, breakable items and carpets need to be removed from the work area.
   - Circumstances in which damage to vehicles may occur.
5. Identify the method of storing tools, equipment and materials when working in new buildings and existing dwellings:
   - Prevention of theft.
   - Avoiding loss and wastage.
   - Minimising damage.
6. Identify the range of hand and power tools required to complete work on domestic pipework systems
7. State the checks to be carried out on tools and equipment to ensure that they work correctly and are correctly calibrated
8. State the work methods for preparing building construction features for installation work:
   - Holes in masonry surfaces – hammer and chisel, large power drill.
   - Making good to masonry surfaces.
   - Lifting and replacing timber flooring materials.
   - Notching timber floor joists.
   - Drilling holes – timber floor joists.
   - Cutting chases – wall and floor surfaces.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 4 Be able to apply general site preparation techniques for domestic plumbing and heating work

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access and exit.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/ method statements are available and worked to.
2. Wear personal protective equipment relevant to the installation, decommissioning or maintenance task being carried out
3. Select the hand and power tools required to complete work on domestic pipework systems
4. Check that tools and equipment selected for work on the installation of domestic pipework systems are safe to use and are correctly calibrated.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 5 Know how to use clips and brackets to support domestic plumbing and heating pipework and components

Assessment Criteria

The learner can:

1. State how to measure and mark out for fixings to pipework and plumbing and heating components
2. Identify the range of general fixing devices:
    - Nails:
        - For timber.
        - For masonry.
    - Screws:
        - Slotted head.
        - Phillips head.
        - Pozidrive.
        - Plastic plugs.
    - Heavy duty fixings:
        - Coach bolts.
        - Rawl bolts.
3. Identify the range of specialist fixing devices:
    - Cavity fixings.
    - Drive in fixings.
4. Identify clip and bracket types for domestic plumbing and heating work:
    - Copper pipework – hot, cold and central heating.
    - LCS pipework – central heating.
    - Plastic pipework – hot, cold, central heating and sanitation pipework.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 6 Be able to apply fixings and brackets to domestic plumbing and heating pipework and components

Assessment Criteria

The learner can:

1. Measure and mark out for fixings to pipework and plumbing and heating components
2. Fix pipework clips and brackets at recommended spacing intervals:
    - Copper pipework.
    - LCS pipework.
    - Plastic pipework.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 7 Know the installation requirements of domestic plumbing and heating pipework

Assessment Criteria

The learner can:

1. Identify the methods of installing domestic plumbing and heating pipework:
   - Prefabrication of pipework.
   - Installing pipework in-situ.
   - Use of sleeves.
   - Firestopping to pipework.
2. Identify how to select pipework materials and fittings from instructions including plans and drawings:
   - Copper pipework – hot, cold and central heating.
   - LCS pipework – central heating.
   - Plastic pipework – hot, cold, central heating and sanitation.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 8 Be able to install domestic plumbing and heating pipework

Assessment Criteria

The learner can:

1. Accurately measure, mark and cut pipework materials for bending and jointing:
   - Copper pipework – hot, cold and central heating.
   - LCS pipework – central heating.
   - Plastic pipework – hot, cold, central heating and sanitation pipework.
2. Bend domestic pipework to clear obstacles:
   - Copper machine bending:
     - 90° bends.
     - Sets and offset bends.
     - Passover bends.
   - LCS Hydraulic machine bending:
     - 90° bends.
     - Sets and offset bends.
     - Passover bends.
   - Plastic (hot, cold and heating):
     - Cabling technique.
3. Position and fix domestic pipework to specifications:
   - Copper pipework – hot, cold and central heating.
   - LCS pipework – central heating.
   - Plastic pipework – hot, cold, central heating and sanitation pipework.
4. Joint domestic pipework systems to specifications:
   - Copper pipe:
     - Solder ring and end feed.
     - Compression (type A and B).
     - Push-fit.
     - Press-fit.
   - Low Carbon steel (LCS) pipe:
     - Hand and machine threaded.
   - Plastic pipe (hot, cold and heating):
     - Push fit.
     - Compression.
     - Proprietary - copper and MDPE.
   - Plastic jointing (sanitary):
     - Ring seal.
     - Compression.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 9 Know the inspection and soundness testing requirements of domestic plumbing and heating pipework

Assessment Criteria

The learner can:

1. Identify the requirements of, and carry out a visual inspection of pipework to confirm that it is ready to be filled with water
2. State how to carry out a soundness test on domestic plumbing and heating pipework:
   - Metallic pipework.
   - Plastic pipework.

Unit 005/205 Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

Outcome 10 Be able to inspect and soundness test domestic plumbing and heating pipework

Assessment Criteria

The learner can:

1. Fill pipework with water at normal operating pressure and check for leakage
2. Perform a soundness test on domestic plumbing and heating pipework:
    - Metallic pipework.
    - Plastic pipework.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Level: 2
Credit value: 8
UAN: H/602/2697

Unit aim

This combination unit provides learning in the installation, maintenance, decommissioning and soundness testing of a basic range of cold water system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The unit covers systems in buildings up to 3 storeys in height with pipework up to 28mm diameter. The scope of the system is from the boundary stop valve into the property feeding the water outlets.

Learning outcomes

There are **twelve** learning outcomes to this unit. The learner will:

1. Know the cold water supply route to dwellings
2. Know the types of cold water system and their layout requirements
3. Know the site preparation techniques for cold water systems and components
4. Be able to apply site preparation techniques for cold water systems and components
5. Know the installation requirements of cold water systems and components
6. Be able to install cold water systems and components
7. Know the service and maintenance requirements of cold water systems and components
8. Be able to service and maintain cold water systems and components
9. Know the decommissioning requirements of cold water systems and components
10. Be able to decommission cold water systems and components
11. Know the inspection and soundness testing requirements of cold water systems and components
12. Be able to inspect and soundness test cold water systems and components

Guided learning hours

It is recommended that **62** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M13, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by Summitskills.

Assessment

This unit will be assessed by:

- A e-volve on-line knowledge assessment and externally set assignments. See Appendix 2 for list of approved materials for use in open book examination.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 1 Know the cold water supply route to dwellings

Assessment Criteria

The learner can:

1. State the key stages in the rainwater cycle
2. Identify the various water supply sources and the typical properties of water from those sources:
   - Surface sources – lakes, reservoirs, rivers and streams.
   - Underground sources – deep and shallow wells, artesian wells, bore-holes, springs.
3. State the two main types of water supply to dwellings:
   - Supply from a water undertaker's main.
   - Supply from a private source.
4. Identify the mains water treatment process and typical mains water distribution system from treatment works to property
5. Identify the uses of cold water supplied to dwellings:
   - Wholesome water for domestic purposes - drinking, washing, food production.
   - Recycled water – WC flushing, water for outdoor use, clothes washing.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 2 Know the types of cold water system and their layout requirements

Assessment Criteria

The learner can:

1. State the cold water system pipework features between the water undertaker's main and the main internal stop valve in dwellings:
   - Connection methods to the main.
   - Communication pipe.
   - Service pipe.
   - Main external stop valve and meter housing including surface mounted meter boxes (Groundbreaker).
   - Depth of external service pipework below ground level.
   - Correct methods of entry of the service pipework to a property.
2. Identify the type of cold water system from layout diagrams
3. State the factors which affect the selection of cold water systems for dwellings:
   - Direct cold water system:
     - Supplying a storage cistern.
     - Supplying a combination boiler.
   - Indirect cold water system.
4. State the typical pipe sizes used in cold water systems in dwellings:
   - Supply pipe.
   - Distributing pipe.
   - Service pipe.
5. State the factors that can lead to backflow from cold water outlets and equipment in dwellings
6. Identify the standard backflow prevention devices that are used in cold water systems in dwellings supplying water to appliances:
   - Baths.
   - WCs.
   - Over the rim bidets.
   - Wash hand basins.
   - Sinks.
   - Mixer taps.
   - Outside taps.
   - Shower mixer valves/ instantaneous showers.
   - Refrigerators, washing machines and dishwashers.

7. Identify the working principles of cold water system components:
    - Stop valves.
    - Servicing valves.
    - Drain valves.
    - Float operated valves.
    - Terminal fittings:
        - Pillar taps.
        - Bib taps.
        - Mixer taps.
        - Ceramic disc taps.
    - Shower mixer valves:
        - Gravity.
        - Mains fed.
    - Water softeners.
    - Water filters.
    - Water conditioners.
    - Water meters.
    - Backflow prevention devices:
        - Simple air gap arrangements.
        - Double and single check valves.
    - Cold water storage cisterns.
    - Combined feed and expansion cisterns.
    - WC/urinal flushing cisterns.
8. State the system layout features for protected plastic storage cisterns:
    - Typical cistern sizes for small dwellings.
    - Warning pipe (overflow) arrangements.
    - Inlet/ outlet position.
    - Position of float operated valve.
    - Position of cistern vent.
    - Position of open vent pipe connection.
    - Requirement for a rigid close fitting lid.
    - Service valve requirements.
    - Cistern base support requirements.
9. State the methods of linking cold water storage cisterns for use in dwellings.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 3 Know the site preparation techniques for cold water systems and components

Assessment Criteria

The learner can:

1. Identify the sources of information required when undertaking work on cold water systems:
   - Statutory regulations.
   - Industry standards.
   - Manufacturer technical instructions.
2. Identify the preparatory work required to be undertaken to the building fabric in order to install, decommission or maintain cold water systems and components
3. Identify the protection measures required to the building fabric or customer property, during and on completion of work on cold water systems and components
4. Identify the pipework materials and fittings required to complete work on cold water systems:
   - External water service pipework.
   - Internal water supply pipework.
5. State the range of hand and power tools required to complete work on cold water systems and components.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 4 Be able to apply site preparation techniques for cold water systems and components

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access and exit.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/method statements are available.
2. Wear personal protective equipment appropriate to the installation, decommissioning or maintenance task being carried out
3. Apply protection measures to the building fabric or customer property, during and on completion of work on cold water systems and components
4. Select the pipework materials and fittings required to complete work on cold water systems ensuring that they are not damaged
5. Select the hand and power tools required to complete work on cold water systems and components
6. Carry out preparatory work in order to install cold water systems and components.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 5 Know the installation requirements of cold water systems and components

Assessment Criteria

The learner can:

1. State how to take readings of the incoming water supply pressure and flow rate
2. Identify suitable methods of connecting cold water system supply pipework to incoming service pipework:
   - Medium density polyethylene (MDPE).
   - Copper.
   - Lead.
3. State the positioning requirements of components in cold water systems:
   - Supply stop valves.
   - Drain valves.
   - Water meters.
   - Water conditioning devices.
   - Service valves.
   - Backflow prevention devices.
4. Identify how to measure, mark out and drill plastic storage cisterns to receive pipework connections
5. Identify how to make pipework connections to storage cisterns
6. State the positioning and fixing requirements for cold water system pipework and components:
   - In suspended timber floors.
   - In solid floors.
   - Embedded in walls.
   - In areas of the building subject to frost.
   - That may be exposed to warming.
7. State how to select clips and brackets appropriate to the cold water system pipework and the industry recommended spacings:
   - Horizontally mounted pipework.
   - Vertically mounted pipework.
8. Identify how to position, fix and connect new cold water pipework to outlets:
   - Bath tap or shower mixer valve.
   - Wash hand basin tap.
   - Sink tap.
   - Combination boiler.
   - WC flushing cistern.
   - Cold water storage cistern.
9. Identify suitable methods of making new pipework connections into existing cold water system pipework:
   - Copper.
   - Plastic.
   - Lead.

- Galvanised steel.

10. Identify the insulation requirements of cold water system components:
    - Pipework sections.
    - Storage cisterns.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 6 Be able to install cold water systems and components

Assessment Criteria

The learner can:

1. Use test instruments to take readings of the incoming water supply pressure and flow rate
2. Connect cold water supply pipework to incoming service pipework:
   - MDPE to copper coupler.
   - Supply stop and drain valve.
3. Joint cold water pipework components in copper with capillary soldered and compression fittings
4. Measure, mark out and drill plastic storage cisterns to receive pipework connections
5. Make pipework connections to storage cisterns
6. Make pipework fixings to copper pipework
7. Position, fix and connect new cold water pipework to outlets:
   - Bath tap or shower mixer valve.
   - Wash hand basin tap.
   - Sink tap.
   - Combination boiler.
   - WC flushing cistern.
   - Cold water storage cistern.
8. Apply insulation to cold water system components:
   - Pipework sections.
   - Storage cisterns.
9. Demonstrate that cold water systems or components cannot be brought into operation by the end user before the work has been fully completed.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 7 Know the service and maintenance requirements of cold water systems and components

Assessment Criteria

The learner can:

1. Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of cold water system components
2. Identify how to carry out routine checks on cold water system components as part of a periodic maintenance programme:
    - Visual inspection of pipework for leakage and adequate support.
    - Effective operation of terminal fittings.
    - Effective operation of float operated valves.
    - Effective operation of stop and service valves.
    - Condition of protected cold water storage cistern.
3. State the procedures for dealing with defects in cold water components and pipework:
    - Cistern failure.
    - Incorrect support to cold water system pipework and storage cisterns.
    - Excessive noise in pipework systems.
    - Leakage of internal cold water system pipework and fittings.
    - Leakage from below ground cold water service pipework.
    - Leakage or ineffective operation of:
        - Terminal fittings.
        - Float operated valves.
        - Stop and service valves.
4. Identify the types of information to be provided on a maintenance record for cold water systems.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 8 Be able to service and maintain cold water systems and components

Assessment Criteria

The learner can:

1. Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of cold water system components
2. Carry out routine checks on cold water system components as part of a periodic maintenance programme:
   - Visual inspection of pipework for leakage and adequate support.
   - Effective operation of terminal fittings.
   - Effective operation of float operated valves.
   - Effective operation of stop and service valves.
   - Condition of protected cold water storage cistern.
3. Carry out repairs to defects in cold water system components:
   - Leakage of cold water system pipework and fittings – repair to water-filled pipework.
   - Leakage or ineffective operation of:
     - Terminal fittings
     - Float operated valves
     - Stop and service valves.
4. Complete the required details contained in a simple maintenance record for a cold water system.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 9 Know the decommissioning requirements of cold water systems and components

Assessment Criteria

The learner can:

1. Identify the working methods that reduce the time periods during which cold water systems need to be isolated
2. State the information that needs to be provided to other persons before decommissioning work takes place
3. State how to temporarily decommission cold water system components and connecting pipework systems
4. Identify the work sequences for permanently decommissioning cold water system components
5. Identify the methods used during the decommissioning process to prevent the end-user from operating cold water system components:
   - Isolation of stop/ servicing valves.
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 10 Be able to decommission cold water systems and components

Assessment Criteria

The learner can:

1. Advise appropriate persons before cold water system components or pipework are isolated in order to undertake work
2. Carry out temporary decommissioning of cold water system components and connecting pipework systems
3. Check to ensure that the decommissioning procedures carried out prevent the end-user from operating cold water system components.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 11 Know the inspection and soundness testing requirements of cold water systems and components

Assessment Criteria

The learner can:

1. State the checks to be carried out during a visual inspection of a cold water system to confirm that it is ready to be filled with water
2. State how to fill cold water pipework with water at normal operating pressure and check for leakage
3. Identify how to carry out a soundness test to industry requirements on cold water systems pipework and components
4. State the flushing procedure for cold water systems and components
5. Identify the actions that must be taken when inspection and testing reveals defects in cold water systems:
   - Dealing with systems that do not meet correct installation requirements.
   - Remedial work associated with defective pipework bracketing.
   - Remedial work associated with leakage from pipework systems.

Unit 006/206 Understand and apply domestic cold water system installation and maintenance techniques

Outcome 12 Be able to inspect and soundness test cold water systems and components

Assessment Criteria

The learner can:

1. Carry out a visual inspection of a cold water system to confirm that it is ready to be filled with water
2. Fill cold water pipework with water at normal operating pressure and check for leakage
3. Perform a soundness test to industry requirements on cold water systems pipework and components
4. Flush the system with wholesome water on completion of soundness testing.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Level: 2
Credit value: 8
UAN: F/602/2884

Unit aim

This combination unit provides learning in the installation, maintenance, decommissioning and soundness testing of a basic range of hot water system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings) The unit covers systems in building up to 3 storeys in height with pipework up to 28mm diameter.

Learning outcomes

There are **eleven** learning outcomes to this unit. The learner will:

1. Know the types of hot water system and their layout requirements
2. Know the site preparation techniques for hot water systems and components
3. Be able to apply site preparation techniques for hot water systems and components
4. Know the installation requirements of hot water systems and components
5. Be able to install hot water systems and components
6. Know the service and maintenance requirements of hot water systems and components
7. Be able to service and maintain hot water systems and components
8. Know the decommissioning requirements of hot water systems and components
9. Be able to decommission hot water systems and components
10. Know the inspection and soundness testing requirements of hot water systems and components
11. Be able to inspect and soundness test hot water systems and components

Guided learning hours

It is recommended that **62** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M13, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- A e-volve on-line knowledge assessment and externally set assignments. See Appendix 2 for list of approved materials for use in open book examination.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 1 Know the types of hot water system and their layout requirements

Assessment Criteria

The learner can:

1. Identify the type of hot water system from layout diagrams:
   - Direct system:
     - Conventional boiler (small hot water only boiler).
     - Immersion heater including low energy tariff types.
   - Indirect system:
     - Fed by combined hot water and heating boiler.
   - Single point of use vented heaters.
   - Instantaneous hot water heaters:
     - Multipoint heaters.
     - Combination boilers.
2. State the factors that need to be considered when the type of hot water system is selected for use in a building:
   - Quantity and usage of hot water required.
   - Distance of outlet from hot water source.
   - Need for a secondary recirculation system.
3. Identify the working principles of hot water system components:
   - Stop valves.
   - Fullway gate valves.
   - Servicing valves.
   - Drain valves.
   - Float operated valves.
   - Terminal fittings:
     - Bib taps.
     - Pillar taps.
     - Mixer taps.
     - Ceramic disc taps.
   - Showers:
     - Gravity mixer.
     - Mains fed mixer.
     - Electric instantaneous.
   - Thermostatic mixing valves.
   - Backflow prevention devices:
     - Simple air gaps.
     - Single check valves.
   - Feed and expansion cisterns.
   - Cold water feed cisterns.
   - Directly heated storage cylinders.

- Indirectly heated storage cylinders:
    - Single feed.
    - Double feed.
    - Combination.
- Instantaneous water heaters:
    - Mains fed multipoint heaters.
    - Mains fed combination boilers.
    - Single point of use vented heaters.

4. State the typical pipe sizes used in centralised open vented hot water systems in dwellings:
    - Primary circuit.
    - Secondary circuit.
5. State the system layout features for the open vent and cold feed pipes of primary and secondary open vented hot water circuits.
6. State the connection requirements for feed and expansion cisterns into open vented primary hot water circuits.
7. State the system layout features for plastic feed and expansion cisterns:
    - Typical cistern sizes for small dwellings.
    - Warning pipe (overflow) arrangements.
    - Inlet/ outlet position.
    - Position of float operated valve.
    - Position of cistern vent.
    - Service valve requirements.
    - Cistern base support requirements.
8. Identify the types and typical sizes of open vented storage cylinder used in hot water systems in dwellings:
    - Direct.
    - Single feed indirect.
    - Double feed indirect.
    - Double feed indirect super duty recovery.
    - Combination.
9. State the system layout features for hot water heaters:
    - Mains fed Instantaneous multipoint water heaters including combination boilers.
    - Localised (point of use) open vented hot water heaters.
10. State the typical pipe sizes used with mains fed instantaneous hot water heaters and open vented point of use water heaters in dwellings.
11. Identify the need for temperature control of hot water systems:
    - Thermostats.
    - Overheat thermostats.
    - Temperature relief valves.
12. State the factors that can lead to backflow from hot water outlets and equipment in dwellings
13. Identify the standard backflow prevention devices that are used in hot water systems in dwellings supplying water to appliances:
    - Baths.
    - Over the rim bidets.
    - Wash hand basins.
    - Sinks.
    - Mixer taps.
    - Showers.
14. State the system layout features for the installation of hot water components:
    - Gravity fed showers.
    - Mains fed showers.

- Instantaneous electric showers.
- Thermostatic mixing valves.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 2 Know the site preparation techniques for hot water systems and components

Assessment Criteria

The learner can:

1. Identify the sources of information required when undertaking work on hot water systems:
   - Statutory regulations.
   - Industry standards.
   - Manufacturer technical instructions.
2. Identify the preparatory work required to be undertaken to the building fabric in order to install, decommission or maintain hot water systems and components
3. Identify the protection measures required to the building fabric or customer property, during and on completion of work on hot water systems and components
4. Identify the pipework materials and fittings required to complete work on hot water systems
5. State the range of hand and power tools required to complete work on hot water systems and components.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 3 Be able to apply site preparation techniques for hot water systems and components

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access and exit.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/ method statements are available.
2. Wear personal protective equipment appropriate to the installation, decommissioning or maintenance task being carried out
3. Apply protection measures to the building fabric or customer property, during and on completion of work on hot water systems and components
4. Select the pipework materials and fittings required to complete work on hot water systems ensuring that they are not damaged
5. Select the hand and power tools required to complete work on hot water systems and components
6. Carry out preparatory work in order to install hot water systems and components.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 4 Know the installation requirements of hot water systems and components

Assessment Criteria

The learner can:

1. State how to take readings of hot water supply pressure and flow rate
2. State the positioning and fixing requirements of hot water pipework and components:
   - In suspended timber floors.
   - In solid floors.
   - Embedded in walls.
   - In areas of the building subject to frost.
3. Identify how expansion and contraction may be catered for in hot water pipework containing:
   - plastics
   - copper
4. State how to select clips and brackets appropriate to the hot water system pipework and the industry recommended spacings:
   - Horizontally mounted pipework.
   - Vertically mounted pipework.
5. State the positioning requirements of components in hot water systems:
   - Heaters/storage cylinders.
   - Cisterns – hot water feed cisterns and feed and expansion cisterns.
   - Drain valves.
   - Service valves.
   - Thermostatic mixing valves.
   - Showers – gravity fed mixer, mains fed mixer and instantaneous electric.
6. Identify how to measure, mark out and drill plastic storage cisterns to receive pipework connections
7. Identify how to make pipework connections to storage cisterns
8. Identify how to make pipework connections to open vented hot water storage cylinders
9. State how to position, fix and connect new hot water pipework to outlets and supply sources:
   - Bath tap or shower mixer valve.
   - Wash hand basin tap.
   - Sink tap.
   - Combination boiler.
   - Cold water storage cistern.
   - Hot water storage cylinder.
   - Thermostatic mixing valve.
10. Identify suitable methods of making new pipework connections into existing hot water system pipework:
    - Copper.
    - Plastic.
11. Identify the insulation requirements of hot water system components:

- Pipework.
- Cisterns.
- Storage vessels.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 5 Be able to install hot water systems and components

Assessment Criteria

The learner can:

1. Use test instruments to take readings of the hot water supply pressure and flow rate from existing hot water outlets
2. Make pipework fixings to copper and plastic pipework
3. Joint hot water pipework components:
   - Copper – capillary soldered and compression.
   - Plastic – pushfit.
4. Measure, mark out and drill plastic storage cisterns to receive pipework connections
5. Make pipework connections to storage cisterns
6. Make pipework connections to open vented hot water storage cylinders
7. Position, fix and connect new hot water pipework to outlets:
   - Bath tap or shower mixer valve.
   - Wash hand basin tap.
   - Sink tap.
   - Combination boiler.
   - Cold water storage cistern.
   - Hot water storage cylinder.
   - Thermostatic mixing valve.
8. Apply insulation to hot water system pipework
9. Demonstrate that hot water components and pipework systems cannot be brought into operation by the end user before the work has been fully completed.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 6 Know the service and maintenance requirements of hot water systems and components

Assessment Criteria

The learner can:

1. Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Identify how to carry out routine checks on hot water components and pipework as part of a periodic maintenance programme:
    - 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/heater and storage cisterns.
    - Effective operation of thermostatic control devices.
3. State the procedures for dealing with defects in hot water components and pipework:
    - Incorrect support to hot water system pipework and storage cisterns.
    - Excessive noise in pipework systems.
    - Leakage of hot water system pipework and fittings.
    - 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.
4. Identify the types of information to be provided on a maintenance record for hot water systems.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 7 Be able to service and maintain hot water systems and components

Assessment Criteria

The learner can:

1. Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Carry out routine checks on hot water components and pipework as part of a periodic maintenance programme:
   - 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/heater and storage cisterns.
   - Effective operation of thermostatic control devices.
3. Carry out repairs to defects in hot water system components:
   - Leakage of hot water system pipework and fittings – repair to water-filled pipework
   - Leakage or ineffective operation of:
     - Terminal fittings
     - Float operated valves
     - Stop and service valves
4. Complete the required details contained in a simple maintenance record for a hot water system.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 8 Know the decommissioning requirements of hot water systems and components

Assessment Criteria

The learner can:

1. Identify the working methods that reduce the time periods during which hot water systems need to be isolated
2. State the information that needs to be provided to other persons before decommissioning work takes place
3. State how to temporarily decommission hot water system components and connecting pipework systems
4. Identify the work sequences for permanently decommissioning hot water components and pipework systems
5. Identify the methods used during the decommissioning process to prevent the end-user from operating hot water system components:
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 9 Be able to decommission hot water systems and components

Assessment Criteria

The learner can:

1. Advise appropriate persons before hot water components or pipework are isolated in order to undertake work
2. Carry out temporary decommissioning of cold water system components and connecting pipework systems
3. Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the hot water system components.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 10 Know the inspection and soundness testing requirements of hot water systems and components

Assessment Criteria

The learner can:

1. State the checks to be carried out during a visual inspection of a hot water system to confirm that it is ready to be filled with water
2. State how to fill hot water pipework with water at normal operating pressure and check for leakage
3. Identify how to carry out a soundness test to industry requirements on hot water systems pipework and components
4. State the flushing procedure for hot water systems and components
5. Identify the actions that must be taken when inspection and testing reveals defects in hot water systems:
   - Dealing with systems that do not meet correct installation requirements.
   - Remedial work associated with defective pipework bracketing.
   - Remedial work associated with leakage from pipework systems.

Unit 007/207 Understand and apply domestic hot water system installation and maintenance techniques

Outcome 11 Be able to inspect and soundness test hot water systems and components

Assessment Criteria

The learner can:

1. Carry out a visual inspection of a hot water system to confirm that it is ready to be filled with water
2. Fill hot water pipework with water at normal operating pressure and check for leakage
3. Perform a soundness test to industry requirements on hot water systems pipework and components
4. Flush the system with wholesome water on completion of soundness testing.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Level: 2
Credit value: 10
UAN: Y/602/2888

Unit aim

This combination unit provides basic learning in the installation, maintenance, decommissioning and soundness testing of a basic range of wet central heating system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The unit covers systems in buildings up to 3 storeys in height and with systems up to a maximum of 40kW heat output and pipework up to 32mm diameter. The unit provides an appreciation of the working principles of the various fossil fuel type heat producing appliances.

Learning outcomes

There are **twelve** learning outcomes to this unit. The learner will:

1. Know the uses of central heating systems in dwellings
2. Know the types of central heating system and their layout requirements
3. Know the site preparation techniques for central heating systems and components
4. Be able to apply site preparation techniques for central heating systems and components
5. Know the installation requirements of central heating systems and components
6. Be able to install central heating systems and components
7. Know the service and maintenance requirements of central heating systems and components
8. Be able to service and maintain central heating systems and components
9. Know the decommissioning requirements of central heating systems and components
10. Be able to decommission central heating systems and components
11. Know the inspection and soundness testing requirements of central heating systems and components
12. Be able to inspect and soundness test central heating systems and components

Guided learning hours

It is recommended that **82** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M13, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by:

- A e-volve on-line knowledge assessment and externally set assignments. See Appendix 2 for list of approved materials for use in open book examinations.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 1 Know the uses of central heating systems in dwellings

Assessment Criteria

The learner can:

1. State the purpose of central heating systems used in dwellings
2. Identify the different types of space heating systems used in dwellings:
   - Full central heating.
   - Background heating.
   - Selective heating.
   - Two and one pipe systems.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 2 Know the types of central heating system and their layout requirements

Assessment Criteria

The learner can:

1. Identify the working principles of central heating systems:
   - Pumped heating only system.
   - Pumped with gravity hot water.
   - Fully pumped with 2 x two port valves.
   - Fully pumped with a mid position valve.
   - Combination boiler with pumped heating.
2. Identify the type of central heating system from layout diagrams:
   - Open vented:
     - Pumped heating only.
     - Pumped with gravity hot water including heat sink circuits.
     - Fully pumped with 2 x two port valves.
     - Fully pumped with a mid position valve.
   - Sealed system:
     - Pumped heating only.
     - Fully pumped with 2 x two port valves.
     - Fully pumped with a mid position valve.
     - Combination boiler with pumped heating.
     - System boiler with pumped heating.
3. State the system layout features for filling and venting systems:
   - Open vented systems:
     - Feed and expansion cistern position.
     - Pump position.
     - Cold feed and open vent pipe connection.
     - Methods of releasing air from the system.
   - Sealed systems:
     - Expansion vessel position.
     - Pressure gauge, pressure relief valve and filling loop position.
     - Pump position.
     - Methods of releasing air from the system.
4. State the layout features for systems that include micro and minibore pipework
5. State the general operating principles of solid fuel heat producing appliances:
   - Open fire with high output back boilers.
   - Room heaters.
   - Cookers.
   - Independent boilers.
6. State the general operating principles of oil fired heat producing appliances:
   - Pressure jet:

        - Traditional boilers.
        - Condensing boilers.
        - Combination boilers.
        - Freestanding boilers.
        - Wall mounted boilers.
        - Open flued boilers.
        - Room sealed boiler.
    - Vaporising:
        - Open flued cookers.
7. State the general operating principles of gas fired heat producing appliances:
    - Open flued boilers.
    - Room sealed boilers.
    - Traditional boilers.
    - Condensing boilers.
    - Combination boilers.
    - System boilers.
    - Freestanding boilers.
    - Wall mounted boilers.
    - Fan assisted boilers.
8. State the operating principles of heat emitters:
    - Panel radiators.
    - Column radiators.
    - Low surface temperature radiators.
    - Fan convectors:
        - Wall mounted.
        - Kick space.
    - Towel warmers.
    - Towel warmers with integral panel radiators.
9. State the operating principles of central heating control components:
    - Radiator valves – thermostatic and manual valves.
    - Automatic air vents.
    - Motorised valves – two port and three port mid position and diverter.
    - Hot water storage cylinders.
    - Feed and expansion cisterns.
    - Circulating pumps.
    - Automatic bypass valves.
    - Thermo-mechanical cylinder control valves.
    - Anti gravity valves.
    - Drain valves.
    - Timing devices – clocks and programmers.
    - Room thermostats.
    - Cylinder thermostats and overheat protection devices.
    - Frost and pipe combined thermostats.
10. State the operating principles of devices used in central heating systems to minimise the build-up of sediment.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 3 Know the site preparation techniques for central heating systems and components

Assessment Criteria

The learner can:

1. Identify the sources of information required when undertaking work on central heating systems:
   - Statutory regulations.
   - Industry standards.
   - Manufacturer technical instructions.
2. Identify the preparatory work required to be carried out to the building fabric in order to install, decommission or maintain central heating systems
3. Identify the protection measures required to the building fabric or customer property, during and on completion of work on central heating systems and components
4. Identify the pipework materials and fittings required to complete work on central heating systems ensuring that they are not damaged
5. State the range of hand and power tools required to complete work on central heating systems.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 4 Be able to apply site preparation techniques for central heating systems and components

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access and exit.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/ method statements are available.
2. Wear personal protective equipment relevant to the installation, decommissioning or maintenance task being carried out
3. Apply protection measures to the building fabric or customer property, during and on completion of work on central heating systems and components
4. Select the pipework materials and fittings required to complete work on central heating systems ensuring that they are not damaged
5. Select the hand and power tools required to complete work on central heating systems
6. Carry out preparatory work in order to install central heating systems.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 5 Know the installation requirements of central heating systems and components

Assessment Criteria

The learner can:

1. State the procedures required to assemble valves to radiators and mount radiators on wall surfaces
2. State the positioning and fixing requirements of central heating pipework and components:
   - In suspended timber floors.
   - In solid floors.
   - Embedded in walls.
   - In areas of the building subject to frost.
3. Identify how expansion and contraction may be catered for in central heating pipework containing:
   - plastics
   - copper
4. State how to select clips and brackets appropriate to the hot water system pipework and the industry recommended spacings:
   - Horizontally mounted pipework.
   - Vertically mounted pipework.
5. Identify how to select joints for use in central heating system pipework:
   - LCS threaded joints.
   - Plastic – Pushfit joints.
   - Capillary solder joints.
   - Compression joints.
6. State the positioning and fixing requirements of components in central heating systems:
   - Radiator valves – thermostatic and manual valves.
   - Automatic air vents.
   - Hot water storage cylinders.
   - Feed and expansion cisterns.
   - Motorised valves – two port and three port mid position and diverter.
   - Circulating pumps.
   - Automatic bypass valves.
   - Thermo mechanical cylinder control valve.
   - Anti gravity valve.
   - Drain valves.
   - Timing devices – clocks and programmers.
   - Room thermostats.
   - Cylinder thermostats and overheat protection devices.
   - Frost and pipe combined thermostat.

7. Identify suitable methods for making new central heating pipework connections to components:
    - Boilers.
    - Central heating control system components.
    - Heat emitters.
    - Hot water storage cylinders.
    - Feed and expansion cisterns.
8. State how to position, fix and connect new central heating pipework to components:
    - Panel radiators.
    - Boilers.
    - Control components.
    - Hot water storage cylinders.
    - Filling and venting components.
9. Identify suitable methods for making new central heating pipework connections into existing central heating circuits:
    - within a one or two pipe copper system
    - within a one or two pipe low carbon steel system
    - to a microbore or minibore system
10. Identify the insulation requirements of central heating system components:
    - Pipework.
    - Cisterns.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 6 Be able to install central heating systems and components

Assessment Criteria

The learner can:

1. Assemble heat emitter components
2. Make pipework fixings to copper and low carbon steel central heating system pipework
3. Joint central heating pipework systems:
   - LCS threaded joints.
   - Capillary solder joints.
   - Compression joints.
4. Position, fix and connect new central heating pipework to components heat emitters:
   - Boilers.
   - Control components.
   - Hot water storage cylinders.
   - Filling and venting components.
5. Apply insulation to central heating system pipework
6. Demonstrate that central heating components and pipework systems cannot be brought into operation by the end user before the work has been fully completed.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 7 Know the service and maintenance requirements of central heating systems and components

Assessment Criteria

The learner can:

1. Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Identify how to carry out routine checks on central heating components and pipework systems as part of a periodic maintenance programme:
   - Visual inspection of pipework for leakage and adequate support.
   - Poor circulation in heat emitters.
   - Poor flow rate through heating systems.
   - Venting of gas build up within heat emitters.
   - Operation of control components.
   - Effective operation of thermostats.
   - Operation/ adjustment – system filling and venting components.
3. State the procedures for dealing with defects in central heating components and pipework:
   - Failure of control components.
   - Leakage in system pipework.
   - Leakage from heat emitters.
   - Replacement of control valves.
   - Replacement of heat emitters.
   - Replacement of hot water storage cylinders.
4. Identify the types of information to be provided on a maintenance record for central heating systems.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 8 Be able to service and maintain central heating systems and components

Assessment Criteria

The learner can:

1. Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Carry out routine checks on central heating components and pipework systems as part of a periodic maintenance programme:
   - Visual inspection of pipework for leakage and adequate support.
   - Venting of gas build up within heat emitters.
   - Operation of control components.
   - Effective operation of thermostats.
   - Operation/ adjustment – system filling and venting components.
3. Carry out repairs to defects in central heating system components:
   - Replacement of a radiator valve on a heat emitter.
   - Replacement of a radiator in an existing system.
4. Complete the required details contained in a simple maintenance record for a central heating system.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 9 Know the decommissioning requirements of central heating systems and components

Assessment Criteria

The learner can:

1. Identify working methods that reduce the periods during which central heating systems are not available to building users
2. State the information that needs to be provided to other persons before decommissioning work takes place
3. State how to temporarily decommission central heating and connecting pipework systems
4. Identify the work sequences for permanently decommissioning central heating and pipework systems
5. Identify the procedures for safely draining and disposing of central heating system contents
6. Identify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
   - Isolation of the fuel/electricity supply to the system.
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 10 Be able to decommission central heating systems and components

Assessment Criteria

The learner can:

1. Advise appropriate persons before central heating components or pipework are isolated in order to undertake work
2. Carry out temporary decommissioning of central heating system components and connecting pipework systems
3. Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the appliance or system:
   - Isolation of the fuel/electricity supply to the system.
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 11 Know the inspection and soundness testing requirements of central heating systems and components

Assessment Criteria

The learner can:

1. State the checks to be carried out during a visual inspection of a central heating system to confirm that it is ready to be filled with water
2. State how to fill central heating systems with water at normal operating pressure and check for leakage
3. Identify how to carry out a soundness test to industry requirements on central heating systems pipework and components
4. Identify the actions that must be taken when inspection and testing reveals defects in central heating systems:
   - Dealing with systems that do not meet correct installation requirements.
   - Remedial work associated with defective pipework bracketing.
   - Remedial work associated with defective control valves.
   - Remedial work associated with leakage from pipework systems.

Unit 008/208 Understand and apply domestic central heating system installation and maintenance techniques

Outcome 12 Be able to inspect and soundness test central heating systems and components

Assessment Criteria

The learner can:

1. Carry out a visual inspection of a central heating system to confirm that it is ready to be filled with water
2. Fill central heating systems with water at normal operating pressure and check for leakage
3. Perform a soundness test to industry requirements on central heating systems pipework and components.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Level: 2
Credit value: 4
UAN: F/602/2917

Unit aim

This combination unit provides learning in the installation and maintenance of gravity rainwater systems that are installed on dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings) in buildings up to 3 storeys in height.

Learning outcomes

There are ten learning outcomes to this unit. The learner will:

1. Know the general principles of gravity rainwater systems
2. Know the layout requirements of gravity rainwater systems
3. Know the site preparation techniques for gravity rainwater systems
4. Be able to apply site preparation techniques for gravity rainwater systems
5. Know the installation requirements of gravity rainwater systems
6. Be able to install gravity rainwater systems
7. Know the service and maintenance requirements of gravity rainwater systems
8. Be able to service and maintain gravity rainwater systems
9. Know the inspection and testing requirements of gravity rainwater systems
10. Be able to inspect and test gravity rainwater systems

Guided learning hours

It is recommended that 30 hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- A e-volve on-line knowledge assessment and externally set assignments. See Appendix 2 for list of approved materials for use in open book examinations.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 1 Know the general principles of gravity rainwater systems

Assessment Criteria

The learner can:

1. State the purpose of gravity rainwater systems used on dwellings
2. Identify the working principles of gravity rainwater systems used on dwellings
3. State the common gravity rainwater system component materials:
   - PVC-U.
   - Extruded Aluminium.
   - Cast Iron.
4. Identify the different types of gutter systems used on dwellings:
   - Half round.
   - Square.
   - Ogee.
   - High capacity.
5. Identify the different types of rainwater pipework used with gutter systems on dwellings:
   - Round section.
   - Square section.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 2 Know the layout requirements of gravity rainwater systems

Assessment Criteria

The learner can:

1. Identify the factors which are used to determine the type (size) of gutter system used on a dwelling:
   - Rainfall intensity.
   - Roof area.
   - Running outlet position.
   - Gutter fall.
   - Changes of direction in the gutter run.
   - Customer preference.
2. Identify the jointing procedures for gutter systems:
   - PVC-U.
   - Extruded Aluminium.
   - Cast Iron.
3. Identify the jointing procedure for rainwater pipework materials:
   - PVC-U.
   - Extruded Aluminium.
   - Cast Iron.
4. State the purpose of components used in an eaves gutter system:
   - Running outlets.
   - Gutter angles.
   - Gutter unions.
   - Stop ends.
   - Specialist unions between different gutter materials.
5. State how building features determine gutter bracket selection for buildings:
   - Fascia boards.
   - Exposed rafters (no fascia boards).
   - No fascia board or exposed rafters (direct fixings to masonry surfaces).
6. State the purpose of components used in rainwater pipework:
   - Offsets.
   - Angles.
   - Branches.
   - Hopper heads.
   - Shoes.
   - Specialist connectors to the drainage system.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 3 Know the site preparation techniques for gravity rainwater systems

Assessment Criteria

The learner can:

1. Identify the sources of information required when carrying out work on gravity rainwater systems:
   - Statutory regulations.
   - Industry standards.
   - Manufacturer technical instructions.
2. Identify the preparatory work required to be carried out to the building fabric in order to install or maintain gravity rainwater systems
3. State the types of pre-existing damage to the existing building fabric or customer property that may be found before commencing work on gravity rainwater systems:
   - Building wall surfaces.
   - Existing gravity rainwater system components.
4. Identify the protection measures required to the building fabric or customer property, during work on gravity rainwater systems
5. Identify the pipework materials and fittings required to complete work on gravity rainwater systems
6. Identify the hand and power tools required to complete work on gravity rainwater systems.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 4 Be able to apply site preparation techniques for gravity rainwater systems

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/ method statements are available.
2. Wear personal protective equipment relevant to the installation or maintenance task being carried out
3. Apply protection measures to the building fabric or customer property, during work on gravity rainwater systems
4. Select the pipework materials and fittings required to complete work on gravity rainwater systems ensuring that they are not damaged
5. Select the hand and power tools required to complete work on gravity rainwater systems.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 5 Know the installation requirements of gravity rainwater systems

Assessment Criteria

The learner can:

1. Identify how expansion and contraction may be catered for in PVC-u gravity rainwater systems
2. State the positioning and fixing requirements of gutter system components:
   - Gutter brackets – fascia, rafter and drive-in types.
   - Running outlets.
   - Gutter angles.
   - Gutter unions.
   - Stop ends.
   - Specialist unions between different gutter materials.
3. Identify how to install lengths of PVC-u gutter and make joints to gutter systems:
   - Running outlet.
   - Gutter angle.
   - Gutter union.
   - Stop ends.
4. Identify how to select brackets for rainwater pipework and space them at appropriate intervals
5. Identify suitable methods for making new rainwater pipework connections to the drainage system:
   - Discharge to gully using a shoe.
   - Direct connection to drainage bend.
   - Direct connection to gulley.
   - Direct connection to a soakaway.
6. Identify suitable methods for making new PVC-u pipework connections into existing rainwater pipework:
   - to existing cast iron pipework
   - to existing PVC-u pipework.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 6 Be able to install gravity rainwater systems

Assessment Criteria

The learner can:

1. Position and fix eaves gutter brackets at recommended spacing intervals
2. Install lengths of PVC-u gutter and make joints to gutter systems:
   - Running outlet.
   - Gutter angle.
   - Gutter union.
   - Stop ends.
3. Make pipework fixings to rainwater pipework
4. Install lengths of rainwater pipework and make connections:
   - To existing drainage systems
   - To eaves gutter systems using offset connection.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 7 Know the service and maintenance requirements of gravity rainwater systems

Assessment Criteria

The learner can:

1. Identify how to carry out routine checks on gravity rainwater systems as part of a periodic maintenance programme:
   - Visual inspection of guttering and rainwater pipework for leakage and adequate support.
   - Visual inspection of guttering and rainwater pipework for damage.
2. State the procedures for dealing with defects in gravity rainwater systems:
   - Leakage from systems.
   - Blockages in systems.
   - Improper support to PVC-u gutter systems.
3. Identify the procedures for safely handling gravity rainwater system components that may be contaminated with foul waste.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 8 Be able to service and maintain gravity rainwater systems

Assessment Criteria

The learner can:

1. Carry out routine checks on gravity rainwater systems as part of a periodic maintenance programme:
   - Visual inspection of guttering and rainwater pipework for leakage and adequate support.
   - Visual inspection of guttering and rainwater pipework for damage.
2. Carry out routine maintenance procedures on gravity rainwater systems:
   - Replacement of a section of gutter.
   - Replacement of a gutter union.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 9 Know the inspection and testing requirements of gravity rainwater systems

Assessment Criteria

The learner can:

1. State the checks to be carried out during a visual inspection of a gravity rainwater system to confirm that it is ready to receive rainwater
2. State the test arrangements for gravity rainwater systems to check for leakage
3. Identify the actions that must be taken when inspection and testing reveals defects in gravity rainwater systems:
   - Dealing with systems that do not meet correct installation requirements.
   - Remedial work associated with defective gutter and pipework bracketing.
   - Remedial work associated with leakage from systems.

Unit 009/209 Understand and apply domestic rainwater system installation and maintenance techniques

Outcome 10 Be able to inspect and test gravity rainwater systems

Assessment Criteria

The learner can:

1. Carry out a visual inspection of a gravity rainwater system to confirm that it is ready to receive rainwater
2. Test the gravity rainwater system for leakage using an appropriate source of water.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Level: 2
Credit value: 6
UAN: J/602/2921

Unit aim

This combination unit provides learning in the installation, maintenance decommissioning and soundness testing of a range of sanitary appliances and connecting sanitary pipework systems in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings) in buildings up to 5 storeys in height.

Learning outcomes

There are **twelve** learning outcomes to this unit. The learner will:

1. Know the uses of sanitary appliances and their operating principles
2. Know the types of sanitary pipework system and system layout requirements
3. Know the site preparation techniques for sanitary appliances and connecting pipework systems
4. Be able to apply site preparation techniques for sanitary appliances and connecting pipework systems
5. Know the installation requirements of sanitary appliances and connecting pipework systems
6. Be able to install sanitary appliances and connecting pipework systems
7. Know the service and maintenance requirements of sanitary appliances and connecting pipework systems
8. Be able to service and maintain sanitary appliances and connecting pipework systems
9. Know the decommissioning requirements of sanitary appliances and connecting pipework systems
10. Be able to decommission sanitary appliances and connecting pipework systems
11. Know the inspection and soundness testing requirements of sanitary appliances and connecting pipework systems
12. Be able to inspect and soundness test sanitary appliances and connecting pipework systems

Guided learning hours

It is recommended that **44** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by

- A e-volve on-line knowledge assessment and externally set assignments. See Appendix 2 for list of approved materials for use in open book examinations.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 1 Know the uses of sanitary appliances and their operating principles

Assessment Criteria

The learner can:

1. State the purpose of sanitary appliances used in dwellings
2. Identify the different types of sanitary appliances used in dwellings
3. Identify the working principles of sanitary appliances:
    - Conventional WCs (not macerators).
    - Baths.
    - Bidets.
    - Wash hand basins.
    - Showers/cubicles.
    - Sinks (not waste disposal units).
    - Urinals.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 2 Know the types of sanitary pipework system and system layout requirements

Assessment Criteria

The learner can:

1. Identify the types of sanitary pipework system and state where they may be used in dwellings:
   - Primary ventilated stack system.
   - Secondary ventilated stack system.
   - Ventilated branch discharge system.
2. State the factors that lead to trap seal loss in sanitary pipework systems
3. State the system layout features for discharge stacks (wetted portion) at the foot of the stack in buildings up to 5 storeys in height:
   - Type of bend.
   - Proximity of low level connections.
4. State the system layout features for discharge stacks (wetted portion):
   - Soil stack sizes based on WC outlet size.
   - Waste stack sizes serving waste appliances only.
   - Use of bends in the wetted portion of the stack.
5. State the system layout features for branch discharge pipework:
   - Layout of unventilated and ventilated branch discharge pipework – maximum length of pipework and pipework gradient.
   - Sizes of branch discharge pipework for soil and waste appliances.
   - Use of traps and self sealing valves in preventing noxious smells in buildings.
   - 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.
6. State the system layout features for stack ventilation (dry portion of the stack):
   - Proximity of vent outlet to openable windows.
   - Use of air admittance valves.
7. State the system layout features for systems and appliances located on the ground floor:
   - Stub stack systems.
   - Waste appliance connections to gullies.
   - Waste appliance connections direct to drain.
   - WC connection direct to drain.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 3 Know the site preparation techniques for sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Identify the sources of information required when carrying out work on sanitary appliances and pipework systems:
   - Statutory regulations.
   - Industry standards.
   - Manufacturer technical instructions.
2. Identify the preparatory work required to be carried out to the building fabric in order to install, decommission or maintain sanitary appliances and pipework systems
3. Identify the protection measures required to the building fabric or customer property, during and on completion of work on sanitary appliances and pipework systems
4. Identify the pipework materials and fittings required to complete work on sanitary pipework systems
5. Identify the hand and power tools required to complete work on sanitary appliances and pipework systems.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 4 Be able to apply site preparation techniques for sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Check the safety of the work location in order for the work to safely proceed:
   - Safe access and exit.
   - Immediate work location eg tripping hazards.
   - Appropriate risk assessments/ method statements are available.
2. Wear personal protective equipment relevant to the installation, decommissioning or maintenance task being carried out
3. Apply protection measures to the building fabric or customer property, during and on completion of work on sanitary appliances and pipework systems
4. Select the pipework materials and fittings required to complete work on sanitary pipework systems ensuring that they are not damaged
5. Select the hand and power tools required to complete work on sanitary appliances and pipework systems
6. Carry out preparatory work in order to install sanitary appliances and pipework systems.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 5 Know the installation requirements of sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Identify how to assemble sanitary appliance fixtures and fittings:
   - Waste fittings to appliances.
   - Terminal fittings to appliances.
   - Flushing cistern assemblies.
   - Pre-fabricated bath supports and fixings.
2. Identify how to make joints to sanitary pipework systems:
   - Ring seal joints.
   - Solvent weld joints.
   - Compression joints.
   - Specialist joints such as pan connectors.
3. Identify how expansion and contraction may be catered for in plastics pipework:
   - Ring seal joints.
   - Solvent weld joints.
   - Compression joints.
4. State the positioning and fixing requirements of sanitary appliances:
   - Conventional WCs (not macerators).
   - Baths.
   - Bidets.
   - Wash hand basins.
   - Showers/cubicles.
   - Sinks (not waste disposal units).
   - Urinals.
5. State how to select brackets appropriate to the sanitary pipework and the industry recommended spacings:
   - Horizontally mounted pipework.
   - Vertically mounted pipework.
6. Identify the suitability of below ground drainage systems to receive foul soil and waste water:
   - Combined drainage systems.
   - Separate drainage systems.
   - Partially separate drainage systems.
7. Identify suitable methods for making new plastic pipework connections:
   - Soil stack at ground level to below ground plastic, clay or cast iron drainage pipework.
   - Waste pipework discharging to ground floor gullies.
   - Stub waste connection to ground floor drainage pipework.
   - WC pan connector direct to ground floor drain.
8. Identify suitable methods for making new plastic pipework connections into existing soil and waste systems:
   - Soil and waste connections to existing cast iron pipework.

- Soil and waste pipework to existing plastic pipework.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 6 Be able to install sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Assemble sanitary appliance fixtures and fittings:
   - Waste fittings to appliances.
   - Terminal fittings to appliances.
   - Flushing cistern assemblies.
   - Pre-fabricated bath supports and fixings.
2. Joint sanitary pipework systems:
   - Ring seal joints.
   - Solvent weld joints.
   - Compression joints.
   - Specialist joints such as pan connectors.
3. Position and fix bathroom appliances to new systems pipework:
   - Bath or shower tray.
   - Wash hand basin.
   - WC.
4. Make plastic sanitary pipework connections:
   - to existing below ground drainage systems
   - from new sanitary appliances into existing sanitary pipework systems
5. Demonstrate that sanitary appliances or pipework systems cannot be brought into operation by the end user before the work has been fully completed.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 7 Know the service and maintenance requirements of sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Identify how to carry out routine checks on sanitary appliances and pipework systems as part of a periodic maintenance programme:
   - Visual inspection of pipework for leakage and adequate support.
   - Operation of flushing cisterns/mechanisms.
   - Fitting of effective waste outlet plugs.
   - Effective operation of appliance traps/ self sealing valves.
3. State the procedures for dealing with defects in sanitary pipework systems:
   - Leakage from plastic soil and waste pipework.
   - Improper support to plastic pipework systems.
   - Loss of trap seal at sanitary appliances.
   - Blockage in above ground soil and waste pipework.
   - Blockage in below ground drainage systems.
4. Identify the types of information to be provided on a maintenance record for sanitary appliances and pipework systems.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 8 Be able to service and maintain sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components
2. Carry out routine checks on sanitary appliances and pipework systems as part of a periodic maintenance programme:
   - Visual inspection of pipework for leakage and adequate support.
   - Operation of flushing cisterns/mechanisms.
   - Fitting of effective waste outlet plugs.
   - Effective operation of appliance traps/ self sealing valves.
3. Carry out repairs to defects in sanitary pipework systems:
   - Leakage from plastic soil and waste pipework.
   - Loss of trap seal at waste appliances.
   - Blockage in above ground sanitary appliances.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 9 Know the decommissioning requirements of sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Identify working methods that reduce the periods during which toilet and washing facilities are not available to building users
2. State the information that needs to be provided to other persons before decommissioning work takes place
3. Identify the safety procedures for safely handling sanitary appliances and pipework components that may be contaminated with foul waste
4. Identify how to temporarily decommission sanitary appliances and connecting pipework systems
5. Identify the work sequences for permanently decommissioning sanitary appliances and pipework systems
6. Identify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 10 Be able to decommission sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Advise appropriate persons before a sanitary appliance or pipework system is isolated in order to undertake work
2. Carry out temporary decommissioning of sanitary appliances and connecting pipework systems
3. Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the appliance or system:
   - Temporary capping of pipework sections.
   - Use of warning notices and signs.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 11 Know the inspection and soundness testing requirements of sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. State the checks to be carried out during a visual inspection of a sanitation system to confirm that it is ready to receive foul water
2. Identify how to carry out an air test on a sanitary pipework system to industry requirements
3. Identify the actions that must be taken when inspection and testing reveals defects in sanitary pipework systems:
   - Dealing with systems that do not meet correct installation requirements.
   - Remedial work associated with defective pipework bracketing.
   - Remedial work associated with leakage from pipework systems.

Unit 010/210 Understand and apply domestic above ground drainage system installation and maintenance techniques

Outcome 12 Be able to inspect and soundness test sanitary appliances and connecting pipework systems

Assessment Criteria

The learner can:

1. Carry out a visual inspection of a sanitation system to confirm that it is ready to receive foul water
2. Perform an air test on a sanitary pipework system to industry requirements.

Unit 019 Apply safe working practices in building services engineering working environment

Level: 2
Credit value: 2
UAN: T/602/2493

Unit aim

The performance unit provides job competence in a basic range of Level 2 health and safety requirements through formal assessment in the workplace.

Learning outcomes

There are four learning outcomes to this unit. The learner will:

1. Be able to demonstrate personal health and safety precautions in the workplace
2. Be able to prepare and use access equipment in the workplace
3. Be able to check that the work area is safe in order to carry out work
4. Be able to liaise with those responsible for health and safety in the workplace

Guided learning hours

It is recommended that 4 hours should be allocated for this unit for co-ordinating evidence collection and assessment planning activities, although patterns of delivery are likely to vary. Guided learning hour specifications do not include time allocations for observation and assessment activities conducted in the workplace.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M1.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by evidence collection and assessment in the workplace. See notes for guidance at end of unit for assessment requirements.

Unit 019 Apply safe working practices in building services engineering working environment

Outcome 1 Be able to demonstrate personal health and safety precautions in the workplace

Assessment Criteria

The learner can:

1. Demonstrate that appropriate personal protective equipment is used throughout work activities
2. Ensure that Health and Safety precautions are in place:
   - First aid kit provision.
   - Fire extinguisher provision.
3. Demonstrate safe manual lifting techniques.

Unit 019 Apply safe working practices in building services engineering working environment

Outcome 2 Be able to prepare and use access equipment in the workplace

Assessment Criteria

The learner can:

1. Use risk assessments to identify safe methods of working at height
2. Check access equipment for safe condition prior to use
3. Perform the safe erection of access equipment
4. Demonstrate the safe use of access equipment.

Unit 019 Apply safe working practices in building services engineering working environment

Outcome 3 Be able to check that the work area is safe in order to carry out work

Assessment Criteria

The learner can:

1. Carry out a check of the work location for health and safety hazards
2. Verify that access and exit routes to and from the immediate work location are safe and free from obstructions
3. Demonstrate safe working practices when working with heat producing equipment.

Unit 019 Apply safe working practices in building services engineering working environment

Outcome 4 Be able to liaise with those responsible for health and safety in the workplace

Assessment Criteria

The learner can:

1. Demonstrate methods of recording accidents in the accident book in accordance with company procedures
2. Demonstrate methods of reporting hazards and accidents in accordance with company procedures.

Unit 019 Apply safe working practices in building services engineering working environment

Notes for guidance

Evidence for this unit must be generated while carrying out work in the building services industry.

Learning outcome 1

Evidence must be provided on two separate occasions of the learner:

- Selecting and correctly using appropriate PPE for a work task
- Ensuring that health and safety provisions are available in the workplace
- Safely manually handling loads

Evidence for this outcome must be provided in the form of:

- Direct observation of the learner applying correct health & safety procedures by a qualified assessor

Learning outcome 2

Evidence must be provided on two separate occasions of the learner (with different types of access equipment)

- Selecting and correctly using an item of access equipment to gain access to a work area

Evidence for this outcome must be provided in the form of:

- Direct observation of the learner applying correct health & safety procedures by a qualified assessor

Learning outcome 3

Evidence must be provided on two separate occasions of the learner:

- Preparing and checking for safe entry and exit routes to and from the workplace
- Safely using heat producing equipment

Evidence for this outcome must be provided in the form of:

- Direct observation of the learner applying correct health & safety procedures by a qualified assessor

Learning outcome 4

Evidence must be provided on two separate occasions of the learner:

- Checking the procedures for dealing with and reporting accidents in the workplace

Evidence for this outcome can be provided in the form of:

- Direct observation of the learner applying correct health & safety procedures by a qualified assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company work based recorder

Unit 020 Install and maintain domestic plumbing and heating systems

Level: 2
Credit value: 4
UAN: D/602/2939

Unit aim

This performance unit confirms job competence at Level 2 in the installation, maintenance decommissioning and soundness testing of a range of basic plumbing and heating systems and components in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings).

Learning outcomes

There are **five** learning outcomes to this unit. The learner will:

1. Be able to prepare sites for the installation of plumbing and heating systems and components in the workplace
2. Be able to install plumbing and heating systems and components in the workplace
3. Be able to soundness test plumbing and heating systems and components in the workplace
4. Be able to decommission plumbing and heating systems in the workplace
5. Be able to maintain plumbing and heating components in the workplace

Guided learning hours

It is recommended that **4** hours should be allocated for this unit for co-odinating evidence collection and assessment planning activities, although patterns of delivery are likely to vary. Guided learning hour specifications do not include time allocations for observation and assessment activities conducted in the workplace.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M13, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by evidence collection and assessment in the workplace. See notes for guidance at end of unit for assessment requirements.

Unit 020 Install and maintain domestic plumbing and heating systems

Outcome 1 Be able to prepare sites for the installation of plumbing and heating systems and components in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the installation work
2. Liaise with other persons to confirm the detail of the installation work to be carried out
3. Comply with health and safety requirements when carrying out the installation work
4. Prepare a safe and unobstructed access route to the work areas to carry out the installation work
5. Check that all required tools, equipment and materials are available to undertake the installation work
6. Use job information to identify the location of the building fabric that requires preparatory work to be carried out
7. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work
8. Provide protection to the building fabric or customer property as the work progresses
9. Carry out preparatory work to the building fabric:
    - Lifting timber floor surfaces.
    - Cutting holes and notches in timber floor joists.
    - Cutting chases in wall or floor surfaces.

Unit 020 Install and maintain domestic plumbing and heating systems

Outcome 2 Be able to install plumbing and heating systems and components in the workplace

Assessment Criteria

The learner can:

1. Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed
2. Measure and mark out the position of the components to be installed:
   - System pipework.
   - Main system components.
   - System controls.
3. Make pipework and component fixings to the building fabric
4. Position and fix pipework and components to the building fabric:
   - Copper.
   - Plastics.
5. Connect pipework to system controls and main components:
   - Cold water systems.
   - Hot water systems.
   - Central heating systems.
   - Sanitation systems.
   - Gravity rainwater systems.
6. Connect system pipework to incoming supplies or outgoing services:
   - Existing system pipework and components.
   - Cold water supply pipework.
   - Below ground drainage pipework.
7. Carry out installation work minimising the wastage of equipment and materials
8. Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed.

Unit 020 Install and maintain domestic plumbing and heating systems

Outcome 3 Be able to soundness test plumbing and heating systems and components in the workplace

Assessment Criteria

The learner can:

1. Carry out a visual inspection of the system or component to be tested to make sure that it is ready to be filled with water
2. Charge the system to normal operating pressure and check for leakage:
   - Cold water systems.
   - Hot water systems.
   - Central heating systems.
3. Perform a soundness test to industry requirements on the installed system or component:
   - Cold water systems.
   - Hot water systems.
   - Central heating systems.
   - Sanitation systems.
   - Gravity rainwater systems.
4. Flush the system with cold water on completion of soundness testing
5. Rectify any leakage from the system or component found during the soundness test procedure.

Unit 020 Install and maintain domestic plumbing and heating systems

Outcome 4 Be able to decommission plumbing and heating systems in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the decommissioning work
2. Liaise with other persons to confirm the detail of the decommissioning work to be carried out
3. Arrange for temporary supplies or services to be available for the duration of decommissioning
4. Comply with health and safety requirements when carrying out decommissioning work
5. Prepare a safe and unobstructed access route to the work areas to carry out the decommissioning work
6. Check that all required tools, equipment and materials are available to undertake the decommissioning work
7. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the decommissioning work
8. Provide protection to the building fabric or customer property as the work progresses
9. Isolate the system from the supply source or outgoing service:
   - Turn off the electricity and fuel supply to the system.
   - Turn off the water supply to the system.
   - Prevent the use of sanitary appliances.
10. Drain and safely dispose of the system contents:
    - Cold water systems.
    - Hot water systems.
    - Central heating systems.
11. Take precautions to ensure that the system cannot be brought back into operation before the decommissioning work is complete
12. Advise other persons that the system has been successfully decommissioned.

Unit 020 Install and maintain domestic plumbing and heating systems

Outcome 5 Be able to maintain plumbing and heating components in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the maintenance work
2. Liaise with other persons to confirm the detail of the maintenance work to be carried out
3. Comply with health and safety requirements when carrying out maintenance work
4. Prepare a safe and unobstructed access route to the work areas to carry out the maintenance work
5. Check that all required tools, equipment and materials are available to undertake the maintenance work
6. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the maintenance work
7. Provide protection to the building fabric or customer property as the work progresses
8. Isolate the component from the supply source or outgoing service:
   - Turn off the electricity and fuel supply to the component.
   - Turn off the water supply to the component.
   - Prevent the use of sanitary appliances.
9. Drain the component contents
10. Take precautions to ensure that the component cannot be brought back into operation before the maintenance work is complete
11. Carry out the maintenance or replacement of the component to industry requirements
12. Re-instate the supply or service to the component and check it for correct operation.
13. Advise other persons that work on the system or component has been successfully completed
14. Complete the details contained in simple maintenance records

Unit 020 Install and maintain domestic plumbing and heating systems

Notes for guidance

All the evidence provided must be from the learner's workplace, simulated assessment activities are not acceptable in meeting the outcomes of the unit.

Learning Outcomes 1 – 3 (Prepare work sites, install and soundness test)

Evidence must be provided (as a minimum) of work carried out on three of the following five system types:

- Cold water system
- Hot water system
- Central heating system
- Sanitation system
- Gravity rainwater system

Of the three system types selected, evidence must be provided of the assessment criteria being met on two separate occasions, ie as a minimum on two different jobs at separate addresses.

Evidence for outcomes 1-3 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified plumbing assessor
- Product assessment of work already completed by a qualified plumbing assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company expert witness
- Professional review undertaken by a qualified assessor of the learner's competence

Scope of the Evidence to be produced for Learning Outcomes 1-3

Hot and cold water systems

The on-site installation in a dwelling must comprise of a minimum of bath or shower, basin and WC which must be part of a new installation or replacement of an existing bathroom suite. Alternatively evidence may be provided from an industrial or commercial environment of the installation of a minimum of three appliances (two of which must be of different appliance types eg Urinal and Basin). In either case the work must include the complete replacement of all hot and cold pipework within the room (other than the supply tails entering the room).

Minimum direct observation requirement for this system type

- The installation of one sanitary appliance and its associated pipework at one address from the above.

Central heating systems

The on-site installation must comprise a minimum of a new or replacement system including 4 radiators, associated controls and connections to the boiler (electrics and fuel supply system

are not included in the scope of the assessment activity). The work must include the new installation or complete replacement of pipework in the system.

Minimum direct observation requirement for this system type

- The installation of one radiator and associated pipework connections to the heating mains at one address from the above.

Sanitation systems

The on-site installation must in a dwelling comprise of the installation or complete replacement of a soil pipe and appropriate venting arrangements to a bathroom suite including a minimum of bath or shower, basin and WC. Alternatively evidence may be provided from an industrial or commercial environment of the installation of a minimum of three appliances (two of which must be of different appliance types but including a WC eg W C and Basin. In either case the work must include the complete replacement or new installation of all soil, vent and waste pipework to its point of connection at the below ground drainage system.

Minimum direct observation requirement for this system type

- The installation of one sanitary appliance and its soil/waste connection to the stack at one address from the above.

Gravity rainwater systems

The on-site installation must comprise of the new installation or complete replacement of the gutter system and associated rainwater pipework (down pipes) to a property.

Minimum direct observation requirement for this system type

- The installation of a significant section of gutter system or a complete section of rainwater pipework at one address from the above.

Learning Outcome 4 (Decommission)

Evidence must be provided (as a minimum) of work carried out on two of the following four system types:

- Cold water system
- Hot water system
- Central heating system
- Sanitation system

Of the two system types selected, evidence must be provided of the assessment criteria being met on one occasion at a property.

Evidence for outcome 4 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified plumbing assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company expert witness
- Professional review undertaken by a qualified assessor of the learner's competence

Scope of the Evidence to be produced for Learning Outcome 4

Evidence must be produced of either the temporary decommissioning of a system eg taking the system out of service to add a new component such as a radiator or the movement of a radiator to a different location in a building, or the permanent decommissioning of a system such as when a system is being fully replaced as part of a major refurbishment of a property. In an industrial/commercial work environment the evidence can include the decommissioning of a significant part of a system such as a complete washroom or public convenience.

Minimum direct observation requirements for Learning Outcome 4

- The decommissioning of one of the system types at a property.

Learning Outcome 5 (Maintenance)

Component repair or replacement

Evidence must be provided (as a minimum) of repair or replacement work carried out on four of the following non-electrical components:

- Taps – mixer or pillar
- Float valve
- Shower mixer valve
- Stop valve
- Gate valve (or similar service valve)
- Drain valve
- Radiator valve
- Thermostatic radiator valve
- WC siphon/ drop valve
- Sanitary appliance trap

System maintenance

Evidence must be provided (as a minimum) of maintenance work carried out on two of the following faults:

- Leaks in system pipework
- Noise in systems
- Corrosion of system components
- Inadequate supply pressure at discharge points
- Loose pipework
- Trap seal loss
- Blockages in system components/pipework

Evidence for outcome 5 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified plumbing assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company expert witness
- Professional review undertaken by a qualified assessor of the learner's competence

Minimum direct observation requirements for Learning Outcome 5

- None specified owing to the sporadic nature of arranging on-site visits for maintenance type work.

Unit 022 Install and maintain domestic heating systems

Level: 2
Credit value: 4
UAN: R/602/2971

Unit aim

The unit confirms job competence at Level 2 in the installation, maintenance decommissioning and soundness testing of a range of basic domestic heating and hot water systems and components in dwellings.

Learning outcomes

There are **five** learning outcomes to this unit. The learner will:

1. Be able to prepare sites for the installation of domestic heating and hot water systems and components in the workplace
2. Be able to install domestic heating and hot water systems and components in the workplace
3. Be able to soundness test domestic heating and hot water systems and components in the workplace
4. Be able to decommission domestic heating and hot water systems in the workplace
5. Be able to maintain domestic heating and hot water components in the workplace

Guided learning hours

It is recommended that four hours should be allocated for this unit for co-odinating evidence collection and assessment planning activities, although patterns of delivery are likely to vary. Guided learning hour specifications do not include time allocations for observation and assessment activities conducted in the workplace.

Details of the relationship between the unit and relevant national standards

This unit is linked to the following SummitSkills National Occupational Standards (NOS) for the Mechanical Services Industry:

- SummitSkills NOS M7, M10, M12, M13, M25.

Support of the unit by a sector or other appropriate body

This unit is endorsed by SummitSkills.

Assessment

This unit will be assessed by:

- Evidence collection and assessment in the workplace. See notes for guidance at end of unit for assessment requirements.

Unit 022 Install and maintain domestic heating systems

Outcome 1 Be able to prepare sites for the installation of domestic heating and hot water systems and components in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the installation work
2. Liaise with other persons to confirm the detail of the installation work to be carried out
3. Comply with health and safety requirements when carrying out the installation work
4. Prepare a safe and unobstructed access route to the work areas to carry out the installation work
5. Check that all required tools, equipment and materials are available to undertake the installation work
6. Use job information to identify the location of the building fabric that requires preparatory work to be carried out
7. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work
8. Provide protection to the building fabric or customer property as the work progresses
9. Carry out preparatory work to the building fabric
    - Lifting timber floor surfaces
    - Cutting holes and notches in timber floor joists
    - Cutting chases in wall or floor surfaces.

Unit 022 Install and maintain domestic heating systems

Outcome 2 Be able to install domestic heating and hot water systems and components in the workplace

Assessment Criteria

The learner can:

1. Confirm that the incoming supplies meet the requirements of the system or component being installed
2. Measure and mark out the position of the components to be installed
   - System pipework
   - Main system components
   - System controls
3. Make pipework and component fixings to the building fabric
4. Position and fix pipework and components to the building fabric
   - Copper
   - Plastics
5. Connect pipework to system controls and main components
   - Cold water systems (connections into)
   - Hot water systems
   - Central heating systems
6. Connect system pipework to hot and cold water systems
7. Carry out installation work using methods and techniques which minimise the wastage of equipment and materials
8. Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed.

Unit 022 Install and maintain domestic heating systems

Outcome 3 Be able to soundness test domestic heating and hot water systems and components in the workplace

Assessment Criteria

The learner can:

1. Carry out a visual inspection of the system or component to be tested to make sure that it is ready to be filled with water
2. Charge the system to normal operating pressure and check for leakage
   - Cold water systems (connections from existing system pipework or cold water system installed by others)
   - Hot water systems
   - Central heating systems
3. Perform a soundness test to industry requirements on the installed system or component –
   - Hot water systems
   - Central heating systems
4. Flush the system with water on completion of soundness testing
5. Rectify any leakage from the system or component found during the soundness test procedure.

Unit 022 Install and maintain domestic heating systems

Outcome 4 Be able to decommission domestic heating and hot water systems in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the decommissioning work
2. Liaise with other persons to confirm the detail of the decommissioning work to be carried out
3. Arrange for temporary supplies or services to be available for the duration of decommissioning
4. Comply with health and safety requirements when carrying out decommissioning work
5. Prepare a safe and unobstructed access route to the work areas to carry out the decommissioning work
6. Check that all required tools, equipment and materials are available to undertake the decommissioning work
7. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the decommissioning work
8. Provide protection to the building fabric or customer property as the work progresses
9. Isolate the system from the supply source
   - Turn off the electricity supply and fuel source to the system
   - Turn off the water supply to the system
10. Drain and safely dispose of the system contents
    - Hot water systems
    - Central heating systems
11. Take precautions to ensure that the system cannot be brought back into operation before the decommissioning work is complete
12. Advise other persons that the system has been successfully decommissioned.

Unit 022 Install and maintain domestic heating systems

Outcome 5 Be able to maintain domestic heating and hot water components in the workplace

Assessment Criteria

The learner can:

1. Check that all necessary job information is available before commencing the maintenance work
2. Liaise with other persons to confirm the detail of the maintenance work to be carried out
3. Comply with health and safety requirements when carrying out maintenance work
4. Prepare a safe and unobstructed access route to the work areas to carry out the maintenance work
5. Check that all required tools, equipment and materials are available to undertake the maintenance work
6. Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the maintenance work
7. Provide protection to the building fabric or customer property as the work progresses
8. Isolate the component from the supply source
   - Turn off the electricity supply and fuel source to the component
   - Turn off the water supply to the component
9. Drain the component contents
10. Take precautions to ensure that the component cannot be brought back into operation before the maintenance work is complete
11. Carry out the maintenance or replacement of the component to industry requirements
12. Reinstate the supply or service to the component and check it for correct operation
13. Advise other persons that work on the system or component has been successfully completed
14. Complete the details contained in simple maintenance records.

Unit 022 Install and maintain domestic heating systems
Notes for guidance

All the evidence provided must be from the learner's workplace, simulated assessment activities are not acceptable in meeting the outcomes of the unit.

Learning Outcomes 1 – 3 (Prepare work sites, install and soundness test)

Evidence must be provided (as a minimum) of work carried out on the following system types:

- Hot water system
- Central heating system

Of the system types, evidence must be provided of the assessment criteria being met on two separate occasions, ie as a minimum on two different jobs at separate addresses.

Evidence for outcomes 1-3 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified assessor
- Product assessment of work already completed by a qualified assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company expert witness
- Professional review undertaken by a qualified assessor of the learner's competence

Scope of the Evidence to be Produced for Learning Outcomes 1-3

Hot water systems

The on-site installation in a dwelling must include the installation of a storage cylinder and connections to the existing pipework system for an open vented system, or for an instantaneous water heater, connections from the appliance to the existing pipework system.

Minimum direct observation requirement for this system type

- A significant proportion of the installation work on the hot water system must be observed by a qualified assessor in the workplace.

Central heating systems

The on-site installation must comprise a minimum of a new or replacement system including 4 radiators, associated controls and connections to the boiler (electrics and fuel supply system are not included in the scope of the assessment activity). The work must include the new installation or complete replacement of pipework in the system.

Minimum direct observation requirement for this system type

- The installation of one radiator and associated pipework connections to the heating mains at one address from the above.

Learning Outcome 4 (Decommission)

Evidence must be provided (as a minimum) of work carried out on the following system types -

- Hot water system
- Central heating system

Of the system types, evidence must be provided of the assessment criteria being met on one occasion at a property.

Evidence for outcome 4 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company expert witness
- Professional review undertaken by a qualified assessor of the learner's competence

Scope of the Evidence to be produced for Learning Outcome 4

Evidence must be produced of either the temporary decommissioning of a system eg taking the system out of service to add a new component such as a radiator or the movement of a radiator to a different location in a building, or the permanent decommissioning of a system such as when a system is being fully replaced as part of a major refurbishment of a property.

Minimum direct observation requirements for Learning Outcome 4

- The decommissioning of one of the system types at a property.

Learning Outcome 5 (Maintenance)

Component repair or replacement

Evidence must be provided (as a minimum) of repair or replacement work carried out on three of the following non-electrical components:

- Float valve
- Shower mixer valve
- Gate valve (or similar service valve)
- Drain valve
- Radiator valve
- Thermostatic radiator valve

System maintenance

Evidence must be provided (as a minimum) of maintenance work carried out on two of the following faults:

- Leaks in system pipework
- Noise in systems
- Corrosion of system components
- Loose pipework
- Blockages in system components/pipework

Evidence for outcome 5 can be provided in the form of:

- Direct observation of the learner carrying out work by a qualified assessor
- Witness testimony type evidence (log book) countersignature required by a qualified in-company work based recorder
- Professional review undertaken by a qualified assessor of the learner's competence

Minimum direct observation requirements for Learning Outcome 5

- None specified owing to the sporadic nature of arranging on-site visits for maintenance type work.

Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the Centres and Training Providers homepage on **www.cityandguilds.com**.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Providing City & Guilds qualifications – a guide to centre and qualification approval contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Ensuring quality contains updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document contains information on:

- Management systems
- Maintaining records
- Assessment
- Internal verification and quality assurance
- External verification.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

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

- *Walled Garden*
  Find out how to register and certificate candidates on line
- *Events*
  Contains dates and information on the latest Centre events
- *Online assessment*
  Contains information on how to register for e-volve assessments.

Appendix 2 Normative references for use in open book examinations

006 – Understand and apply domestic cold water system installation and maintenance techniques

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- BS EN 806- Specification for installations inside buildings conveying water for human consumption (parts 1-5)
- BS 8558- Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806
- BS 8000 part 15 - Workmanship on building sites. Code of practice for hot and cold water services (domestic scale)
- Building Regulations Approved Document A (D in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)
- Building Regulations Approved Document G (P in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)

007 – Understand and apply domestic hot water system installation and maintenance techniques

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- BS EN 806- Specification for installations inside buildings conveying water for human consumption (parts 1-5)
- BS 8558- Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806
- BS 8000 part 15 - Workmanship on building sites. Code of practice for hot and cold water services (domestic scale)
- Building Regulations Approved Document A (D in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)
- Building Regulations Approved Document G (P in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)
- Domestic Building Services Compliance Guide, freely downloaded at **www.planningportal.gov.uk**

008 – Understand and apply domestic central heating system installation and maintenance techniques

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- Building Regulations Approved Document A (D in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)
- ISBN 1 903287 40 5 CIBSE Domestic Heating Design Guide, revised 2011
- Domestic Building Services Compliance Guide, freely downloaded at **www.planningportal.gov.uk**

009 – Understand and apply domestic rainwater system installation and maintenance techniques

- Building Regulations Approved Document H (N in Northern Ireland), freely downloaded at www.planningportal.gov.uk (www.dfpni.gov.uk in Northern Ireland)
- BS EN 12056 part 3 - Gravity drainage systems inside buildings. Roof drainage, layout and calculation

010 Understand and apply domestic above ground drainage system installation

- BS 6465 part 2 - Code of practice for space requirements for sanitary appliances
- BS 8000 part 13 - Workmanship on building sites. Code of practice for above ground drainage and sanitary appliances
- BS EN 12056 part 2 - BS EN 12056: 2 - Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation
- Building Regulations Approved Document A (D in Northern Ireland), freely downloaded at www.planningportal.gov.uk (www.dfpni.gov.uk in Northern Ireland)
- Building Regulations Approved Document H (N in Northern Ireland), freely downloaded at www.planningportal.gov.uk (www.dfpni.gov.uk in Northern Ireland)

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