

Level 3 Domestic Plumbing and Heating (6189)

Unit Pack for centres



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Version and date	Change detail	Section
2.0 May 2013	Where necessary, amended type of assessment within unit to reflect information in the Handbook.	Unit
3.0 October 2013	Removed references to BS 6700 and replaced with BS EN 806	Units 302/012, 303/013
3.1 January 2014	Corrected Unit Accreditation Number for Unit 308 to L/502/9391	Unit 308

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1 Units

Availability of units

The complete set of units including learning outcomes and assessment criteria for the additional competence based units are viewable on the Register of Regulated Qualifications <http://register.ofqual.gov.uk>

Structure of units

These units each have the following:

- City & Guilds unit number
- Title
- Level
- Credit value
- Unit Accreditation Number (UAN)
- Unit aim(s)
- Recommended Guided Learning Hours (GLH)
- Relationship to National Occupational Standards (NOS)
- Endorsement by a sector or other appropriate body
- Information on assessment
- Learning outcomes which are comprised of a number of assessment criteria.

Summary of units

City & Guilds unit	Title	QCF unit ref (UAN)	Credits	GLH
212	Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations	D/503/8628	3	16
301	Understand how to organise resources within BSE	R/602/2498	3	26
302/012	Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques	K/502/8930	9	76
303/023	Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques	K/502/9155	9	76
304/024	Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques	M/502/9156	12	98
305/025	Understand and carry out electrical work on domestic plumbing and heating systems and components	T/502/9157	12	102
306	Install, commission, service and maintain domestic heating systems	A/502/8933	3	4

City & Guilds unit	Title	QCF unit ref (UAN)	Credits	GLH
307	Understand core oil firing safety principles within domestic building services engineering	H/502/9557	12	110
308	Apply core oil firing safety within domestic building services engineering	L/502/9391	4	6
309	Understand the principles of domestic oil firing pressure jet appliances	D/502/9394	7	60
310	Service and maintain domestic oil firing pressure jet appliances	M/502/9402	3	4
311	Install, test and commission domestic oil firing pressure jet appliances	Y/502/9393	3	4
312	Install, test and commission domestic oil firing vaporising appliances	A/502/9404	3	4
313	Service and maintain domestic oil firing vaporising appliances	F/502/9405	3	4
314	Understand the principles of domestic oil firing vaporising appliances	T/502/9403	7	60
315	Understand core solid fuel safety principles within domestic building services engineering	J/502/9406	12	110
316	Apply core solid fuel safety within domestic building services engineering	L/502/9407	4	6
317	Service and maintain domestic solid mineral fuel burning appliances	L/502/9410	3	4
318	Understand the principles of domestic solid mineral fuel burning appliances	R/502/9408	7	60
319	Install, test and commission domestic solid mineral fuel burning appliances	Y/502/9409	3	4
320	Service and maintain domestic biomass fuel burning appliances	H/502/9414	2	3
321	Install, test and commission domestic biomass fuel burning appliances	K/502/9415	3	4
322	Understand the installation and commissioning principles of biomass fuel burning appliances	R/502/9411	7	60
323	Understand the service and maintenance principles of biomass fuel burning appliances	Y/502/9412	3	22
324	Understand the fundamental principles and requirements of environmental technology systems	K/602/3138	2	15
325	Know the requirements to install, commission and handover solar thermal hot water systems	F/602/3100	4	35
326	Install, commission and handover 'active' solar thermal hot water systems	L/602/3102	2	15
327	Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems	Y/602/3104	2	15
328	Inspect, service and maintain 'active' solar thermal hot water systems	K/602/3107	2	15
329	Install, commission and handover heat pumps non-refrigerant circuits	D/602/3072	2	15

City & Guilds unit	Title	QCF unit ref (UAN)	Credits	GLH
330	Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits	F/602/3078	2	15
331	Inspect, service and maintain heat pump installations non-refrigerant circuits	L/602/3083	2	15
332	Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits	Y/602/3054	4	35
333	Inspect, service and maintain rainwater harvesting and greywater reuse systems	A/602/3130	2	15
334	Install, commission and handover rainwater harvesting and greywater reuse systems	K/602/3110	2	15
335	Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems	M/602/3111	2	15
336	Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems	T/602/3109	4	35
337	Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises	T/502/8381	19	115
338	Specific core installation and maintenance	H/502/8487	21	120
339	Understand core gas safety principles for natural gas within domestic building services engineering	J/502/9390	13	120
340	Maintain gas warm air central heating systems and appliances	T/502/8302	11	54
341	Install domestic gas warm air central heating appliances	F/502/8299	12	54
344/026	Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques	D/502/9296	8	72
345	Install, commission, service and maintain domestic plumbing and heating systems	K/502/9298	3	4

Unit 212

Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Level: 2

Credit value: 3

UAN: D/503/8628

Unit aim(s)

The aim of the unit is to assess the competence of individuals to recognised national occupational standards. The unit supports workforce development and describes the competencies necessary to tightness test, purge, commission and decommission gas pipework.

The scope of work of this unit covers the work activities of planning, de-commissioning, commissioning and gas tightness testing and direct purging of small 2nd family gas (natural gas) installations downstream of an Emergency Control Valve (ECV). The unit is based on the Institution of Gas Engineers and Managers, normative standard IGE/UP/1B

The gas installation to be tested and purged:

- must have a maximum operating pressure (MOP) at the outlet of the ECV not exceeding 2 bar
- an operating pressure (OP) at the outlet of the primary meter of 21 mbar (nominal)
- a nominal bore of pipework not greater than 35mm
- a maximum rated capacity through the primary meter of 16m³/h (U16), and
- a maximum installation volume (IV) supplying an individual dwelling or non domestic premises of 0.035 cubic metre.

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

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

1. be able to plan and prepare work activities for tightness testing and direct purging
2. be able to de-commission gas systems and components to industry standards
3. be able to carry out tightness testing and direct purging of gas systems and components
4. be able to use and communicate data and information to carry out de-commissioning, tightness testing and direct purging
5. be able to resolve problems which could affect de-commissioning, tightness testing and direct purging
6. be able to install, commission and de-commission gas pipework up to 35mm (1¼) diameter in domestic and small commercial premises.

Guided learning hours

It is recommended that **16** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.6 Gas Tightness Testing and Direct Purging.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 212 Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 1 Be able to plan and prepare work activities for tightness testing and direct purging

Assessment Criteria

The learner can:

1. carry out a risk assessment which incorporates:
 - safety provisions in the work site
 - access to the work site
 - movement of the workforce
 - members of the public
 - the movement and safe storage of materials, tools and equipment
2. survey the work site for:
 - any damage or defects to existing building features
 - record details of any features that may affect the work
3. advise the property occupier of any defects found
4. protect the work site and the building fabric against possible damage being caused during the:
 - tightness testing process
 - direct purging process
5. obtain confirmation from the property occupier before the job starts to ensure that they agree the planned work
6. confirm the:
 - siting of the gas supply
 - provision of ventilationmeets the requirements for tightness testing and direct purging
7. check and confirm all:
 - materials
 - tools
 - test equipmentnecessary for the tightness testing and direct purging process are available as required and are fit for purpose
8. check and confirm that the:
 - gas supply
 - earthing supply
 - provision of ventilationmeet the industry standard's requirements for the installation
9. carry out all necessary checks and tests to confirm the gas supply meets the industry requirements for the installation
10. check existing installation for unsafe appliances and system components and apply the gas industry unsafe situations procedures as necessary.

Unit 212 Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 2 Be able to de-commission gas systems and components to industry standards

Assessment Criteria

The learner can:

1. check and confirm that conditions within the gas system will permit safe de-commissioning
2. select and use the correct:
 - tools
 - equipmentfor de-commissioning activities
3. use designated safe:
 - isolation methods
 - tests
 - proceduresto de-commission gas systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - gas systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system componentsas necessary.

Unit 212

Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 3

Be able to carry out tightness testing and direct purging of gas systems and components

Assessment Criteria

The learner can:

1. confirm the complete pipework installation complies with the:
 - manufacturer's specification
 - industry standards
2. carry out preparatory work for tightness testing and direct purging to meet industry standards
3. check that conditions within the gas system will permit safe tightness testing and direct purging
4. select and use the correct tools and equipment for tightness testing and direct purging activities
5. measure, calculate and record gas system installation volumes for tightness testing and direct purging activities
6. ensure ventilation for tightness testing and direct purging activities meets industry standard's requirements
7. remove existing gas components as necessary
8. carry out the tightness testing and direct purging process, minimising damage to:
 - customer property
 - building features
9. use tightness testing procedures to confirm the integrity of the newly installed
 - gas system
 - new and or existing appliances
10. use tightness testing procedures to confirm the integrity of the existing:
 - gas system
 - new and existing appliances

to ensure the installation doesn't exceed the maximum permissible pressure drop

11. use tightness testing procedures to confirm the integrity of the gas system where the:
 - maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2 bar
 - no meter inlet valve is fitted
12. where the installation fails the tightness test, either:
 - trace and repair the escape and retest installation
 - isolate unsafe gas appliances
 - gas system
 - components

and apply the gas industry unsafe situations procedure

13. use purging procedures to confirm the safe supply of gas to the installed:
 - gas system
 - appliances

14. instruct the property occupier on the correct operation of the gas

- system
- valves
- components

15. take precautionary actions to prevent the unauthorised use of uncommissioned gas:

- appliances
- systems
- components

by isolation procedures and use of warning notices.

Unit 212 Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 4 Be able to use and communicate data and information to carry out de-commissioning, tightness testing and direct purging

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work during the tightness testing and direct purging processes to minimise disturbance to the job
2. use:
 - normative documents
 - industry standards
 - British Standards
 - information from manufacturer's instructionsto ensure the work is carried out to the specification
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the job supervisor
5. advise the designated person in the property of any unsafe situations and actions required to remedy those situations
6. check that the customer is satisfied with the finished job
7. complete records and documentation confirming the safe tightness testing and direct purging of gas systems and components
8. complete gas system de-commissioning records.

Unit 212

Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 5

Be able to resolve problems which could affect de-commissioning, tightness testing and direct purging

Assessment Criteria

The learner can:

1. rectify and report deficiencies in gas and earthing input services
2. resolve problems in accordance with approved procedures where pre-tightness testing and direct purging checks and tests reveal gas system or component defects
3. resolve problems in accordance with approved procedures when gas systems and components being tightness tested and purged do not meet design requirements
4. resolve problems in accordance with approved procedures when the gas system and components cannot be restored to full performance.

Unit 212

Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

Outcome 6

Be able to install, commission and de-commission gas pipework up to 35mm (1¼) diameter in domestic and small commercial premises

Assessment Criteria

The learner can:

1. describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process
2. explain safe access and working at heights procedures
3. specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
4. describe the methods of working which protect the building décor, customer property and existing systems and components
5. state the care and maintenance requirements of tools and equipment, and checks for safe condition
6. state the tools, equipment, materials and components required for the gas system installation, commission and de-commission, – ordering, supplying, advising, checking and delivery procedures
7. explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
8. describe the potential hazards that could arise from all de-commissioning, installation and commissioning activities and the checks to be carried out before work takes place
9. explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, installation and commissioning activity
10. demonstrate how and where to access the required information, i.e. normative documents, industry standards guidance documents, British Standards and manufacturer's instructions applicable to the gas system and appliance, to ensure the work is done to the specification and industry standards
11. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
12. describe how to measure and record installation and site details for prefabrication purposes
13. explain how to confirm that the gas supply and earthing system requirements are adequate for the installation of the new gas system and components or, for extending the system or adding components to
14. explain how to confirm that the provision of ventilation meets the industry standard's requirements for the installation, ie in voids, shafts, ducts
15. calculate correct sizing of pipework to ensure minimum pressure loss across installation
16. state checks and tests to confirm suitability of the gas supply
17. state checks and tests to confirm suitability of the earthing system, including the installation and positioning of the main equipotential bonding
18. state safe isolation methods, tests and procedures for temporary and permanent de-commissioning of gas systems, earthing systems and components, including the use of temporary continuity bonds
19. explain the precautions to ensure that de-commissioned gas and earthing systems do not prove a safety hazard

20. describe measures to prevent de-commissioned gas systems being brought into operation utilising safety and warning notices
21. describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas system operation
22. summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required
23. state the industry practices and work standards for fabricating and installing gas pipework, valves, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
24. identify and describe the types of pipe materials suitable for carrying gas - steel, malleable iron, copper, corrugated stainless steel tube (CSST), polyethylene and lead
25. identify and describe the types of pipe fittings suitable for carrying gas – capillary, compression, push-fit, union joints and screwed joints
26. state the industry practices and work standards for jointing materials and fittings suitable for carrying gas, including connecting to lead composition pipes
27. state the safety precautions to take when jointing materials and fittings - including COSHH
28. state the industry practices and methods of bending pipe materials suitable for carrying gas, ie bending methods of copper pipe, corrugated stainless steel tube (CSST) and stainless steel flexible pipe (anacondas)
29. describe the industry practices and methods of bending copper pipework to set measured distances to include; double sets/offset bends, 90 degree bends, crank sets/passover bends
30. state the positioning and fixing requirements for gas pipework, valves, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
31. describe how installation of gas pipework meets the industry standard's requirements for; location, siting, clearance requirements and relationship to other services, ie. electricity supply
32. state industry practices and work standards of providing adequate support(s) for pipework installation to conform with industry standard's requirements
33. produce a plan showing the positioning, protection and fixing methods for gas pipework, valves, systems and components in; floors, ducts, through walls, buried in walls, multi-occupancy buildings and protected shafts containing stairs, lifts or other protected fire escape routes, to comply with industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations, i.e. sleeving, purposed designed channels, fire stops, purposed designed shafts
34. state the industry practices and work standards for pipe installation within suspended and joisted floors including methods of lifting and replacing floorboards and chipboard flooring
35. state the industry practices and work standards for pipe installation in concrete floors
36. explain the installation and protection of external installations to meet industry standards requirements, i.e. protection against mechanical damage, minimum depth below ground level
37. state the procedures and work methods for connecting to input services including; gas, earthing and ventilation systems
38. state the procedures and work methods of connecting pipework, valves and components to both new and existing gas systems and appliances
39. describe the procedures and work methods to ensure correct gas pipe identification
40. describe the process and procedures, equipment and legislative requirements for applying tightness testing and purging to gas appliances, systems and components
41. describe the process and procedures, equipment and legislative requirements for applying electrical tests to earthing systems and components to ensure safe functioning, i.e. earth continuity checks
42. describe the procedures for checking the correct operation and performance of gas systems, valves and components and checking against the design specification to ensure safe functioning
43. state the routines and sequences for commissioning gas systems, valves and components
44. explain how to complete all installation and commissioning documentation and records to be left with the property occupier including; Benchmark, Landlord/Home owner gas safety record

45. explain system handover procedures and demonstrate the operation of gas systems, valves and components to end users
46. summarise the steps to take when problems arise in the work activities
47. describe Job management structures and methods of reporting and recording job progress or problems delaying progress
48. describe how to safely collect and dispose of system contents that may be hazardous to health or the environments, i.e. waste products including asbestos and insulation materials
49. demonstrate how and where to access the required information, i.e. industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment, i.e. Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations
50. explain how to isolate unsafe gas appliances, gas systems and components and apply the gas industry unsafe situations procedure.

Unit 301

Understand how to organise resources within BSE

Level: 3

Credit value: 3

UAN: R/602/2498

Unit aim(s)

This knowledge unit provides learning in the organising and planning of work programs, risk assessments, method statements in the BSE in a supervisory role and knowing the responsibilities of others and communicating with them.

Learning outcomes

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

1. know the responsibilities of relevant people in the building services industry
2. know how to oversee building services work
3. know how to produce risk assessments and method statements for the building services industry
4. know how to plan work programmes for work tasks in the building services industry.

Guided learning hours

It is recommended that **26** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 301

Understand how to organise resources within BSE

Outcome 1

Know the responsibilities of relevant people in the building services industry

Assessment Criteria

The learner can:

1. define the types of client that are encountered when working:
 - private customer:
 - direct communication
 - through customer representatives - managing agents
 - contracting customer
 - internal customer – within same company
2. specify the types of communication that may be required with clients throughout the progress of a job
3. specify the types of communication that may be required with the site management team:
 - architect
 - quantity surveyor
 - buyer/estimator
 - surveyor
 - project manager/clerk of works
 - structural engineer
 - building services engineer
 - contracts manager
 - construction manager
4. define the typical site responsibilities for craft operatives in the workplace:
 - apprentices/trainees
 - level 2 craft level qualified staff
 - limited self responsibility
 - level 3 craft level qualified staff
 - supervision of self and other staff members
5. specify the different methods of supervising individuals that can be used:
 - styles of supervision
 - methods of motivating staff
6. define the job responsibilities when supervising staff:
 - identifying the competence of subordinates to undertake work
 - identifying when direct supervision or detailed direction is required
 - specific health and safety issues:
 - responsibility for planning safe working for subordinates
 - how to adjust work schedules when health and safety problems delay works.

Unit 301

Understand how to organise resources within BSE

Outcome 2

Know how to oversee building services work

Assessment Criteria

The learner can:

1. specify how to deal with variations to works:
 - prescribed by the work environment:
 - communication to the client
 - agreement to extra time and costs
 - prescribed by the customer:
 - agreement to extra time and costs
2. clarify how to undertake ongoing monitoring of the work progress against the work programme to ensure:
 - safety
 - cost effectiveness
 - quality
3. clarify how to deal with problems that arise with deficiencies in work performance that could affect:
 - safety
 - cost effectiveness
 - quality.

Unit 301

Understand how to organise resources within BSE

Outcome 3

Know how to produce risk assessments and method statements for the building services industry

Assessment Criteria

The learner can:

1. define the levels of risk presented by work situations
2. define the hazards presented by work situations
3. specify the methods used to carry out a risk assessment for a task:
 - methods of assessing risk
 - risk calculation formula
 - presentation of a risk assessment
4. identify how to produce a method statement for areas of work with safety risk:
 - information to be provided in a method statement
 - presentation of a method statement.

Unit 301

Understand how to organise resources within BSE

Outcome 4

Know how to plan work programmes for work tasks in the building services industry

Assessment Criteria

The learner can:

1. specify the types of work programme that would be used for:
 - private installation work
 - private service/maintenance work
 - new-build installation contract work
 - service/maintenance contract work
2. state the process for planning work activities against job specifications:
 - the scope, purpose and requirements of the work
 - identification of work responsibilities
 - external factors that affect timeframe
3. state the process for selecting the required resources against the job specification:
 - materials
 - plant
 - vehicles
 - equipment
4. specify material delivery requirements against work programmes and the impact that the non-availability of materials may have on work progress:
 - work in private properties
 - work on new-build housing
 - work on commercial contracts
 - avoiding loss of materials on site (theft)
5. define the factors which affect working time allocation to work activities:
 - labour resources
 - planning work with other trades
 - material deliveries
6. identify how to produce simple work programmes:
 - simple bar (progress) charts.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Level: 3
Credit value: 9
UAN: K/502/8930

Unit aim(s)

This unit provides learning in application of design techniques, installation, maintenance, diagnostics and rectification of faults and commissioning procedures, along with the backflow protection in plumbing systems to comply with current legislation and regulations. The unit covers systems in multi story dwellings with water supplied from the water under taker and private water supplies.

Learning outcomes

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

1. know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes
2. know the types of cold water system layout used in multi-storey dwellings
3. know the types of cold water system layout used with single occupancy dwellings fed by private water supplies
4. know the requirements for backflow protection in plumbing systems
5. know the uses of specialist components in cold water systems
6. know the design techniques for cold water systems
7. be able to apply design techniques for cold water systems
8. know the fault diagnosis and rectification procedures for cold water systems and components
9. be able to diagnose and rectify faults in cold water systems and components
10. know the commissioning requirements of cold water systems and components
11. be able to commission cold water systems and components.

Guided learning hours

It is recommended that **76** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test
- an externally set assignment.

Permitted reference material

The learner is permitted to use the following materials during their assessment for this unit:

Cold water

- 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 Building Regulations Approved Document G (P in Northern Ireland), freely downloaded at **www.planningportal.gov.uk** (**www.dfpni.gov.uk** in Northern Ireland)
- OFWAT guaranteed standards scheme paper freely downloaded from **www.ofwat.gov.uk**
- The Water Supply (Water Fittings) Regulations freely downloaded from **www.legislation.gov.uk**

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 1 Know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes

Assessment Criteria

The learner can:

1. interpret the legislation controlling the installation and use of water systems:
 - supplied from a water undertaker
 - supplied from a private source
2. clarify the notification requirements for work on wholesome and recycled water systems:
 - water undertaker
 - building control or self-certification
3. differentiate between installer and user responsibilities under water legislation.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 2 Know the types of cold water system layout used in multi-storey dwellings

Assessment Criteria

The learner can:

1. state the cold water system component layout features for multi-storey dwellings:
 - supplied direct from the main
 - using break cistern arrangements
 - providing drinking water
2. state the system layout features for large scale storage cisterns used in multi-storey cold water systems for dwellings:
 - warning/overflow pipe
 - alternative filling methods using:
 - float switches and solenoid valves
 - specialist inlet valves
 - interlinking multiple cisterns
 - use of sectional cisterns
3. state the system layout features for break cisterns used in multi-storey cold water systems for dwellings
4. define the function of components used in boosted cold water systems in multi-storey dwellings:
 - booster pumps:
 - sets with integral controls
 - self assembled sets
 - pressure/expansion vessels
 - pressure switch (transducer)
 - float switch.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 3 Know the types of cold water system layout used with single occupancy dwellings fed by private water supplies

Assessment Criteria

The learner can:

1. propose the methods of providing private water supplies to single occupancy dwellings:
 - pumped from wells and boreholes
 - collected from surface water sources – streams and springs
 - use of externally sited break cisterns
2. propose the methods of treating water for use in single occupancy dwellings:
 - localised water filtration units
 - localised water treatment units – ultra violet
3. state the system layout features for cold water systems fed from private water supplies:
 - conventional direct or indirect systems from an incoming supply
 - boosted (pumped) supply from a well or borehole
 - boosted (pumped) supply from a low level internal or external break cistern
4. define the method of operation of the components used in a boosted (pumped) cold water supply system from private sources for single occupancy dwellings:
 - small booster pump sets which incorporate all controls and components
 - boosted system with separate controls and components
 - use of accumulators in increasing system flow rate.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 4 Know the requirements for backflow protection in plumbing systems

Assessment Criteria

The learner can:

1. interpret the five fluid risk levels as laid down in water legislation
2. define terminology used when selecting and applying backflow prevention devices:
 - point of use protection
 - whole site or zone protection
3. propose the installation situations in which non-mechanical backflow prevention devices may be used:
 - Type AA – air gap with unrestricted discharge above spill over level
 - Type AB – air gap with weir overflow
 - Type AD – air gap with injector
 - Type AG – air gap with minimum size circular overflow
 - Type AUK1 – air gap with interposed cistern
 - Type AUK2 – air gaps for taps and combination taps
 - Type AUK3 - air gaps for taps and combination taps
 - Type DC pipe interrupter with permanent atmospheric vent
4. propose the installation situations in which mechanical backflow prevention devices may be used:
 - Type BA – reduced pressure zone valve
 - Type CA – non verifiable disconnecter
 - Type DB – pipe interrupter with permanent atmospheric vent and moving element
 - Type EA/EB – single check valves
 - Type EC/ED – double check valves
 - Type HA – hose union backflow preventer
 - Type HUK1 – hose union tap with double check valves
 - Type HC – diverter with automatic return.
5. determine methods of preventing cross connection in systems that contain non-wholesome water sources.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 5 Know the uses of specialist components in cold water systems

Assessment Criteria

The learner can:

1. analyse the working principles of cold water system components:
 - infra-red operated taps
 - concussive taps
 - combination bath tap and shower head
 - flow limiting valves
 - spray taps
 - urinal – water conservation controls
 - shower pumps – single and twin impellor
 - pressure reducing valves
 - shock arrestors/mini expansion vessels
2. evaluate the use of components in cold water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 6 Know the design techniques for cold water systems

Assessment Criteria

The learner can:

1. interpret information sources when undertaking design work on cold water systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
2. clarify how to take measurements of building features in order to carry out design calculations:
 - from plans, drawings and specifications
 - from site
3. calculate the size of cold water system components used in single occupancy dwellings:
 - cistern
 - pipework
 - pump
 - pressure vessel
4. clarify how to present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 7 Be able to apply design techniques for cold water systems

Assessment Criteria

The learner can:

1. use information sources when undertaking design work for cold water systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
2. calculate the size of cold water system components used in single occupancy dwellings:
 - cistern
 - pipework
 - pump
 - pressure vessel
3. present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 8 Know the fault diagnosis and rectification procedures for cold water systems and components

Assessment Criteria

The learner can:

1. state the methods of obtaining details of system faults from end users
2. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components
3. propose routine checks and diagnostics on cold water system components as part of a fault finding process:
 - checking components for correct operating pressures and flow rates
 - cleaning system components (including dismantling and reassembly)
 - checking for correct component operation:
 - pumps
 - pressure switches (transducers)
 - float switches
 - expansion and pressure vessels
 - gauges and controls
 - checking for correct operation of treatment devices
 - water filters
 - water softeners
4. specify methods of repairing faults in cold water system components:
 - pumps
 - expansion/pressure vessels
 - pressure switches (transducers)
 - float switches
 - gauges and controls
5. specify methods of safely isolating cold water systems or components to prevent them being brought into operation before the work has been fully completed
6. define procedures for carrying out diagnostic tests to locate faults in cold water system components:
 - booster (pump) set to a system
 - backflow prevention devices
7. specify methods for diagnosing and preventing corrosion within cold water system pipework:
 - electrolytic corrosion
 - blue water corrosion.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 9 Be able to diagnose and rectify faults in cold water systems and components

Assessment Criteria

The learner can:

1. use manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components
2. isolate cold water systems or components to prevent them being brought into operation before the work has been fully completed
3. carry out diagnostic tests to locate faults in cold water system components and carry out repair work:
 - booster (pump) set to a system
 - backflow prevention devices.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 10 Know the commissioning requirements of cold water systems and components

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on cold water systems
2. state the checks to be carried out during a visual inspection of a boosted cold water system to confirm that it is ready to be filled with water
3. state how to fill cold water pipework with water at normal operating pressure and check for leakage
4. identify how to conduct a soundness test on cold water systems:
 - metallic systems
 - plastic pipework systems
5. specify the disinfection procedures for cold water systems and the circumstances in which disinfection should be applied
6. state the flushing procedure for cold water systems and components
7. clarify how to take flow rate and pressure readings from new and existing cold water systems
8. specify the actions that must be taken when commissioning reveals defects in cold water systems:
 - dealing with systems that do not meet correct installation requirements
 - micro-biological contamination within a cold water systems
 - remedial work associated with defective components
9. state the procedure for notifying works carried out to the relevant authority
10. propose the range of information that would be detailed on a commissioning record for a cold water system
11. propose the points to be covered when handing over a completed system to the end-user.

Unit 302/012 Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

Outcome 11 Be able to commission cold water systems and components

Assessment Criteria

The learner can:

1. carry out a visual inspection of a boosted cold water system to confirm that it is ready to be filled with water
2. charge 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. perform a disinfection procedure on a cold water system to industry requirements
5. flush the system with wholesome water on completion of soundness testing
6. use test instruments to take readings of the water supply pressure and flow rate
7. adjust and set controls to achieve system design requirements:
 - pressure at outlets
 - flow rate at outlets.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Level: 3
Credit value: 9
UAN: K/502/9155

Unit aim(s)

This unit provides learning in application of design techniques, installation and use of specialist components, maintenance, diagnostics and rectification of faults and commissioning procedures, along with the backflow protection in plumbing systems to comply with current legislation and regulations. The unit covers open vented and un-vented systems in multi story dwellings.

Learning outcomes

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

1. know the types of hot water system and their layout requirements
2. know the uses of specialist components in hot water systems
3. know the design techniques for hot water systems
4. be able to apply design techniques for hot water systems
5. know the installation requirements of hot water systems and components
6. be able to install hot water systems and components
7. know the fault diagnosis and rectification procedures for hot water systems and components
8. be able to diagnose and rectify faults in hot water systems and components
9. know the commissioning requirements of hot water systems and components
10. be able to commission hot water systems and components.

Guided learning hours

It is recommended that **76** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test and an externally set assignment.

Permitted reference material

The learner is permitted to use the following materials during their assessment for this unit:

Hot water

- 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**
- 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**
- The Water Supply (Water Fittings) Regulations freely downloaded from **www.legislation.gov.uk**

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

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

Assessment Criteria

The learner can:

1. compare the types of hot water supply systems used in dwellings:
 - centralised systems:
 - unvented hot water systems
 - open vented hot water systems
 - localised systems:
 - unvented point of use heaters
 - instantaneous heaters
2. identify hot water system pipework layout features for dwellings:
 - centralised unvented hot water systems
 - larger systems requiring a secondary circulation system
3. confirm the recommended design temperatures within hot water systems:
 - hot water storage vessel
 - hot water outflow
 - secondary return
 - at point of use:
 - instantaneous heaters
 - storage system
 - thermostatic mixing valve installations
4. evaluate the various types of unvented hot water system:
 - indirect storage systems
 - direct storage systems:
 - electrically heated
 - gas or oil fired
 - small point of use (under sink)
5. clarify the use of cold water accumulators in unvented hot water systems
6. define the function of components in unvented hot water systems:
 - safety devices:
 - control thermostat
 - overheat thermostat (thermal cut-out)
 - temperature relief valve
 - functional devices:
 - line strainer
 - pressure reducing valve
 - single check valve
 - expansion device (vessel or integral to cylinder)
 - expansion relief valve
 - tundish arrangements
 - application of composite valves

7. specify the layout features for temperature and expansion relief pipework in unvented hot water systems
8. specify the layout features for pipework systems incorporating secondary circulation:
 - pump type and location
 - timing devices
 - prevention of reverse circulation
 - methods of balancing circuits
9. state how trace heating can be used as an alternative to a secondary circulation system.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 2 Know the uses of specialist components in hot water systems

Assessment Criteria

The learner can:

1. analyse the working principles of hot water system components:
 - infra-red operated taps
 - concussive taps
 - combination bath tap and shower head
 - flow limiting valves
 - spray taps
 - shower pumps – single and twin impellor
 - pressure reducing valves
 - shock arrestors/mini expansion vessels
2. evaluate the use of components in hot water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 3 Know the design techniques for hot water systems

Assessment Criteria

The learner can:

1. define the factors which affect the selection of hot water systems for single occupancy dwellings
2. state the criteria used when selecting hot water system and component types:
 - customers needs
 - building layout and features
 - suitability of system
 - energy efficiency
 - environmental impact
3. interpret information sources when undertaking design work on hot water systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
4. clarify how to take measurements of building features in order to carry out design calculations:
 - from plans, drawings and specifications
 - from site
5. calculate the size of hot water system components used in single occupancy dwellings:
 - cistern
 - hot water storage vessel
 - pipework
 - secondary circulation pump
 - booster pump (shower and full system)
6. clarify how to present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 4 Be able to apply design techniques for hot water systems

Assessment Criteria

The learner can:

1. use information sources when undertaking design work for hot water systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
2. calculate the size of hot water system components used in single occupancy dwellings:
 - cistern
 - cylinder
 - pipework
 - secondary circulation pump
 - booster pump (shower and full system)
3. present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

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

Assessment Criteria

The learner can:

1. define the terms balanced and unbalanced supply pressures in unvented hot water storage systems
2. specify the positioning and fixing requirements of components in unvented hot water systems:
 - safety devices:
 - control thermostat
 - overheat thermostat (thermal cut-out)
 - temperature relief valve
 - functional devices:
 - line strainer
 - pressure reducing valve
 - single check valve
 - expansion device (vessel or integral to cylinder)
 - expansion relief valve
 - Tundish arrangements
 - application of composite valves
3. State the pipe size and positioning methods for safety relief pipework connected to unvented hot water cylinder safety valves:
 - D1 section
 - Tundish
 - D2 section
4. State how to position, fix and connect new hot water safety relief pipework:
 - D1 pipework
 - Tundish
 - D2 pipework
 - correct termination
5. state the positioning and fixing requirements of components of secondary circulation systems:
 - system pipework
 - pump
 - control valves
 - timing devices
 - reverse circulation control valves
 - pipework insulation.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 6 Be able to install hot water systems and components

Assessment Criteria

The learner can:

1. connect pipework to an unvented hot water system
 - incoming supply pipework:
 - line strainer
 - pressure reducing valve
 - expansion vessel
 - storage cylinder
 - check valve
2. position, fix and connect new hot water safety relief pipework:
 - D1 pipework
 - Tundish
 - D2 pipework
 - correct termination.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 7 Know the fault diagnosis and rectification procedures for hot water systems and components

Assessment Criteria

The learner can:

1. specify the periodic servicing requirements of hot water systems
2. state the methods of obtaining details of system faults from end users
3. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components
4. propose routine checks and diagnostics on hot water system components as part of a fault finding process:
 - checking components for correct operating pressures, temperatures and flow rates
 - cleaning system components (including dismantling and reassembly)
 - checking for correct operation of system components:
 - thermostats
 - pumps
 - timing devices
 - expansion and pressure vessels
 - gauges and controls
 - checking for correct operation of system safety valves:
 - temperature relief
 - expansion relief
5. specify methods of repairing faults in hot water system components:
 - pumps
 - expansion/pressure vessels
 - safety valves:
 - temperature relief
 - expansion relief
 - thermostats
 - gauges and controls
6. specify methods of safely isolating hot water systems or components to prevent them being brought into operation before the work has been fully completed
7. define procedures for carrying out diagnostic tests to locate faults in hot water system components:
 - shower booster pump unit
 - safety devices
 - expansion devices
 - thermostats.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 8 Be able to diagnose and rectify faults in hot water systems and components

Assessment Criteria

The learner can:

1. use manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components
2. isolate hot water systems or components to prevent them being brought into operation before the work has been fully completed
3. carry out diagnostic tests to locate faults in hot water system components and carry out repair work:
 - shower booster pump unit
 - safety devices
 - expansion devices
 - thermostats
4. carry out the periodic service of an unvented hot water storage system.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 9 Know the commissioning requirements of hot water systems and components

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on hot water systems
2. state the checks to be carried out during a visual inspection of an unvented hot water storage system to confirm that it is ready to be filled with water
3. state how to fill hot water pipework with water at normal operating pressure and check for leakage
4. identify how to conduct a soundness test on hot water systems:
 - metallic systems
 - plastic pipework systems
5. state the flushing procedure for hot water systems and components
6. clarify how to take flow rate and pressure readings from new and existing hot water outlets
7. state how to balance a secondary circulation system during commissioning activities
8. specify the actions that must be taken when commissioning reveals defects in hot water systems:
 - dealing with systems that do not meet correct installation requirements
 - remedial work associated with defective components
9. state the procedure for notifying works carried out to the relevant authority
10. propose the range of information that would be detailed on a commissioning record for a hot water system
11. propose the points to be covered when handing over a completed system to the end-user.

Unit 303/023 Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

Outcome 10 Be able to commission hot water systems and components

Assessment Criteria

The learner can:

1. carry out a visual inspection of an unvented hot water system to confirm that it is ready to be filled with water
2. charge 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
5. use test instruments to take readings of the water supply pressure and flow rate
6. adjust and set system controls to achieve system design requirements:
 - pressure at outlets
 - flow rate at outlets.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Level: 3
Credit value: 12
UAN: M/502/9156

Unit aim(s)

This unit provides learning in installation, maintenance, application of design techniques to include heat and ventilation loss through the building fabric, diagnostics and rectification of faults and commissioning procedures. This unit provides in-depth learning of system types, components, controls, and servicing requirements in systems up to large domestic dwellings and/or system of equal size in commercial & industrial premises.

Learning outcomes

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

1. know the types of central heating system and their layout requirements
2. know the design techniques for central heating systems
3. be able to apply design techniques for central heating systems
4. know the installation requirements of central heating systems and components
5. be able to install central heating systems and components
6. know the fault diagnosis and rectification procedures for central heating systems and components
7. be able to diagnose and rectify faults in central heating systems and components
8. know the commissioning requirements of central heating systems and components
9. be able to commission central heating systems and components.

Guided learning hours

It is recommended that **98** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test and an externally set assignment.

Permitted reference material

The learner is permitted to use the following materials during their assessment for this unit:

Central heating

- Water Regulations Guide by Laurie Young & Graham May, published by WRAS, 2000
- ISBN 1 903287 40 5 CIBSE Domestic Heating Design Guide, revised 2011
- Domestic Building Services Compliance Guide, freely downloaded at www.planningportal.gov.uk

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 1 Know the types of central heating system and their layout requirements

Assessment Criteria

The learner can:

1. define the space heating zoning requirements under statutory legislation for larger single occupancy dwellings
2. define the function of components used in central heating systems:
 - zone control valves for multiple space heating applications with appropriate time and temperature control arrangements
 - controllers:
 - weather compensation
 - delayed start
 - optimum start
 - home automation systems
3. analyse the operating principles of environmental heat sources used in conjunction with central heating systems:
 - heat pumps:
 - ground source
 - air source
 - micro combined heat and power
4. identify the layout features of underfloor central heating systems
5. analyse the working principles of underfloor central heating system pipework and components:
 - use of manifolds
 - controls system application - time and temperature to space heating zones
 - underfloor pipework arrangements from manifold to room
6. identify the system layout features for multiple boiler installations incorporating low loss headers
7. analyse functional flow wiring diagrams to determine the method of control operation for central heating systems:
 - pumped heating only systems
 - pumped heating systems with combination boilers
 - pumped heating with gravity hot water systems
 - fully pumped incorporating 3 port valves – mid position and diverter valves
 - fully pumped incorporating 2 x two port valves
 - fully pumped incorporating hot water and multiple space heating zones
 - fully pumped incorporating weather compensation, optimum start or delayed start controllers
 - multiple boiler controls application
 - application of frost thermostats and boilers with pump overrun facility.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 2 Know the design techniques for central heating systems

Assessment Criteria

The learner can:

1. define the factors which affect the selection of central heating systems for dwellings
2. state the criteria used when selecting heating system and component types:
 - customer's needs
 - building layout and features
 - suitability of system
 - energy efficiency
 - environmental impact
3. interpret information sources when undertaking design work on central heating systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
4. clarify how to take measurements of building features in order to carry out design calculations:
 - from plans, drawings and specifications
 - from site
5. justify the selection of system and control types for single family dwellings
6. state the principles of heat loss and gain in dwellings:
 - through the building fabric
 - due to ventilation
7. evaluate the heating requirements of rooms in dwellings when designing a central heating system:
 - room size
 - temperature required – indoor to outdoor
 - air change rate
8. specify the methods of sizing pipework and circulators for central heating systems:
 - pipe sizing calculations – space heating and hot water circuits
 - pump sizing calculations
9. justify the selection criteria for boilers in dwellings:
 - space heating load
 - hot water heating load
 - heat loss from pipework
 - factors for intermittent heating
10. clarify how to size expansion vessels for sealed central heating systems and feed and expansion cisterns for open vented systems

11. clarify the design principles for underfloor central heating systems:
 - combined with radiators
 - stand alone
12. calculate the size of central heating components used in single occupancy dwellings:
 - heat emitter size
 - hot water heating load
 - pipe size
 - pump size
 - boiler size
13. clarify how to present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 3 Be able to apply design techniques for central heating systems

Assessment Criteria

The learner can:

1. use information sources when undertaking design work for central heating systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
2. calculate the size of central heating components used in single occupancy dwellings:
 - heat emitter size
 - hot water heating load
 - pipe size
 - pump size
 - boiler size
3. present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 4 Know the installation requirements of central heating systems and components

Assessment Criteria

The learner can:

1. specify the positioning and fixing requirements of components in underfloor central heating systems:
 - manifolds
 - pipework arrangements (cabling)
 - pipework installation techniques:
 - solid floor
 - suspended timber floor
2. specify the positioning, fixing and connection requirements of new central heating components for sealed central heating systems:
 - connections to a boiler
 - fully pumped central heating control components – mid position or 2 x two port valve arrangement
 - sealed system components
 - connections to panel radiators or underfloor heating manifold
 - connections to hot water cylinder
3. specify the positioning and fixing requirements of multiple boiler installations with low loss headers.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 5 Be able to install central heating systems and components

Assessment Criteria

The learner can:

1. connect pipework to an underfloor central heating system
2. position, fix and connect new central heating components for a sealed central heating system:
 - connections to a boiler
 - fully pumped central heating control components – mid position or 2 x two port valve arrangement
 - sealed system components
 - connections to panel radiators or underfloor heating manifold
 - connections to hot water cylinder.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 6 Know the fault diagnosis and rectification procedures for central heating systems and components

Assessment Criteria

The learner can:

1. specify the periodic servicing requirements of central heating systems
2. state the methods of obtaining details of system faults from end users
3. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components
4. propose routine checks and diagnostics on central heating system components as part of a fault finding process:
 - checking components for correct operation – pressure settings, temperature and circulation
 - cleaning system components (including dismantling and reassembly)
 - checking for blockages in heat emitters and pipework
 - checking for correct operation of system components:
 - circulating pumps
 - control components
 - expansion vessels
 - pressure relief valves
 - feed and expansion cisterns
5. specify methods of repairing faults in central heating system components:
 - sealed and open vented – fill and vent pipework and components
 - circulating pumps
 - central heating control components:
 - motorised valves
 - timing devices
 - thermostats
 - specialist controls – weather compensation, delayed and optimum start
 - blockages in heat emitters and pipework by power flushing
6. specify methods of safely isolating central heating systems or components to prevent them being brought into operation before the work has been fully completed
7. define procedures for carrying out diagnostic tests to locate faults in central heating system components:
 - replacement of circulating pumps
 - sealed heating system components
 - control components.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 7 Be able to diagnose and rectify faults in central heating systems and components

Assessment Criteria

The learner can:

1. use manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components
2. isolate central heating systems or components to prevent them being brought into operation before the work has been fully completed
3. carry out diagnostic tests to locate faults in central heating system components and carry out repair work:
 - replacement of a circulating pump
 - sealed heating system components
 - control components
 - clean system components using power flushing equipment
4. carry out the periodic service of a central heating system.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 8 Know the commissioning requirements of central heating systems and components

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on central heating systems
2. 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
3. state how to fill central heating pipework with water at normal operating pressure and check for leakage
4. identify how to conduct a soundness test on central heating systems:
 - metallic systems
 - plastic pipework systems
5. specify the flushing requirements, including the use of chemical treatments for new and existing central heating systems:
 - cold and hot flushing
 - power flushing
 - system additives:
 - neutralisers
 - cleansers
 - corrosion inhibitors
6. specify the method required to balance a central heating system during commissioning activities
7. specify the actions that must be taken when commissioning reveals defects in central heating systems:
 - dealing with systems that do not meet correct installation requirements
 - defects in the connection of components in systems
 - unbalanced systems – poor circulation
 - poor boiler connection into a low loss header
 - remedial work associated with defective components
8. propose the range of information that would be detailed on a commissioning record for a central heating system
9. state the procedure for notifying works carried out to the relevant authority
10. propose the points to be covered when handing over a completed system to the end-user.

Unit 304/024 Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

Outcome 9 Be able to commission 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. charge central heating components 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
4. flush and treat a central heating system with appropriate additives:
 - system cleanser/neutraliser
 - system inhibitor
5. balance a central heating system to meet design requirements.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Level: 3
Credit value: 12
UAN: T/502/9157

Learning outcomes

There are **13** learning outcomes to this unit. The learner will:

1. know the electrical standards that apply to the mechanical services industry
2. know the principles of electricity supply to buildings
3. know the layout features of electrical circuits in buildings
4. understand the electrical industry safe isolation procedure
5. be able to carry out the electrical industry safe isolation procedure
6. know the site preparation techniques for the electrical connection of mechanical services components
7. be able to demonstrate and apply site preparation techniques for the electrical connection of mechanical services components
8. understand the installation and connection requirements of electrically operated mechanical services components
9. be able to install and connect electrically operated mechanical services components
10. know the inspection and testing requirements of electrically operated mechanical services components
11. be able to inspect and test electrically operated mechanical services components
12. know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components
13. be able to safely diagnose and rectify faults in electrically operated mechanical services components.

Guided learning hours

It is recommended that **102** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test
- an externally set assignment.

Permitted reference material

The learner is permitted to use the following material during their assessment for this unit:

- On-Site Guide

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 1 Know the electrical standards that apply to the mechanical services industry

Assessment Criteria

The learner can:

1. state the statutory legislation and guidance information that applies to electrical supply and control of domestic mechanical services systems and their components:
 - general legislation
 - construction specific legislation
 - mechanical services specific legislation:
 - professional body guidance
 - codes of practice
 - manufacturer installation and service/maintenance instructions
 - manufacturer user instructions
2. identify the range of information that would be detailed on a minor works certificate for an electrical system or component
3. specify the procedure for notifying works carried out to the relevant authority.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 2 Know the principles of electricity supply to buildings

Assessment Criteria

The learner can:

1. specify the methods by which electricity is generated:
 - basic power station operation
 - principles of generation
 - types of supply:
 - single phase
 - three-phase and neutral
2. specify the methods by which generated electricity is distributed to non dwellings and commercial properties:
 - basic operation of the national grid and local distribution systems:
 - sub-stations
 - supply transformers
 - local distribution of three – and single-phase supplies to premises
3. state the purpose of electrical components at entry to the property:
 - main fuse (single phase) and cable head connection
 - meter
 - consumer unit
 - main earth terminal.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 3 Know the layout features of electrical circuits in buildings

Assessment Criteria

The learner can:

1. define the system layout features for electrical circuits in dwellings:
 - ring main circuit
 - radial circuit
 - fixed equipment supplies:
 - spurs and fused outlets
2. specify the types of cables and conductors used for the installation of electrical equipment in mechanical services systems
3. state the applications and limitations of the types of cable and conductors used for the installation of electrical equipment in mechanical services systems
4. clarify the difference between Class 1 and Class 2 electrical equipment
5. define the function of electrically operated components used in mechanical services systems:
 - flame rectification devices
 - flame suppression devices
 - solenoid valves
 - thermistors
 - thermocouples
 - micro switches
 - relays
 - printed circuit boards
 - pressure switches
 - pumps
 - fans
 - leak detection
 - control components:
 - thermostats
 - programmers/timers
 - electrically operated control valves (actuators)
 - sensors
 - wiring centres
 - switches:
 - rocker plate (with/without CPC single and double pole)
 - pull cord
 - pressure operated
 - DP lockable isolators

6. define the operating principles of electrical circuit protection devices:
 - miniature circuit breakers
 - residual current devices including RCBOS
 - fuses:
 - re-wireable
 - cartridge
 - high breaking capacity
7. clarify the need for, and requirements of, earthing systems:
 - main earthing systems:
 - TT system
 - TN - S system
 - TN-C-S system
 - protective equipotential bonding
 - high risk rooms (zones) in dwellings
 - supplementary earthing (bonding)
 - temporary continuity bonding
8. identify the warning notices to be applied.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 4 Understand the electrical industry safe isolation procedure

Assessment Criteria

The learner can:

1. identify the test equipment required to prove that circuits to be worked on are dead:
 - approved voltage indicating device
 - proving unit
2. specify the electrical industry agreed procedure for safe isolation of electrical circuits:
 - select the approved voltage indicating device and test on a known supply
 - locate and identify the isolation point for the equipment to be worked on
 - isolate the supply and prevent re-energisation
 - verify that the equipment is dead
 - fit warning labels
 - re-check the approved voltage indicating on a known supply for correct function
3. clarify the methods of ensuring that circuits cannot be re-activated while work is taking place on them:
 - use of locking devices
 - device retention (fuse removal).

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 5 Be able to carry out the electrical industry safe isolation procedure

Assessment Criteria

The learner can:

1. check to ensure that test equipment is safe to be used
2. carry out the safe isolation procedure to industry standards.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 6 Know the site preparation techniques for the electrical connection of mechanical services components

Assessment Criteria

The learner can:

1. identify the required sources of information when carrying out work on electrical 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, commission, decommission or maintain electrical systems or components
3. state the types of pre-existing damage to the existing building fabric or customer property that may be encountered before commencing work on electrical systems and components:
 - building wall/floor surfaces
 - existing electrical system components
 - building décor and carpets
4. identify the protection measures to be applied to the building fabric or customer property, during, and on completion of, work on electrical systems and components:
 - building wall/floor surfaces
 - existing and new electrical systems and kitchen furniture/components and hygiene
 - building décor and carpets
5. identify the cable, materials and fittings required to complete work on electrical systems
6. identify the hand and power tools required to complete work on electrical systems.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 7 Be able to demonstrate and apply site preparation techniques for the electrical connection of mechanical services 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 e.g. tripping hazards
 - appropriate risk assessments/method statements are followed
2. wear Personal Protective Equipment relevant to the installation, decommissioning, servicing or maintenance tasks being carried out.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 8 Understand the installation and connection requirements of electrically operated mechanical services components

Assessment Criteria

The learner can:

1. define the method used to identify that existing electrical supplies and circuits are suitable for the proposed installation of electrical equipment used in domestic mechanical services systems
2. state the procedure for sizing electrical materials and components:
 - basic cable sizing procedure type cables and conductors
 - basic circuit protection device sizing procedure –circuit types
3. specify the method used to select suitable cables and cords for components and circuits:
 - selection of appropriate multi-core cables
 - selection of appropriate multi-core cords
 - selection of PVC single conductors
4. specify the requirements for protecting cables installed in the building fabric and terminating in enclosures:
 - protection methods in wall and floor surfaces:
 - embedded (sheathing) – depth of cover, application of RCD protection
 - exposed (mini-trunking)
 - within ducting
 - within timber stud partitions
 - within timber floor structures
 - junction boxes
 - switch/socket boxes:
 - countersunk
 - pattresses
 - surface mounted
 - wiring centres
5. define the types of cable termination methods approved for use in dwellings:
 - screw terminals
 - pillar terminals
 - claw and washer terminals
 - crimping
 - strip connectors

6. specify the method of installation and wiring termination for fixed electrical equipment:
- distribution boards:
 - air handling units/VRF systems/system control panels/building energy management systems/heat pumps/pressure boosting sets/gas supply safety controls
 - control panels:
 - heating system wiring centres/pumps/heat pumps/fan motors/solar collection systems/pressurisation units/boilers/motorised valve actuators/solenoid valves/thermostatic control devices and sensors/fire protection controls
 - existing appliance supply point:
 - heating system wiring centres/pumps/heat pumps/fan motors/solar collection systems/pressurisation units/boilers/motorised valve actuators/solenoid valves/thermostatic control devices and sensors/fire protection controls.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 9 Be able to install and connect electrically operated mechanical services components

Assessment Criteria

The learner can:

1. carry out the electrical wiring of a mechanical control system from an existing supply:
 - mechanical engineering services systems incorporating all necessary control components
 - positioning and fixing of all necessary enclosures, switches and circuit protection devices
 - correct routing, installation and termination of appropriate cables and conductors to control system components
 - correct earthing provision for all components and exposed metallic parts of the system
2. apply temporary continuity bonding to metallic pipework prior to making pipework connections.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 10 Know the inspection and testing requirements of electrically operated mechanical services components

Assessment Criteria

The learner can:

1. specify the requirements of a visual inspection of completed electrical installation work for mechanical services systems prior to electrical inspection and testing
2. define the equipment used for electrical testing of mechanical services components and its calibration requirements
3. identify the importance of carrying out tests on dead circuits wherever possible
4. state the purpose of the electrical testing procedures for new and existing circuits:
 - polarity
 - earth continuity
 - insulation resistance
 - earth fault loop impedance
 - residual current device
5. clarify the requirements for carrying out functional testing of electrical components
6. clarify the procedure for final handover of electrical circuits that supply electrically operated domestic mechanical services components:
 - installation completion of certification
 - demonstration to the user.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 11 Be able to inspect and test electrically operated mechanical services components

Assessment Criteria

The learner can:

1. carry out the inspection and testing of a completed mechanical engineering services control system:
 - visual inspection
 - selection and use of appropriate test equipment
 - appropriate circuit testing:
 - polarity
 - earth continuity
 - insulation resistance
 - functional testing
 - completion of a minor works certificate
2. carry out the inspection and testing of existing electrical circuits following replacement of electrical conductors, to mechanical engineering services systems and/or equipment components.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 12 Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components

Assessment Criteria

The learner can:

1. state the methods of obtaining details of system faults from end users
2. identify and use manufacturer instructions and industry standards to establish the diagnostic requirements of electrical system components
3. identify the electrical test equipment used to undertake fault diagnostics
4. identify the situations in which dead testing of components can be carried out
5. identify the situations in which live testing of components may be necessary and the safety precautions required
6. define how to perform a range of routine checks and diagnostics on electrical system components as part of a fault finding process. checking for correct operation of:
 - appliance components:
 - flame rectification devices
 - flame suppression devices
 - solenoid valves
 - thermistors
 - thermocouples
 - micro switches
 - relays
 - pressure switches
 - printed circuit boards
 - pumps
 - fans
 - leak detection
 - control components:
 - thermostats
 - programmers/timers
 - electrically operated control valves
 - wiring centres
 - switches:
 - rocker plate (with/without CPC) - single and double pole
 - pull cord
 - pressure operated
 - DP lockable isolators
7. state the methods of correcting deficiencies in electrical components:
 - inadequate earthing provision
 - defective cable positioning (aged cables/proximity to other services)
 - failed electrical components
 - incorrect polarity
 - provision of inadequate circuit protection devices.

Unit 305/025 Understand and carry out electrical work on domestic plumbing and heating systems and components

Outcome 13 Be able to safely diagnose and rectify faults in electrically operated mechanical services components

Assessment Criteria

The learner can:

1. safely isolate electrical systems or components to prevent them being brought into operation before the work has been fully completed
2. carry out diagnostic checks to electrical circuits:
 - inadequate earthing provision
 - defective cable routing
 - defective termination
 - incorrect polarity
 - provision of inadequate circuit protection devices
3. carry out diagnostic tests to locate faults in electrical components and carry out repair work:
 - heating components replacement
 - water components replacement
 - control components:
 - thermostats
 - programmers/timers
 - motorised valve actuators
 - sensors.

Unit 306

Install, commission, service and maintain domestic heating systems

Level: 3

Credit value: 3

UAN: A/502/8933

Unit aim(s)

This performance unit is to demonstrate the correct selection of system types and components, the installation of domestic heating and hot water systems, the commissioning, diagnostic of faults and the rectification of those faults. The correct preparation of the working area for all such work must also be demonstrated.

Learning outcomes

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

1. be able to select domestic heating and hot water systems and components for application in the workplace
2. be able to prepare work sites for the installation of domestic heating and hot water systems and components in the workplace
3. be able to install domestic heating and hot water systems and components in the workplace
4. be able to commission domestic heating and hot water systems in the workplace
5. be able to diagnose faults in domestic heating and hot water components in the workplace
6. be able to rectify faults in domestic heating and hot water components in the workplace.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 306

Install, commission, service and maintain domestic heating systems

Outcome 1

Be able to select domestic heating and hot water systems and components for application in the workplace

Assessment Criteria

The learner can:

1. obtain details of the customer job requirement:
 - by face to face site visit
 - by taking details from plans, drawings and specifications
2. discuss and agree initial system and component options with the customer:
 - hot water systems
 - central heating systems
3. calculate the size and quantities of components required for systems installation
4. present design calculations and information to the customer
5. obtain agreement from the customer to progress domestic heating and hot water work:
 - items of small jobbing (maintenance) type work
 - full system/component installation work
6. apply changes to customer job requirements and obtain customer agreement to those changes.

Unit 306

Install, commission, service and maintain domestic heating systems

Outcome 2

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

Assessment Criteria

The learner can:

1. use job information to plan the installation work
2. confirm the position of pipework and components with other persons before commencing the installation work
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. arrange for all tools, equipment and materials to be 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.

Unit 306

Install, commission, service and maintain domestic heating systems

Outcome 3

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 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:
 - hot water systems
 - central heating systems
6. connect system pipework to incoming supplies
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 306

Install, commission, service and maintain domestic heating systems

Outcome 4

Be able to commission domestic heating and hot water systems in the workplace

Assessment Criteria

The learner can:

1. carry out a visual inspection of the system 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:
 - hot water systems
 - central heating systems
3. perform a soundness test to industry requirements on the installed system:
 - hot water systems
 - central heating systems
4. flush the system with cold water on completion of soundness testing
5. rectify any leakage from the system found during the soundness test procedure
6. re-fill the system treating the contents with additives as appropriate
7. operate the system and take performance readings in order to compare them to the design specifications:
 - mechanical component readings
 - electrical component readings
8. adjust system controls to establish that the system operates to its design specifications
9. carry out remedial work to systems when commissioning reveals that the system does not work to the design specifications
10. prepare commissioning records for completed systems
11. instruct the customer in the efficient and effective operation of the system.

Unit 306

Install, commission, service and maintain domestic heating systems

Outcome 5

Be able to diagnose faults in domestic heating and hot water components in the workplace

Assessment Criteria

The learner can:

1. use job information to plan the fault diagnosis work
2. comply with health and safety requirements when carrying out fault diagnosis work
3. prepare a safe and unobstructed access route to the work areas to carry out the fault diagnosis work
4. arrange for all required tools, equipment and materials to be available to undertake the fault diagnosis work
5. report any pre-existing damage to the building fabric or customer property to other persons before carrying out the fault diagnosis work
6. provide protection to the building fabric or customer property as the work progresses
7. establish details of the fault from other persons
8. test the component to diagnose the cause of the fault.

Unit 306

Install, commission, service and maintain domestic heating systems

Outcome 6

Be able to rectify faults in domestic heating and hot water components in the workplace

Assessment Criteria

The learner can:

1. liaise with other persons to reach agreement on the rectification work to be carried out
2. isolate unsafe components that are not to be rectified and leave the component in a safe condition
3. isolate the component from the supply source:
 - turn off the electricity supply and fuel supply source to the component
 - turn off the water supply to the component
4. drain the component contents
5. take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete
6. carry out the rectification or replacement of the component to industry requirements
7. reinstate the supply or service to the component
8. test the component for effective operation
9. advise other persons that work on the system or component has been successfully completed
10. complete the details contained in a maintenance record for the system or component.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Level: 3

Credit value: 12

UAN: H/502/9557

Unit aim(s)

This knowledge unit provides learning for oil supply legislation and safety. The learner will know: the installation and decommissioning requirements for types of storage tanks and pipelines, the sizing requirements for oil storage and supply, the testing procedures for supply pipe work and flue systems, the correct procedures for fault diagnostic and rectification, and the unsafe situation procedures.

Learning outcomes

There are **13** learning outcomes to this unit. The learner will:

1. know the oil supply legislation that applies to work in dwellings
2. know the types of oil storage tank, associated fittings and installation requirements in dwellings
3. know the positioning requirements of oil storage tanks in dwellings
4. know the installation requirements of oil supply pipelines in dwellings
5. know the sizing requirements of oil storage and supply systems in dwellings
6. know how to test oil pipework for soundness
7. know the fault diagnosis and rectification procedures for oil supply systems in dwellings
8. know the decommissioning requirements of oil storage tanks
9. know the combustion process and the types of burners used in oil fired appliances in dwellings
10. know the ventilation requirements of oil fired appliances installed in dwellings
11. know the standards of chimneys and flue systems to be used with oil fired appliances in dwellings
12. know how to test oil fired appliance flue systems in dwellings for effective operation
13. know how to identify and respond to unsafe situations relating to oil systems and appliances in dwellings.

Guided learning hours

It is recommended that **110** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 1

Know the oil supply legislation that applies to work in dwellings

Assessment Criteria

The learner can:

1. define the types of statutory legislation and guidance information that applies to oil installation and maintenance work in the industry:
 - building regulations
 - industry standards
 - manufacturer installation and service/maintenance instructions
2. identify the recommended responsibilities of key personnel relating to the installation and maintenance of oil fired equipment:
 - business registration and competence
 - personnel registration and competence
 - consumers – private householders and tenants
3. identify the legislative requirements related to the prevention of pollution from oil storage and supply systems
4. analyse and interpret the requirements of specific oil safety legislation
5. define the range of information that would be contained within a commissioning record for oil fired equipment:
 - oil storage tank and supply pipework
 - oil fired appliances
6. identify the procedure for notifying works carried out to the relevant building control body:
 - notification to the building control body
 - self certification via a competent person's scheme.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 2

Know the types of oil storage tank, associated fittings and installation requirements in dwellings

Assessment Criteria

The learner can:

1. state the main features of oil storage tanks used in dwellings:
 - steel tanks
 - polyethylene tanks
 - single skin tanks
 - integrally banded tanks
2. define the purpose of oil tank fittings:
 - fill pipe
 - extended fill pipe
 - vent pipe
 - drain valve
 - isolating valve
 - contents gauge – sight glass, hydrostatic pressure operated, float operated, electronic gauges with remote readout
 - overfill alarms and prevention devices – electronic, mechanical
3. specify the installation requirements of oil tank fittings:
 - fill pipe
 - extended fill pipe:
 - above ground extended fill line
 - extended fill line installation in a building
 - underground extended fill line
 - vent pipe
 - drain valve
 - isolating valve
 - contents gauge
 - overfill alarms and prevention devices
4. define the points to be analysed when undertaking a risk assessment to determine whether secondary containment to an oil storage tank is required:
 - tank capacity
 - tank proximity to controlled water sources
 - tank proximity to spillage running into open drain or loose fitting inspection chamber cover
 - tank proximity to borehole or spring
 - tank siting on hard ground providing run-off to controlled water source
 - tank vent pipe not visible from the fill point
 - tank serving other than a single family dwelling
5. specify the types of secondary containment that can be provided to oil storage tanks:
 - integrally banded storage tanks
 - use of bunds (catchpits)

6. specify the main features when constructing a bund to act as secondary containment to an oil storage tank:
- bund holding capacity
 - bund base
 - bund walls
 - bund surface sealant materials
 - pipework projection through bund via puddle flange.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 3

Know the positioning requirements of oil storage tanks in dwellings

Assessment Criteria

The learner can:

1. define the points that need to be considered when positioning the base of a storage tank for height:
 - access to maintain a connected oil filter
 - vertical distance between base and oil control valve/pump in gravity feed systems
2. specify the methods of providing adequate base support to oil storage tanks:
 - polyethylene tanks:
 - tank sited on a concrete base; tank sited on pre-cast lintels; tank sited on paving slabs; tank sited on platform with concrete base; tank sited on platform with lintel base; methods of preventing tank floatation in high wind conditions
 - steel tanks:
 - tank sited on piers with concrete base; tank sited on piers with lintel base
3. specify the minimum fire separation distance to non-fire rated building components for external oil storage tanks serving single family dwellings (below 45kw and 3500 litres):
 - proximity to non-fire rated building or structure
 - proximity to fire rated building or structure with door or window openings
 - proximity to flue terminations
 - proximity to non-fire rated building eaves
 - proximity to non-fire rated boundary eg hedge or fence
4. define the features of fire protection barriers applied to oil storage tanks as fire protection measures:
 - fire resistance requirements of fire protection barriers
 - minimum dimensions of a fire protection barrier:
 - installed at the side of the tank
 - installed at the rear of the tank
 - installed above tank at non-fire rated eaves
5. specify the fire protection requirements to multiple oil tank installations serving single family dwellings
6. define the features of internally sited oil storage tanks:
 - fire protection chamber
 - bunding requirements
 - chamber ventilation requirements
 - tank maintenance requirements
 - filling methods:
 - via chamber access door
 - extended fill line
7. define the features of oil storage tanks sited underground:
 - type of tank to be used
 - chamber requirements
 - fire protection requirements.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 4

Know the installation requirements of oil supply pipelines in dwellings

Assessment Criteria

The learner can:

1. identify the layout features of oil supply pipeline systems
2. define the function of oil supply pipeline components:
 - service/isolation valves
 - oil filters
 - de-aerators – internal and external
 - oil lifters
 - fire valves
 - anti-syphon valves
 - pressure reducing valves
3. clarify the pipework materials and jointing processes suitable for oil supply lines:
 - R220 copper - manipulative (type B) flared fittings
 - low carbon steel – screw thread joints using PTFE tap and petroleum resisting compound
4. specify the support and fixing requirements for oil supply pipework:
 - requirements for sleeving
 - external and internal surface mounted installation pipework – copper and low carbon steel
 - pipework protection against corrosion – externally mounted
5. specify the installation requirements of underground oil supply lines:
 - proximity to other services
 - pipework protection against corrosion
 - use of pipework ducts
 - minimum trench depth
 - trench preparation
 - use of warning tape
 - access to underground joints
 - use of a pipe in pipe system (sleeving)
 - production of records
 - specify the installation requirements of oil filters
 - oil filter positioning:
 - storage tank
 - oil fired appliances
 - oil filter clearance requirements for maintenance
6. specify the installation requirements of de-aerator devices:
 - types of oil fired appliance used with de-aerator devices
 - external de-aerator
 - internal de-aerator
7. specify the installation requirements of oil lifters:
 - types of oil fired appliance used with oil lifters
 - lifter positioning

8. specify the installation requirements of oil supply line components:
 - anti-syphon valves
 - pressure reducing valves
9. state the types of fire valves considered suitable for use in dwellings
10. clarify the positioning requirements of fire valves fitted to oil supply pipelines:
 - standard external valve position to internal appliance
 - internal valve position to existing internal appliance
 - position for external boiler
 - position for vaporising range cooker
 - position for vaporising roomheater
 - position for oil lifter
11. clarify the earth bonding requirements of oil supply pipework systems and components.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 5

Know the sizing requirements of oil storage and supply systems in dwellings

Assessment Criteria

The learner can:

1. determine the recommended size of storage tank for use in dwellings
2. state the size of oil tank fitting connections:
 - standard vent size
 - standard fill pipe size
3. calculate the size of oil supply pipework:
 - single pipe gravity system
 - single pipe system with oil lifter
 - single pipe suction system with de-aerator.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 6

Know how to test oil pipework for soundness

Assessment Criteria

The learner can:

1. state the soundness test procedure for new and existing oil supply pipework:
 - requirement to minimise oil pollution
 - visual inspection requirements
 - test medium
 - test equipment
 - test holding times
2. state the soundness test procedure for extended fill lines:
 - visual inspection requirements
 - test medium
 - test equipment
 - test holding times.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 7

Know the fault diagnosis and rectification procedures for oil supply systems in dwellings

Assessment Criteria

The learner can:

1. state the methods of obtaining details of oil supply system faults from users
2. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of oil supply systems
3. propose routine diagnostics on oil supply systems to identify the causes of poor or no oil supply at appliances:
 - unauthorised isolation of service/isolation valves
 - presence of water in oil storage tanks
 - water contamination in the oil storage tank
 - incorrect oil in the storage tank
 - blockage or air locks in the supply pipework:
 - gravity system
 - suction system
 - blockage/operation of de-aerator devices
 - correct operation/positioning of the appliance fire valve.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 8

Know the decommissioning requirements of oil storage tanks

Assessment Criteria

The learner can:

1. specify the industry standards to be used when decommissioning and disposing of oil storage tanks:
 - cleaning and gas freeing of tanks
 - use of hot work
 - competence requirements of those disposing of tanks
2. clarify the decommissioning phases of an oil storage tank:
 - removal of residual liquid
 - disposal of hazardous waste residues
 - isolation of the storage tank:
 - disconnection from supply lines and outlet capping
 - application of warning notices
 - disconnection of, and warning notice to, extended fill line
 - de-gassing
 - cleaning
 - cutting (if required) and safe disposal.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 9

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

Assessment Criteria

The learner can:

1. identify the uses of heating oils to supply oil fired appliances in dwellings:
 - Class C2 – kerosene
 - Class D – kerosene
2. define the key properties of heating oils:
 - viscosity
 - density
 - flashpoint temperature
 - sulphur content
 - ash content
 - water content
 - sediment content
 - carbon residue
 - char value
 - smoke point
 - cold filter plugging point
 - calorific value – gross and nett
 - mean specific heat capacity
 - minimum storage temperature
 - atomisation temperature
3. identify the combustion process with heating oils used in dwellings:
 - the combustion equation
 - air requirements for combustion
 - main constituents of complete combustion
 - main constituents of incomplete combustion:
 - carbon monoxide
 - soot deposits
4. identify the potential effects of carbon monoxide when incomplete combustion takes place:
 - effects of exposure to carbon monoxide on the human body
 - symptoms of CO poisoning
 - advice to give to a person who describes symptoms of being affected by products of combustion
5. specify the measures necessary to ensure that exposure to carbon monoxide does not take place:
 - primary measures – correct appliance installation and maintenance
 - secondary measures – use of carbon monoxide detectors
 - types of CO detectors available and standards of manufacture
 - the positioning requirements for carbon monoxide detectors
 - causes of activation of CO detectors and indicators

6. define the layout features and basic operating principles of burners to oil fired appliances:
 - pressure jet burners
 - vaporising burners.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 10

Know the ventilation requirements of oil fired appliances installed in dwellings

Assessment Criteria

The learner can:

1. calculate the ventilation requirements for open flued oil fired appliances:
 - adventitious air supplies
 - for single open flued appliances installed in a room or space
 - for multiple open flued appliances installed in the same room or space
 - for appliances fitted with a flue draught stabiliser
2. state the maximum permissible extract rates for fans sited in the same space as an open flued oil fired appliance:
 - pressure jet appliance
 - vaporising appliance
3. calculate the ventilation required for appliances located in compartments:
 - open flued appliances
 - room sealed appliances
4. identify the types of grilles and vents available for ventilation:
 - types of grilles and vents
 - sizing of grilles and vents (free area availability)
5. calculate the free area of unmarked grilles and vents
6. specify the acceptable locations for ventilation to appliances:
 - restrictions to ventilator/grille locations
 - installation of vents through walls (including cavity walls)
 - ventilation paths via other rooms
 - ventilation paths to compartments including ducts
 - siting of ventilation:
 - wall
 - window
 - floor/ceiling (ducted and un-ducted)
7. clarify the effect that other heat producing appliances and other types of extraction have on the requirement for ventilation of oil fired appliances:
 - gas or solid fuel appliances and flue systems
 - passive stack ventilation
 - extractor fans
 - cooker hoods
 - tumble driers.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 11

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

Assessment Criteria

The learner can:

1. state how oil fired appliances are classified according to the type of chimney or flue used:
 - open flued:
 - natural draught
 - forced (fanned) draught
 - room sealed
2. identify the working principles of flue systems serving oil fired appliances:
 - open flued chimneys
 - room sealed - natural draught
3. state the effects that the flue gas temperature from oil fired appliances has on the selection of suitable materials for the open flue/chimney construction:
 - appliances with a flue gas temperature above 250°C
 - appliances with a flue gas temperature below 250°C
4. state the types and general layout features of chimney and flue construction:
 - rigid chimney types:
 - brick/masonry
 - pre-cast flue blocks
 - metallic (single and double wall flues)
 - flexible metallic liner installation
5. specify the requirements for new and existing chimney/flue installation:
 - minimum cross sectional area of new chimney installations to serve appliances and types of flue liners – during construction (salt glazed, clay etc.)
 - poured/pumped concrete flue liners - pre-cast flue blocks - flexible flue liners
 - restrictions on the use of poured concrete liners
 - pre-cast flue design - minimum cross sectional area of new flue blocks/minimum requirement of vertical flue blocks before off-sets/jointing material for pre-cast flue blocks/minimum flue size diameter for connecting pre-cast transfer blocks to termination point/effects of temperature on installation requirements for pre-cast flues
 - flexible flue liners- sealing and support requirements for flexible flue liners in chimneys/flexible liner components/termination of flue liners

6. define the design requirements of flues used with oil fired appliances:
 - requirements of designer, builder, provider or installer when installing chimneys
 - requirements for hearths – flue/hearth dataplate
 - chimney system design:
 - distance requirements when passing through combustible material
 - special requirements for chimneys passing adjacent to combustible material or through other dwellings
 - temperature effects and condensation problems caused by flue pipe runs
 - open flued chimney system:
 - parts of an open flue chimney system
 - room-sealed chimney system:
 - parts of a room sealed flue chimney system
7. specify the requirements for the provision of hearths to oil fired appliances:
 - appliances with base temperature below 100°C
 - appliances with base temperature above 100°C
8. specify the requirements for the termination of flue systems serving oil fired appliances:
 - room sealed flue positions - including the restrictions on fuel type for flue outlets discharging below 2M from ground level
 - condensing appliances
 - terminal guard requirements
 - open flue terminal positions
 - methods of dealing with down-draught on steeply pitched roofs
9. identify the working principles of flue draught stabilisers and their uses with open flued oil fired appliances
10. specify the requirements for installing chimney fans to open flues/chimney systems:
 - requirements prior to installing fans in flues
 - additional safety requirements when fans are installed in flues.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 12

Know how to test oil fired appliance flue systems in dwellings for effective operation

Assessment Criteria

The learner can:

1. specify the key points to be checked in the visual inspection of a flue system prior to undertaking commissioning of the oil fired appliance/flue system:
 - open flue systems
 - room sealed flue systems
2. state the factors that can affect flue system performance:
 - downdraught conditions
 - wind effects at the appliance termination
 - passive stack ventilation
 - extraction fans sited in the vicinity of open flued appliances
3. specify the testing procedures that should be performed to check the correct operation of an existing chimney/flue system:
 - flue flow test
 - spillage test
 - flue testing procedures with appliances sited in the vicinity of extraction fans
 - testing fanned draught open-flue systems and associated safety controls
4. specify the testing procedures for room sealed fanned draught flue installations:
 - checking case seals/case integrity
 - checking flue pipe/air inlet connections for leakage
5. specify the combustion performance tests to be carried out with oil fired appliances:
 - vaporising appliances
 - oil fired appliances.

Unit 307

Understand core oil firing safety principles within domestic building services engineering

Outcome 13

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

Assessment Criteria

The learner can:

1. clarify the types of unsafe situation that may be found with appliances and supply system installations:
 - types of immediate risk – safety and environmental:
 - actions to take
 - 'Do not use' notices and labels
 - warning notice forms
 - types of potential risk – safety and environmental:
 - actions to take
 - use of warning notices
2. identify the use of general notices and warning labels to avoid the occurrence of unsafe situations:
 - oil fired installation commissioning certificates
 - oil fired service certificates
 - landlords safety certificates.

Unit 308

Apply core oil firing safety within domestic building services engineering

Level: 3

Credit value: 4

UAN: L/502/9391

Unit aim(s)

This performance unit is to enable learners to demonstrate occupational competence in: tank installations, pipework systems and fittings, testing, fault diagnosis & rectification; the correct selection and ventilation requirements along with the suitability of chimneys and flues; unsafe situations procedures.

Learning outcomes

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

1. be able to identify correct and incorrect oil storage tank installations
2. be able to identify oil supply pipework systems and fittings
3. be able to install oil supply pipework and fittings
4. be able to test oil pipework for soundness
5. be able to carry out fault diagnosis and rectification procedures on oil supply systems
6. be able to select and install ventilation for oil fired appliances
7. be able to check the suitability of chimneys and flue systems
8. be able to test oil fired appliance flue systems for effective operation
9. be able to correctly respond to unsafe oil situations.

Guided learning hours

It is recommended that **six** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 1

Be able to identify correct and incorrect oil storage tank installations

Assessment Criteria

The learner can:

1. carry out a risk assessment to determine the type of oil storage tank required:
 - existing system with incorrect single skin tank
 - new installation requiring secondary containment
2. confirm that the proposed tank installation location meets standards requirements for fire protection:
 - external tanks
 - internal tanks
 - underground tanks
3. confirm that the tank base construction meets standards requirements:
 - polyethylene tank at ground level
 - polyethylene tank on piers
 - steel tank on piers
4. confirm that the tank filling and vent fittings have been correctly installed
5. confirm that the contents gauge has been fitted and is operating correctly
6. confirm that the oil and sludge connection has been correctly made:
 - drain valve
 - isolation valve
 - oil filter.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 2

Be able to identify oil supply pipework systems and fittings

Assessment Criteria

The learner can:

1. confirm the type of oil supply system installed in a dwelling:
 - single pipe gravity system
 - single pipe system with oil lifter
 - single pipe suction system with de-aerator
2. confirm the name/type of oil supply line components for given installations:
 - filters
 - fire valves
 - oil lifters
 - anti-syphon valves
 - pressure reducing valves
 - de-aerators.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 3

Be able to install oil supply pipework and fittings

Assessment Criteria

The learner can:

1. cut and joint R220 soft copper pipework using Type B manipulative flared fittings
2. carry out a visual inspection of an oil pipework system to confirm its correct installation:
 - correct installations
 - incorrect installations
3. make connections from an existing oil supply line to oil supply components, siting all components correctly:
 - oil filter
 - de-aerator
 - fire valve.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 4

Be able to test oil pipework for soundness

Assessment Criteria

The learner can:

1. carry out a visual inspection on an oil supply line:
 - confirming that it is installed to standards requirements
 - confirming that it is ready to be soundness tested
2. carry out a soundness test on an oil supply line to confirm that it is leak free
3. trace leaks in defective oil supply lines and make repairs
4. fill and purge air from the oil pipework system on completion of soundness testing.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 5

Be able to carry out fault diagnosis and rectification procedures on oil supply systems

Assessment Criteria

The learner can:

1. obtain details of the fault from the end user and from diagnostic information
2. carry out diagnostic tests to locate faults in oil supply systems and carry out repair work:
 - incorrect oil type, water in the storage tanks or no oil stored in the tank
 - no oil or poor oil flow:
 - unauthorised isolation of supply line valves
 - air lock in supply line
 - blockage in oil filter
 - blockage/defect in de-aerator
 - defect in the fire valve.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 6

Be able to select and install ventilation for oil fired appliances

Assessment Criteria

The learner can:

1. calculate the ventilation requirements (free area of air vent) for oil fired appliances from on-site information:
 - single open flued appliances
 - single open flued appliances with draught stabilisers
 - multiple open flued appliances
2. calculate the compartment ventilation requirements for oil fired appliances from on-site information:
 - open flued appliances
 - room sealed appliances
3. determine by measurement and calculation the free area of grilles and ventilators to supply combustion air and compartment ventilation to oil fired appliances:
 - marked ventilators and grilles
 - unmarked ventilators and grilles
4. determine the suitability of grilles and vents to provide combustion air and compartment ventilation:
 - grille/vent construction
 - flyscreen not fitted/correctly sized
 - projection through walls including cavity walls
 - fixing arrangements
5. confirm the correct positioning of grilles and ventilators to provide combustion air to open flued oil fired appliances:
 - open flued positioning
 - open flued incorrect positioning
 - combustion air supply to open flued appliances from adjacent rooms
6. confirm the correct positioning of grilles and ventilators to provide air for compartment ventilation:
 - open flued - correct and incorrect positioning
 - room sealed - correct and incorrect positioning.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 7

Be able to check the suitability of chimneys and flue systems

Assessment Criteria

The learner can:

- confirm the parts of a flue system from an existing installation:
 - appliance with open flue system
 - appliance with room sealed flue system
- confirm the type of open flue system installed:
 - brick masonry chimneys – with/without liners
 - rigid flues – metallic and non-metallic including single and double skin
- confirm the suitability of the chimney/flue for use with an open flued oil fired appliance:
 - flue chimney soundness and construction
 - flue materials
 - flue draught stabiliser (if fitted)
 - appliance connection to flue/chimney
 - flue proximity to combustible materials
 - flue length and routing – internal/external
 - flue jointing methods and materials
 - flue supports
 - flue inspection points are provided (where required)
 - flue connection to termination point
 - selection of correct flue terminal
- confirm that the flue outlets (terminals) of open flued appliances are correctly positioned:
 - correctly positioned terminals
 - incorrectly positioned terminals
- confirm the type of room sealed flue system that is installed
- confirm the suitability of the flue system for use with the room sealed appliance:
 - flue length, changes of direction and jointing methods conform to manufacturer requirements
 - flue connection to appliance
 - flue supports
 - flue proximity to combustible materials
 - flue inspection points are provided (where required)
 - flue connection to termination point
 - provision of plume kit (where required)
- confirm that the flue outlets (terminals) of room sealed appliances are correctly positioned:
 - correctly positioned terminals
 - incorrectly positioned terminals
 - provision of flue terminal guard.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 8

Be able to test oil fired appliance flue systems for effective operation

Assessment Criteria

The learner can:

1. carry out visual inspections of oil fired appliance flue systems to confirm their suitability prior to testing the operation of the flue system:
 - open flued – masonry lined and flue pipe system
 - room sealed
2. carry out flue flow tests of open flue systems:
 - correctly operating flues
 - incorrectly operating flues
3. carry out spillage tests of open flued appliances:
 - correctly operating appliances
 - incorrectly operating appliances
4. carry out case seal integrity checks to natural draught room sealed appliances:
 - correctly sealed appliances
 - incorrectly sealed appliances.

Unit 308

Apply core oil firing safety within domestic building services engineering

Outcome 9

Be able to correctly respond to unsafe oil situations

Assessment Criteria

The learner can:

1. perform safety checks on oil supplies and appliances to check for unsafe situations:
 - complete report forms – installation and service
 - complete landlords safety report form
2. inspect and apply the unsafe situations procedure to oil supplies and appliances:
 - immediate risks – safety and environmental
 - potential risks – safety and environmental
3. label systems, appliances and components as appropriate
4. isolate appliances as appropriate.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Level: 3

Credit value: 7

UAN: D/502/9394

Unit aim(s)

This knowledge unit provides learning in operating principles linked to legislation covering energy efficiency, including the disposal of condensate waste, installation requirements, fault finding, commissioning and decommissioning requirements plus associated equipment needed to meet manufacturer's instructions.

Learning outcomes

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

1. know the types of pressure jet oil fired appliance and their operating principles
2. know the condensate disposal requirements of condensing oil fired appliances
3. know the energy efficiency legislation applicable to pressure jet oil fired appliances
4. know the factors to be considered when selecting pressure jet oil fired appliances to meet customers' needs
5. know the installation requirements of pressure jet oil fired appliances
6. know the fault diagnosis and rectification procedures for pressure jet oil fired appliances
7. know the range of equipment used to commission pressure jet oil fired appliances
8. know the commissioning requirements of pressure jet oil fired appliances
9. know the decommissioning requirements of pressure jet oil fired appliances.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 1

Know the types of pressure jet oil fired appliance and their operating principles

Assessment Criteria

The learner can:

1. clarify the operating principles of oil fired appliances that contain a pressure jet oil burner:
 - traditional boilers
 - condensing boilers
 - system boilers
 - combination boilers
 - freestanding boilers
 - wall mounted boilers – internal and external
 - open flued boilers
 - room sealed boilers – high level and low level discharge
 - external independent boilers
 - open flued cookers.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 2

Know the condensate disposal requirements of condensing oil fired appliances

Assessment Criteria

The learner can:

1. identify the properties of condensate water discharged from condensing boilers
2. specify the main installation requirements of condensate pipework:
 - acceptable pipework materials
 - fall required
 - maximum recommended length of run
 - recommended pipe sizes
 - trapping requirement
 - insulation requirement (external pipework)
3. define the layout features of condensate waste disposal systems:
 - internal connection to a main soil stack
 - internal connection to an existing waste pipe
 - external connection to a soakaway
 - external connection to a gulley.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 3

Know the energy efficiency legislation applicable to pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. specify the types of oil fired boiler that must be installed to meet the requirements of energy efficiency legislation:
 - new properties
 - replacement of boilers in existing properties
2. state the main features of the condensing boiler assessment procedure
3. specify the level of central heating controls to be provided in heating and hot water systems incorporating oil fired boilers:
 - new properties
 - when carrying out replacement of existing oil fired boilers.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 4

Know the factors to be considered when selecting pressure jet oil fired appliances to meet customers' needs

Assessment Criteria

The learner can:

1. define the factors which affect the selection of oil fired pressure jet appliances in dwellings
2. state the criteria used when selecting oil fired pressure jet appliances:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - restrictions placed on boilers installed in certain rooms:
 - bathrooms/shower rooms; bedroom/bedsitting rooms; understairs cupboards; loft spaces; garages; externally sited appliances
 - proximity of combustible materials to the appliance:
 - casing temperature above 100°C; casing temperature below 100°C
 - building layout and features – suitable appliance space
 - suitability of heating system
 - loadings placed on the oil fired appliance
 - energy efficiency legislation requirements
 - environmental impact
3. define the processes used when calculating the size of replacement existing boilers using the whole house boiler sizing method.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 5

Know the installation requirements of pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. specify the requirements of a pre-installation inspection to determine that the pressure jet appliance can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - condensate disposal arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. state how to position, fix and connect pressure jet oil fired appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make connections to the heating/hot water system
 - position and fix the condensate disposal pipework
 - make final connections to the oil supply pipework
 - make final electrical connections to the central heating control system.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 6

Know the fault diagnosis and rectification procedures for pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. specify the periodic servicing intervals of pressure jet oil fired appliances
2. define the schedule of activities to be carried out during the periodic service of an oil fired pressure jet appliance
3. state the methods of obtaining details of system faults from end users
4. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of pressure jet oil fired appliances
5. specify methods of safely isolating pressure jet oil fired appliances to prevent them being brought into operation before the work has been fully completed
6. propose routine checks and diagnostics on pressure jet oil fired appliances as part of a fault finding process:
 - cleaning system components
 - checking for blockages/poor flow rate:
 - heat exchanger
 - fuel supply system including oil nozzle
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of pressure jet appliance burner components
7. specify methods of identifying and repairing faults in oil fired pressure jet burners:
 - oil pump defects/incorrect settings
 - solenoid defects
 - motor/fan defects
 - incorrect air shutter settings
 - nozzle – defects/incorrect selection
 - blast tube assembly – defects/positioning
 - ignition electrodes – defects/positioning
 - ignition transformer - defects
 - photoresistor - defects
 - control box – defects
8. define the actions to take in the event that the appliance/component fault cannot be rectified:
 - use of the unsafe situations procedure
 - provision of suitable warning notices
9. specify the procedures to re-commission appliances following completion of service/maintenance or fault repair activities.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 7

Know the range of equipment used to commission pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. specify the equipment used to set the oil pump pressure and its method of use:
 - pressure gauge
 - vacuum gauge
2. specify the equipment used to carry out an initial test to determine the cleanliness of combustion and its method of use:
 - smoke pump (tester)
 - draught gauge
3. specify the equipment used to carry out combustion analysis of an oil fired appliance and its method of use:
 - electronic test equipment
 - manual/wet analysis equipment
 - carbon dioxide analyser
 - flue gas thermometer
4. define the maintenance and calibration requirements of test equipment used to commission pressure jet oil fired appliances.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 8

Know the commissioning requirements of pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on pressure jet oil fired appliances
2. state the checks to be carried out during a visual inspection of a pressure jet oil fired appliance to confirm that it is ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser
 - pressure jet appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. specify the range of operational tests to be carried out prior to appliance light up:
 - flue flow test (where required)
4. specify the range of operational tests to be carried out on initial appliance light up:
 - initial function of appliance burner
 - correct operation of burner safety controls
 - oil pressure readings, set and adjust the oil pump
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (flue draught interference test, where required)
5. specify the range of tests to be carried out to determine the appliance combustion efficiency and adjust/fine tune the burner accordingly
6. specify the checks to be carried out to ensure that the appliance temperature controls are operating correctly:
 - appliance control thermostat
 - appliance energy cut-out device
7. specify the range of checks to be carried out to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. define the actions to take in the event that the appliance/component cannot be correctly commissioned:
 - use of the unsafe situations procedure
 - provision of suitable warning notices

9. propose the range of information that would be detailed on a commissioning record for an oil fired pressure jet appliance
10. state the procedure for notifying works carried out to the relevant authority
11. propose the points to be covered when handing over a completed installation to the end-user.

Unit 309

Understand the principles of domestic oil firing pressure jet appliances

Outcome 9

Know the decommissioning requirements of pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. specify working methods that reduce the periods during which pressure jet appliances are not available to building users
2. state the information that needs to be provided to other persons before decommissioning work takes place
3. define how to temporarily decommission pressure jet appliances
4. define the work sequences for permanently decommissioning pressure jet appliances
5. specify the procedures for safely draining and disposing of system contents:
 - central heating/hot water system
 - fuel supply system
6. specify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
 - safe isolation of the fuel supply system
 - safe isolation of the heating/hot water system
 - safe isolation of the heating/hot water electrical control system
 - temporary capping of pipework sections
 - use of warning notices and signs.

Unit 310

Service and maintain domestic oil firing pressure jet appliances

Level: 3

Credit value: 3

UAN: M/502/9402

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the servicing, commissioning and decommissioning of appliances, and to be able to diagnose and rectify faults.

Learning outcomes

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

1. be able to diagnose faults and carry out rectification work on pressure jet oil fired appliances
2. be able to commission pressure jet oil fired appliances
3. be able to decommission pressure jet oil fired appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 310

Service and maintain domestic oil firing pressure jet appliances

Outcome 1

Be able to diagnose faults and carry out rectification work on pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. carry out a visual inspection of existing pressure jet oil fired appliances to confirm that they are installed to manufacturer/standard's requirements
2. isolate pressure jet oil fired appliances to prevent them being brought into operation before the work has been fully completed
3. carry out periodic servicing to oil fired pressure jet appliances in accordance with manufacturer instructions
4. use manufacturer instructions and industry standards to establish the diagnostic requirements of oil fired pressure jet appliances
5. carry out routine checks and diagnostics on pressure jet oil fired appliances as part of a fault finding process:
 - cleaning system components
 - checking for blockages/poor flow rate
 - heat exchanger
 - fuel supply system including oil nozzle
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of pressure jet appliance burner components
6. carry out fault identification and repair work on oil fired pressure jet burners:
 - oil pump defects/incorrect settings
 - solenoid defects
 - motor/fan defects
 - incorrect air shutter settings
 - nozzle – defects/incorrect selection
 - blast tube assembly – defects/positioning
 - ignition electrodes – defects/positioning
 - ignition transformer - defects
 - photoresistor - defects
 - control box – defects
7. re-commission appliances following completion of service/maintenance or fault repair activities.

Unit 310

Service and maintain domestic oil firing pressure jet appliances

Outcome 2

Be able to commission pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on pressure jet oil fired appliances
2. carry out a visual inspection of pressure jet oil fired appliances and their associated supplies to confirm that they are ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser
 - pressure jet appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - initial function of appliance burner
 - correct operation of burner safety controls
 - oil pressure readings, set and adjust the oil pump
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (where required, flue draught interference test (where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune burner controls accordingly
6. carry out checks to ensure that the appliance temperature controls are operating correctly:
 - appliance control thermostat
 - appliance energy cut-out device
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for pressure jet oil fired appliances.

Unit 310

Service and maintain domestic oil firing pressure jet appliances

Outcome 3

Be able to decommission pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity and fuel supply to the appliance and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
 - fuel supply system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 311

Install, test and commission domestic oil firing pressure jet appliances

Level: 3

Credit value: 3

UAN: Y/502/9393

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in understanding customer requirements by pre-installation inspections, and the installation, commissioning, and decommissioning of appliances.

Learning outcomes

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

1. be able to select pressure jet oil fired appliances to meet customers' needs
2. be able to install pressure jet oil fired appliances
3. be able to commission pressure jet oil fired appliances
4. be able to decommission pressure jet oil fired appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 311

Install, test and commission domestic oil firing pressure jet appliances

Outcome 1

Be able to select pressure jet oil fired appliances to meet customers' needs

Assessment Criteria

The learner can:

1. select suitable pressure jet appliances meeting installation/standard requirements:
 - customers' needs/preference
 - provision of suitable flueing arrangements
 - suitable room/property location
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space
 - suitability of heating system
 - loadings placed on the oil fired appliance
 - energy efficiency legislation requirements
 - environmental impact
2. calculate the size of pressure jet oil fired appliances required for a boiler replacement using the whole house boiler sizing method.

Unit 311 **Install, test and commission domestic oil firing pressure jet appliances**

Outcome 2 Be able to install pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. carry out a pre-installation inspection to determine that pressure jet appliances can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - condensate disposal arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. position, fix and connect pressure jet oil fired appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make connections to the heating/hot water system
 - position and fix the condensate disposal pipework
 - make final connections to the oil supply pipework
 - make final electrical connections to the central heating control system
3. take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Unit 311

Install, test and commission domestic oil firing pressure jet appliances

Outcome 3

Be able to commission pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on pressure jet oil fired appliances
2. carry out a visual inspection of pressure jet oil fired appliances and their associated supplies to confirm that they are ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser
 - pressure jet appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - initial function of appliance burner
 - correct operation of burner safety controls
 - oil pressure readings, set and adjust the oil pump
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (where required, flue draught interference test (where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune burner controls accordingly
6. carry out checks to ensure that the appliance temperature controls are operating correctly:
 - appliance control thermostat
 - appliance energy cut-out device
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for pressure jet oil fired appliances.

Unit 311

Install, test and commission domestic oil firing pressure jet appliances

Outcome 4

Be able to decommission pressure jet oil fired appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity and fuel supply to the appliance and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
 - fuel supply system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 312

Install, test and commission domestic oil firing vaporising appliances

Level: 3
Credit value: 3
UAN: A/502/9404

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in understanding customer requirements by pre-installation inspections, and the installation, commissioning, and decommissioning of appliances.

Learning outcomes

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

1. be able to select vaporising oil fired appliances to meet customers' needs
2. be able to install vaporising oil fired appliances
3. be able to commission vaporising oil fired appliances
4. be able to decommission vaporising oil fired appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 312 Install, test and commission domestic oil firing vaporising appliances

Outcome 1 Be able to select vaporising oil fired appliances to meet customers' needs

Assessment Criteria

The learner can:

1. select suitable vaporising appliances meeting installation/standard requirements:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - suitable room/property location
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space
 - suitability of heating system
 - loadings placed on the oil fired appliance
 - energy efficiency legislation requirements
 - environmental impact
2. calculate the size of vaporising appliances required for given situations.

Unit 312

Install, test and commission domestic oil firing vaporising appliances

Outcome 2

Be able to install vaporising oil fired appliances

Assessment Criteria

The learner can:

1. carry out a pre-installation inspection to determine that vaporising appliances can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. position, fix and connect vaporising oil fired appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make connections to the heating/hot water system
 - make final connections to the oil supply pipework
 - make final electrical connections to the central heating control system
3. take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Unit 312 Install, test and commission domestic oil firing vaporising appliances

Outcome 3 Be able to commission vaporising oil fired appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on vaporising oil fired appliances
2. carry out a visual inspection of vaporising oil fired appliances and their associated supplies to confirm that they are ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustibles, flue termination and provision of flue draught stabiliser
 - vaporising appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - determination of cold oil depth and/or oil flow rate
 - initial function of appliance burner
 - correct operation of burner safety controls
 - appliance flame picture (where required)
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (flue draught interference test, where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune burner controls accordingly
6. carry out checks to ensure that the appliance oil flow rate/temperature controls are operating correctly
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for vaporising oil fired appliances.

Unit 312

Install, test and commission domestic oil firing vaporising appliances

Outcome 4

Be able to decommission vaporising oil fired appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity and fuel supply to the appliance and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
 - fuel supply system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 313

Service and maintain domestic oil firing vaporising appliances

Level: 3

Credit value: 3

UAN: F/502/9405

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the servicing, commissioning and decommissioning of appliances, and to be able to diagnose and rectify faults.

Learning outcomes

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

1. be able to diagnose faults and carry out rectification work on vaporising oil fired appliances
2. be able to commission vaporising oil fired appliances
3. be able to decommission vaporising oil fired appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 313

Service and maintain domestic oil firing vaporising appliances

Outcome 1

Be able to diagnose faults and carry out rectification work on vaporising oil fired appliances

Assessment Criteria

The learner can:

1. carry out a visual inspection of existing vaporising oil fired appliances to confirm that they are installed to manufacturer/standards requirements
2. isolate vaporising oil fired appliances to prevent them being brought into operation before the work has been fully completed
3. carry out periodic servicing to oil fired vaporising appliances in accordance with manufacturer instructions
4. use manufacturer instructions and industry standards to establish the diagnostic requirements of oil fired vaporising appliances
5. carry out routine checks and diagnostics on vaporising oil fired appliances as part of a fault finding process:
 - cleaning system components
 - checking for blockages/poor flow rate:
 - heat exchanger
 - fuel supply system including oil controls
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of vaporising appliance burner components
6. carry out fault identification and repair work on oil fired vaporising burners:
 - burner defects
 - oil level control defects
 - oil flow rate control defects
 - flue system performance
 - inadequate air supply
7. re-commission appliances following completion of service/maintenance or fault repair activities.

Unit 313

Service and maintain domestic oil firing vaporising appliances

Outcome 2

Be able to commission vaporising oil fired appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on vaporising oil fired appliances
2. carry out a visual inspection of vaporising oil fired appliances and their associated supplies to confirm that they are ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser
 - vaporising appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - determination of cold oil depth and/or oil flow rate
 - initial function of appliance burner
 - correct operation of burner safety controls
 - appliance flame picture (where required)
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (where required, flue draught interference test (where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune burner controls accordingly
6. carry out checks to ensure that the appliance oil flow rate/temperature controls are operating correctly
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for vaporising oil fired appliances.

Unit 313

Service and maintain domestic oil firing vaporising appliances

Outcome 3

Be able to decommission vaporising oil fired appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity and fuel supply to the appliance and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
 - fuel supply system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Level: 3

Credit value: 7

UAN: T/502/9403

Unit aim(s)

This knowledge unit provides learning in operating principles linked to legislation covering energy efficiency, installation requirements, fault finding, commissioning and decommissioning, plus equipment needed to meet manufacturer's requirements.

Learning outcomes

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

1. know the types of vaporising oil fired appliance and their operating principles
2. know the energy efficiency legislation applicable to vaporising oil fired appliances
3. know the factors to be considered when selecting vaporising oil fired appliances to meet customers needs
4. know the installation requirements of vaporising oil fired appliances
5. know the fault diagnosis and rectification procedures for vaporising oil fired appliances
6. know the range of equipment used to commission vaporising oil fired appliances
7. know the commissioning requirements of vaporising oil fired appliances
8. know the decommissioning requirements of vaporising oil fired appliances.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 1

Know the types of vaporising oil fired appliance and their operating principles

Assessment Criteria

The learner can:

1. identify the operating principles of vaporising oil fired appliances featuring:
 - perforated sleeve burners
 - natural draught pot burners
 - natural draught multi stage burners
 - fan pressurised pot burners
2. define the purpose of components of a biomass appliance:
 - perforated sleeve burners:
 - deep well; circular multi-sleeve; rectangular
 - natural draught pot burners:
 - manual ignition; automatic ignition
 - natural draught multi stage burners
 - fan pressurised pot burners
 - oil level controls:
 - single float type; twin float type
 - flow rate controls:
 - manual type; vapour pressure type thermostatic; electrical bi-metal type
3. clarify the operating principles of oil fired appliances containing vaporising appliances:
 - heat storage cookers
 - roomheaters (stoves).

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 2

Know the energy efficiency legislation applicable to vaporising oil fired appliances

Assessment Criteria

The learner can:

1. specify the types of vaporising oil fired appliance that must be installed to meet the requirements of energy efficiency legislation
2. specify the level of controls to be provided in heating and hot water systems incorporating vaporising oil fired appliances.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 3

Know the factors to be considered when selecting vaporising oil fired appliances to meet customers' needs

Assessment Criteria

The learner can:

1. define the factors which affect the selection of oil fired vaporising appliances in dwellings
2. state the criteria used when selecting oil fired vaporising appliances:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - restrictions placed on appliances installed in certain rooms:
 - bathrooms/shower rooms; bedroom/bedsitting rooms; understairs cupboards; loft spaces; garages; externally sited appliances
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space
 - suitability of heating or hot water system (where required)
 - loadings placed on the oil fired appliance
 - energy efficiency legislation requirements
 - environmental impact.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 4

Know the installation requirements of vaporising oil fired appliances

Assessment Criteria

The learner can:

1. specify the requirements of a pre-installation inspection to determine that the vaporising appliance can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. state how to position, fix and connect vaporising oil fired appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make connections to the heating/hot water system
 - make final connections to the oil supply pipework
 - make final electrical connections to the central heating control system.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 5

Know the fault diagnosis and rectification procedures for vaporising oil fired appliances

Assessment Criteria

The learner can:

1. specify the periodic servicing intervals of vaporising oil fired appliances
2. define the schedule of activities to be carried out during the periodic service of a vaporising oil fired appliance:
 - perforated sleeve burners
 - natural draught pot burners
 - natural draught multi stage burners
 - fan pressurised pot burners
3. state the methods of obtaining details of system faults from end users
4. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of vaporising oil fired appliances
5. specify methods of safely isolating vaporising oil fired appliances to prevent them being brought into operation before the work has been fully completed
6. propose routine checks and diagnostics on vaporising oil fired appliances as part of a fault finding process:
 - cleaning system components
 - checking for blockages/poor flow rate:
 - heat exchanger
 - fuel supply system including oil controls
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of vaporising appliance burner components
7. specify methods of identifying and repairing faults in vaporising appliances:
 - burner defects
 - oil level control defects
 - oil flow rate control defects
 - flue system performance
 - inadequate air supply
8. define the actions to take in the event that the appliance/component fault cannot be rectified:
 - use of the unsafe situations procedure
 - provision of suitable warning notices
9. specify the procedures to re-commission appliances following completion of service/maintenance or fault repair activities.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 6

Know the range of equipment used to commission vaporising oil fired appliances

Assessment Criteria

The learner can:

1. specify the equipment used to set the cold oil depth/oil flow rate:
 - pressure gauge
 - vacuum gauge
2. specify the equipment used to carry out an initial test to determine the cleanliness of combustion and its method of use:
 - smoke pump (tester)
 - draught gauge
3. specify the equipment used to carry out combustion analysis of an oil fired appliance and its method of use:
 - electronic test equipment
 - manual/wet analysis equipment:
 - carbon dioxide analyser
 - flue gas thermometer
4. define the maintenance and calibration requirements of test equipment used to commission vaporising oil fired appliances.

Unit 314

Understand the principles of domestic oil firing vaporising appliances

Outcome 7

Know the commissioning requirements of vaporising oil fired appliances

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on vaporising oil fired appliances
2. state the checks to be carried out during a visual inspection of a vaporising oil fired appliance to confirm that it is ready to be commissioned:
 - oil storage tank
 - oil supply system – checked, filled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustibles, flue termination and provision of flue draught stabiliser
 - vaporising appliance – correct positioning and assembly of components such as flue baffles
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance burner and controls – setting, positioning etc.
3. specify the range of operational tests to be carried out prior to appliance light up:
 - flue flow test (where required)
4. specify the range of operational tests to be carried out on initial appliance light up:
 - determination of cold oil depth and/or oil flow rate
 - initial function of appliance burner
 - appliance flame picture (where required)
 - correct operation of burner safety controls
 - appliance flame picture (where required)
 - initial readings to determine the cleanliness of combustion and adjust accordingly – smoke reading and flue draught
 - flue operational tests – flue spillage (where required), flue draught interference test (where required)
5. specify the range of tests to be carried out to determine the appliance combustion efficiency and adjust/fine tune the burner accordingly
6. specify the checks to be carried out to ensure that the appliance oil flow rate/temperature controls are operating correctly
7. specify the range of checks to be carried out to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. define the actions to take in the event that the appliance/component cannot be correctly commissioned:
 - use of the unsafe situations procedure
 - provision of suitable warning notices

9. propose the range of information that would be detailed on a commissioning record for a vaporising oil fired appliance
10. state the procedure for notifying works carried out to the relevant authority
11. propose the points to be covered when handing over a completed installation to the end-user.

Unit 314 **Understand the principles of domestic oil firing vaporising appliances**

Outcome 8 Know the decommissioning requirements of vaporising oil fired appliances

Assessment Criteria

The learner can:

1. specify working methods that reduce the periods during which vaporising appliances are not available to building users
2. state the information that needs to be provided to other persons before decommissioning work takes place
3. define how to temporarily decommission vaporising appliances
4. define the work sequences for permanently decommissioning vaporising appliances
5. specify the procedures for safely draining and disposing of system contents:
 - central heating/hot water system
 - fuel supply system
6. specify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
 - safe isolation of the fuel supply system
 - safe isolation of the heating/hot water system
 - safe isolation of the heating/hot water electrical control system
 - temporary capping of pipework sections
 - use of warning notices and signs.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Level: 3

Credit value: 12

UAN: J/502/9406

Unit aims

This knowledge unit provides learning in legislation and operating principles. The learner will know the combustion process, ventilation, flue systems and testing, and standards of chimneys. The learner will know how to identify and respond to unsafe situations, understand diagnostic methods used to identify problems in flue/chimney performance, and understand the requirements for hearths and surrounds.

Learning outcomes

There are **11** learning outcomes to this unit. The learner will:

1. know the solid fuel legislation that applies to work in dwellings
2. know the types of solid fuels and the factors affecting fuel selection
3. know the basic operating principles of solid fuel appliances
4. know the factors which affect the selection of solid fuel appliances
5. know the combustion process and the principles of safe combustion of solid fuels
6. know the ventilation requirements of solid fuel appliances installed in dwellings
7. know the standards of chimneys and flue systems to be used with solid fuel appliances in dwellings
8. know the methods of diagnosing problems with flue/chimney performance
9. know the requirements for hearths and fireplace surrounds to solid fuel appliances
10. know how to test solid fuel appliances and associated flue systems in dwellings for effective operation
11. know how to identify and respond to unsafe situations relating to solid fuel flue systems and appliances in dwellings.

Guided learning hours

It is recommended that **110** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 1

Know the solid fuel legislation that applies to work in dwellings

Assessment Criteria

The learner can:

1. define the types of statutory legislation and guidance information that applies to solid fuel installation and maintenance work in the industry:
 - building regulations
 - industry standards
 - manufacturer installation and service/maintenance instructions
2. identify the recommended responsibilities of key personnel relating to the installation and maintenance of solid fuel equipment:
 - business registration and competence
 - personnel registration and competence
 - consumers – private householders and tenants
3. identify the legislative requirements related to clean air (smoke control areas) in the UK
4. analyse and interpret the requirements of specific solid fuel safety legislation
5. define the range of information that would be contained within a commissioning record for solid fuel equipment
6. identify the procedure for notifying works carried out to the relevant building control body:
 - notification to the building control body
 - self certification via a competent persons scheme.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 2

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

Assessment Criteria

The learner can:

1. clarify the types of solid mineral fuels burnt in solid fuel appliances:
 - bituminous (house) coals
 - bituminous coal briquettes
 - natural smokeless fuels
 - manufactured smokeless fuels
2. clarify the types of wood burnt in solid fuel appliances:
 - wood logs
 - wood chips
 - wood briquettes
 - wood pellets
3. define the term 'sustainable sources' related to the production and burning of wood in solid fuel appliances
4. define the factors which affect the selection of solid fuels:
 - customer preference
 - appliance type
 - fuel storage requirements
 - smoke control legislation.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 3

Know the basic operating principles of solid fuel appliances

Assessment Criteria

The learner can:

1. state the operating principles of solid fuel open fires:
 - inset (dry)
 - freestanding (dry)
 - convector (dry)
 - with underfloor air supply
 - with small hot water only boiler
 - with high output back boiler
2. state the operating principles of solid fuel room heaters (stoves):
 - inset (dry)
 - freestanding (dry)
 - with integral boiler
 - automatic feed type e.g. pellet burners
3. state the operating principles of solid fuel cookers:
 - cooking only
 - cooking with small hot water boiler
 - cooking with high output boiler
4. state the operating principles of solid fuel independent boilers:
 - batch fed appliances (log boilers)
 - gravity fed appliances
 - automatic feed type, e.g. pellet burners.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 4

Know the factors which affect the selection of solid fuel appliances

Assessment Criteria

The learner can:

1. specify the minimum solid fuel appliance efficiency requirements laid down by statutory legislation
2. clarify the impact of smoke control legislation on the selection of solid fuel appliances:
 - appliance fuel types restricted in smoke control areas
 - use of exempted appliances
3. specify the fuel storage requirements of solid fuel appliances burning solid mineral fuels
4. specify the fuel storage requirements of solid fuel appliances burning wood:
 - seasoning requirements for wood logs:
 - soft woods
 - hard woods
 - storage requirements for wood logs during the seasoning process
 - storage requirements for wood ready for burning:
 - wood logs
 - wood chips
 - wood briquettes
 - wood pellets.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 5

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

Assessment Criteria

The learner can:

1. define the terms related to solid fuel composition:
 - calorific value
 - moisture content
 - volatile content
2. identify the combustion process with solid fuels used in dwellings:
 - the combustion equation
 - air requirements for combustion including excess air
 - optimum combustion temperature
 - impact of fuel size on the combustion process
 - main constituents of complete combustion
 - soot production as a by-product of the combustion process
3. specify the main causes of incomplete combustion with solid fuels:
 - inadequate air supply
 - incorrect fuel
 - inadequate flue/chimney performance
4. identify the production of carbon monoxide as a possible by-product of incomplete combustion
5. identify the potential effects of carbon monoxide when incomplete combustion takes place:
 - effects of exposure to carbon monoxide on the human body
 - symptoms of CO poisoning
 - advice to give to a person who describes symptoms of being affected by products of combustion
6. specify the measures necessary to ensure that exposure to carbon monoxide does not take place:
 - primary measures – correct appliance installation and maintenance
 - secondary measures – use of carbon monoxide detectors
 - types of CO detectors available and standards of manufacture
 - the positioning requirements for carbon monoxide detectors
 - causes of activation of CO detectors and indicators
7. clarify the use of CO analysers in measuring CO concentrations in ambient air:
 - test procedure for measuring CO in ambient air
 - response required based on CO in ambient air levels (action levels).

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 6

Know the ventilation requirements of solid fuel appliances installed in dwellings

Assessment Criteria

The learner can:

1. calculate the ventilation requirements for open flued solid fuel appliances:
 - for single open flued appliances installed in a room or space
 - for multiple open flued appliances installed in the same room or space including mixed solid fuel and gas or oil fired appliances
2. identify the types of grilles and vents available for ventilation
 - types of grilles and vents
 - restrictions on the use of flyscreens
 - sizing of grilles and vents (free area availability)
3. calculate the free area of unmarked grilles and vents
4. specify the acceptable locations for ventilation to appliances:
 - restrictions to ventilator/grille locations
 - installation of vents through walls (including cavity walls)
 - ventilation paths via other rooms
 - siting of ventilation:
 - wall
 - window
 - floor/ceiling (ducted and un-ducted)
5. clarify the effect that other heat producing appliances and extractor fans have on the requirement for ventilation of solid fuel appliances:
 - gas or solid fuel appliances and flue systems
 - passive stack ventilation
 - extractor fans
 - cooker hoods
 - tumble driers.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 7

Know the standards of chimneys and flue systems to be used with solid fuel appliances in dwellings

Assessment Criteria

The learner can:

1. state the function of an open flue/chimney system:
 - clearing the products of combustion
 - inducing combustion air into the solid fuel appliance
2. identify the working principles of open flue systems including the effect that height has on flue performance
3. state the types and general layout features of chimney and flue construction:
 - rigid chimney types:
 - brick/masonry
 - pre-cast flue blocks
 - metallic (single and double wall flues)
 - flexible metallic liner installation – types and suitability
- 4 a) specify the requirements for new and existing chimney/flue installation:
 - minimum cross sectional area of new chimney installations to serve appliances
 - insulation requirements for flues/chimneys
 - restrictions placed on (bends) changes of direction in the chimney/flue system
 - types of flue liners – during construction (salt glazed, clay etc):
 - poured/pumped concrete flue liners; pre-cast flue blocks; flexible flue liners; flue system jointing methods
 - restrictions on the use of poured concrete liners
 - pre-cast flue design:
 - minimum cross sectional area of new flue blocks; minimum requirement of vertical flue blocks before off-sets; jointing material for pre-cast flue blocks; minimum flue size diameter for connecting pre-cast transfer blocks to termination point; effects of temperature on installation requirements for pre-cast flues
- 4 b) specify the requirements for new and existing chimney/flue installation:
 - flexible flue liners:
 - sealing and support requirements for flexible flue liners in chimneys
 - flexible liner components
 - termination of flue liners
 - metallic rigid flue/chimney systems:
 - support requirements
 - jointing methods
 - use external to the building

- 5 a) define the design requirements of flues used with solid fuel appliances:
- requirements of designer, builder, provider or installer when installing chimneys
 - chimney system design:
 - distance requirements when passing through combustible material; fire-stopping requirements when passing through compartments; methods of preventing contact of combustible materials with metallic internal flue pipes e.g. in cupboards, roofspaces; special requirements for chimneys passing adjacent to combustible material or through other dwellings; proximity of single skin flue pipes to combustible materials
- 5 b) define the design requirements of flues used with solid fuel appliances:
- temperature effects and condensation problems caused by flue pipe runs
 - requirements for access to appliances and chimneys/flue systems for cleaning purposes
6. specify the requirements for the termination of flue systems serving solid fuel appliances:
- low level open flue appliance termination (pellet burners)
 - open flue terminal positions on roof surfaces
 - open flue terminal positions on easily ignited roof surfaces
 - methods of dealing with down-draught on steeply pitched roofs
 - types of chimney pots and approved cowls for use with solid fuel flue systems
7. specify the methods of making correct appliance connection to the flue system:
- forming chimney gathers – open fires
 - throats to open fires
 - use, positioning and sizing of canopies to open fires
 - flue connection to freestanding appliances (open fire, cooker, roomheater and boiler)
 - freestanding appliance (open fire, cooker, roomheater and boiler) connection to rigid metallic flue pipe systems
 - inset room heater connection to flue systems
8. identify the working principles of flue draught stabilisers and their uses with solid fuel appliances
9. specify the requirements for installing chimney fans to open flues/chimney systems:
- requirements prior to installing fans in flues
 - additional safety requirements when fans are installed in flues.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 8

Know the methods of diagnosing problems with flue/chimney performance

Assessment Criteria

The learner can:

1. specify the range of faults and their potential solution associated with flues/chimneys sited in high pressure zones
2. specify the range of faults and their potential solution associated with insufficient flue draught
3. specify the range of faults and their potential solution associated with no, or limited chimney updraught
4. specify the range of faults and their potential solution associated with chimney down-draughting.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 9

Know the requirements for hearths and fireplace surrounds to solid fuel appliances

Assessment Criteria

The learner can:

1. specify the requirements for the provision of hearths to solid fuel appliances:
 - appliances with base temperature below 100°C
 - appliances with base temperature above 100°C
2. clarify the constructional features of hearths to solid fuel appliances (base temperatures above 100°C):
 - constructional hearth dimensions
 - superimposed hearth dimensions
 - proximity of appliances on hearths to combustible materials
3. specify the methods of forming recessed fireplace openings
4. specify the methods of installing fireplace surrounds including the suitability of surround material
5. identify the requirements for the provision of a flue/appliance hearth dataplate.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 10

Know how to test solid fuel appliances and associated flue systems in dwellings for effective operation

Assessment Criteria

The learner can:

1. identify the requirements for sweeping an existing flue system prior to new solid fuel appliance installation
2. specify the key points to be checked in the visual inspection of a flue system prior to undertaking commissioning of the solid fuel appliance/flue system
3. specify the circumstances in which CCTV inspection of a flue system may be required
4. state the factors that can affect flue system performance:
 - downdraught conditions
 - wind effects at the appliance termination
 - passive stack ventilation
 - extractor fans sited in the vicinity of open flued appliances
5. specify the testing procedures that should be performed to check the correct operation of an existing chimney/flue system:
 - coring ball test
 - smoke test
 - flue testing procedures with appliances sited in the vicinity of extraction fans
6. specify the testing procedures applied to solid fuel appliances:
 - flue flow test
 - appliance air leakage test (closed appliances)
 - appliance spillage test (open appliances)
 - taking flue draught readings and adjustment of appliance air control devices
7. specify the procedures for using combustion analysis equipment to commission selected solid fuel appliances.

Unit 315

Understand core solid fuel safety principles within domestic building services engineering

Outcome 11

Know how to identify and respond to unsafe situations relating to solid fuel flue systems and appliances in dwellings

Assessment Criteria

The learner can:

1. clarify the types of unsafe situation that may be found with solid fuel appliances and flue systems:
 - types of risk:
 - actions to take
 - 'Do Not Use' notices and labels
 - warning notice forms
2. identify the use of general notices and warning labels to avoid the occurrence of unsafe situations:
 - solid fuel commissioning certificates
 - solid fuel service certificates.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Level: 3

Credit value: 4

UAN: L/502/9407

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the identification of solid flues and their uses. Select and install ventilation, check suitability of flue systems and test for effective operation. Be able to diagnose and rectify faults correctly respond to unsafe situations.

Learning outcomes

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

1. be able to correctly identify solid fuels and their uses
2. be able to correctly state the type of solid fuel appliance and determine minimum operating efficiencies
3. be able to select and install ventilation for solid fuel appliances
4. be able to check the suitability of chimneys, hearths and flue systems
5. be able to test solid fuel appliance flue systems for effective operation
6. be able to diagnose faults in open flue systems and identify rectifying actions
7. be able to correctly respond to unsafe solid fuel situations.

Guided learning hours

It is recommended that **six** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 1

Be able to correctly identify solid fuels and their uses

Assessment Criteria

The learner can:

1. confirm the type of solid mineral fuel supplied and identify the suitability of the fuel to be burnt in selected appliances:
 - bituminous (house) coals
 - bituminous coal briquettes
 - natural smokeless fuels
 - manufactured smokeless fuels
2. confirm the type of wood supplied and identify the suitability of the fuel to be burnt in selected appliances:
 - wood logs
 - wood chips
 - wood briquettes
 - wood pellets.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 2

Be able to correctly state the type of solid fuel appliance and determine minimum operating efficiencies

Assessment Criteria

The learner can:

1. name the type of solid fuel appliance to be installed
2. determine the minimum appliance efficiency for stated appliances and confirm their compliance with statutory regulation requirements.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 3

Be able to select and install ventilation for solid fuel appliances

Assessment Criteria

The learner can:

1. calculate the ventilation requirements (free area of air vent) for solid fuel appliances from on-site information:
 - single open flued appliances
 - multiple open flued appliances
2. determine by measurement and calculation the free area of grilles and ventilators to supply combustion air to solid fuel appliances:
 - marked ventilators and grilles
 - unmarked ventilators and grilles
3. determine the suitability of grilles and vents to provide combustion air and compartment ventilation:
 - grille/vent construction
 - flyscreen not fitted/correctly sized
 - projection through walls including cavity walls
 - fixing arrangements
4. confirm the correct positioning of grilles and ventilators to provide combustion air to open flued solid fuel appliances:
 - open flued - correct positioning
 - open flued - incorrect positioning
 - combustion air supply to open flued appliances from adjacent rooms.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 4

Be able to check the suitability of chimneys, hearths and flue systems

Assessment Criteria

The learner can:

1. confirm the parts of a flue system from an existing installation
2. confirm the type of open flue system installed:
 - brick masonry chimneys – with/without liners
 - rigid flues – including single and double skin
3. confirm the suitability of the chimney/flue for use with an open flued solid fuel appliance:
 - flue chimney soundness and construction
 - flue materials
 - flue draught stabiliser (if fitted)
 - appliance connection to flue/chimney
 - flue proximity to combustible materials
 - flue length and routing – internal/external
 - flue jointing methods and materials
 - flue supports
 - flue inspection points are provided (where required)
 - flue connection to termination point
 - selection of correct chimney pot/approved cowl
4. confirm that the flue outlets (terminals) of open flued appliances are correctly positioned:
 - correctly positioned terminals
 - incorrectly positioned terminals
5. confirm the suitability of hearth provided for use with solid fuel appliances.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 5

Be able to test solid fuel appliance flue systems for effective operation

Assessment Criteria

The learner can:

1. carry out visual inspections of open flued (masonry lined and rigid metallic) flue systems to confirm their suitability prior to testing the operation of the flue system
2. carry out testing procedures to open flue systems:
 - coring ball test
 - smoke test
3. carry out flue flow tests of appliances/open flue systems:
 - correctly operating flues
 - incorrectly operating flues
4. carry out spillage tests of open flued appliances:
 - correctly operating appliances
 - incorrectly operating appliances
5. carry out appliance air leakage tests to open flued appliances.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 6

Be able to diagnose faults in open flue systems and identify rectifying actions

Assessment Criteria

The learner can:

1. diagnose faults in solid fuel open flued systems:
 - flues/chimneys sited in high pressure zones
 - insufficient flue draught
 - no, or limited updraught
 - downdraughting
2. present solutions to overcome faults in open flue systems.

Unit 316

Apply core solid fuel safety within domestic building services engineering

Outcome 7

Be able to correctly respond to unsafe solid fuel situations

Assessment Criteria

The learner can:

1. perform safety checks on solid fuel appliances and flue systems to check for unsafe situations:
 - complete report forms – installation and service
2. inspect and apply unsafe situations procedures to solid fuel appliances and flue systems
3. label systems, appliances and components as appropriate
4. isolate appliances as appropriate.

Unit 317

Service and maintain domestic solid mineral fuel burning appliances

Level: 3

Credit value: 3

UAN: L/502/9410

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the servicing, commissioning and decommissioning of appliances, and to be able to diagnose and rectify faults.

Learning outcomes

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

1. be able to service and maintain solid mineral fuel appliances
2. be able to diagnose faults in solid mineral fuel appliances
3. be able to rectify faults in solid mineral fuel appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 317

Service and maintain domestic solid mineral fuel burning appliances

Outcome 1

Be able to service and maintain solid mineral fuel appliances

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work to take place
2. safely isolate solid mineral fuel appliances in order to undertake periodic service and maintenance work
3. carry out a periodic service of a solid mineral fuel installation to include checks in relation to:
 - visual inspection of the installation for compliance with regulation requirements
 - cleaning of components
 - checking of system water content
 - functional tests on system components
4. complete maintenance records relating to solid mineral fuel appliances.

Unit 317

Service and maintain domestic solid mineral fuel burning appliances

Outcome 2

Be able to diagnose faults in solid mineral fuel appliances

Assessment Criteria

The learner can:

1. use information sources as part of the fault diagnosis procedure
2. carry out fault finding procedures to identify the cause of faults with solid mineral fuel appliances:
 - cleaning system components
 - checking for blockages:
 - heat exchanger
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of appliance components – thermostats, fans etc.

Unit 317

Service and maintain domestic solid mineral fuel burning appliances

Outcome 3

Be able to rectify faults in solid mineral fuel appliances

Assessment Criteria

The learner can:

1. carry out fault rectification work on solid mineral fuel appliances:
 - cleaning system components
 - checking for blockages:
 - heat exchanger
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of appliance components – thermostats, fans etc.
2. re-commission appliances following completion of fault repair activities
3. complete maintenance report forms following rectification work.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Level: 3

Credit value: 7

UAN: R/502/9408

Unit aim(s)

This knowledge unit provides learning in operating principles linked to legislation covering energy efficiency, installation requirements, fault finding, commissioning and decommissioning. Know the range of equipment needed to meet manufactures requirements.

Learning outcomes

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

1. know the types of solid mineral fuel appliance and their operating principles
2. know the energy efficiency legislation applicable to solid mineral fuel appliances
3. know the factors to be considered when selecting solid mineral fuel appliances to meet customers' needs
4. know the installation requirements of solid mineral fuel appliances
5. know the fault diagnosis and rectification procedures for solid mineral fuel appliances
6. know the range of equipment used to commission solid mineral fuel appliances
7. know the commissioning requirements of solid mineral fuel appliances
8. know the decommissioning requirements of solid mineral fuel appliances.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 1

Know the types of solid mineral fuel appliance and their operating principles

Assessment Criteria

The learner can:

1. identify the operating principles of solid mineral fuel appliances:
 - batch fed open fires – with/without boilers
 - batch fed room heaters – with/without boilers
 - batch fed cookers – with/without boilers
 - semi automatic independent boilers
2. define the purpose of components of solid mineral fuel appliances:
 - open fires:
 - chairbrick/boiler, connection to the flue system, firefront parts, damper mechanism (where fitted), underfloor air mechanism
 - roomheaters:
 - combustion chamber, firebed, connection to the flue system, ash removal, appliance door seals, air supply control
 - cookers:
 - combustion chamber, firebed, connection to the flue system, ash removal, appliance door seals, air supply control
 - independent boilers:
 - combustion, firebed, fuel storage, connection to the flue system, ash removal system, appliance seals, blocked flue cut-off, thermostatic control, air supply fan, primary air supply
3. clarify the operating principles of biomass appliances:
 - open fires with/without boilers
 - roomheaters with/without boilers
 - cookers with/without boilers
 - independent boilers.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 2

Know the energy efficiency legislation applicable to solid mineral fuel appliances

Assessment Criteria

The learner can:

1. specify the types of solid mineral appliance that must be installed to meet the requirements of energy efficiency legislation:
 - new properties
 - replacement of boilers in existing properties
2. state the limitation on the installation of solid mineral fuel appliances laid down by the Clean Air Act
3. specify the level of central heating controls to be provided in heating and hot water systems incorporating solid mineral fuel appliances:
 - new properties
 - when carrying out replacement of existing fossil fuel burning appliances.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 3

Know the factors to be considered when selecting solid mineral fuel appliances to meet customers' needs

Assessment Criteria

The learner can:

1. define the factors which affect the selection of solid mineral fuel appliances in dwellings
2. state the criteria used when selecting solid mineral fuel appliances:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - restrictions placed on boilers installed in certain rooms:
 - bathrooms/shower rooms
 - bedroom/bedsitting rooms
 - understairs cupboards
 - loft spaces
 - garages
 - externally sited appliances
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space and fuel storage
 - suitability of heating system
 - loadings placed on the solid mineral fuel appliance
 - energy efficiency legislation requirements
 - environmental impact
3. define the processes used when calculating the size of replacement existing boilers using the whole house boiler sizing method.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 4

Know the installation requirements of solid mineral fuel appliances

Assessment Criteria

The learner can:

1. specify the requirements of a pre-installation inspection to determine that the solid mineral fuel appliance can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. state how to position, fix and connect solid mineral fuel appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble the appliance flue system/connection
 - make/assemble the appliance fuel storage arrangements
 - make connections to the heating/hot water system
 - make final electrical connections to the central heating control system.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 5

Know the fault diagnosis and rectification procedures for solid mineral fuel appliances

Assessment Criteria

The learner can:

1. specify the periodic servicing intervals of solid mineral fuel appliances
2. define the schedule of activities to be carried out during the periodic service of a solid mineral fuel appliance:
 - open fire
 - roomheater
 - cooker
 - independent boiler
3. state the methods of obtaining details of system faults from end users
4. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of solid mineral fuel appliances
5. specify methods of safely isolating solid mineral fuel appliances to prevent them being brought into operation before the work has been fully completed
6. propose routine checks and diagnostics on solid mineral fuel appliances as part of a fault finding process:
 - cleaning system components
 - checking for blockages:
 - heat exchanger
 - checking the flue system for correct operation
 - checking for provision of adequate ventilation to the appliance
 - checking for correct operation of appliance components – thermostats, fans etc
7. specify methods of identifying and repairing faults in solid mineral fuel appliances:
 - defective firebars
 - defective thermostatic controls
 - flue performance problems
 - inadequate appliance ventilation
 - defective fans/combustion controls
 - defective door seals
8. define the actions to take in the event that the appliance/component fault cannot be rectified:
 - use of the unsafe situations procedure
 - provision of suitable warning notices
9. specify the procedures to re-commission appliances following completion of service/maintenance or fault repair activities.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 6

Know the range of equipment used to commission solid mineral fuel appliances

Assessment Criteria

The learner can:

1. specify the equipment used to determine flue draught readings
 - draught gauge
2. define the maintenance and calibration requirements of test equipment used to commission biomass appliances.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 7

Know the commissioning requirements of solid mineral fuel appliances

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on solid mineral fuel appliances
2. state the checks to be carried out during a visual inspection of a solid mineral fuel appliance to confirm that it is ready to be commissioned:
 - fuel storage provision – correctly assembled, sited and correct fuel supplied
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser (where required)
 - solid mineral fuel appliance – correct positioning and assembly of components such as flue mechanisms, ash cleaning mechanism etc.
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
3. specify the range of operational tests to be carried out prior to appliance light up:
 - flue flow test (where required)
4. specify the range of operational tests to be carried out on initial appliance light up:
 - initial lighting of the appliance
 - appliance air leakage test
 - correct operation of burner safety controls
 - initial readings to determine the flue draught
 - flue operational tests – flue spillage (flue draught interference test, where required)
5. specify the range of tests to be carried out to determine the appliance combustion efficiency and adjust/fine tune the burning rate accordingly
6. specify the checks to be carried out to ensure that the appliance temperature controls are operating correctly
7. specify the range of checks to be carried out to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. define the actions to take in the event that the appliance/component cannot be correctly commissioned:
 - use of the unsafe situations procedure
 - provision of suitable warning notices
9. propose the range of information that would be detailed on a commissioning record for a solid mineral fuel appliance
10. state the procedure for notifying works carried out to the relevant authority
11. propose the points to be covered when handing over a completed installation to the end-user.

Unit 318

Understand the principles of domestic solid mineral fuel burning appliances

Outcome 8

Know the decommissioning requirements of solid mineral fuel appliances

Assessment Criteria

The learner can:

1. specify working methods that reduce the periods during which biomass appliances are not available to building users
2. state the information that needs to be provided to other persons before decommissioning work takes place
3. define how to temporarily decommission solid mineral fuel appliances
4. define the work sequences for permanently decommissioning solid mineral fuel appliances
5. specify the procedures for safely draining and disposing of system contents:
 - central heating/hot water system
 - fuel and ash system
6. specify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
 - safe isolation of the heating/hot water system
 - safe isolation of the heating/hot water electrical control system
 - temporary capping of pipework sections
 - use of warning notices and signs.

Unit 319

Install, test and commission domestic solid mineral fuel burning appliances

Level: 3

Credit value: 3

UAN: Y/502/9409

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in customer requirements by pre-installation inspections, the installation, commissioning and decommissioning of appliances.

Learning outcomes

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

1. be able to select solid mineral fuel appliances to meet customers' needs
2. be able to install solid mineral fuel appliances
3. be able to commission solid mineral fuel appliances
4. be able to decommission solid mineral fuel appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 319

Install, test and commission domestic solid mineral fuel burning appliances

Outcome 1

Be able to select solid mineral fuel appliances to meet customers' needs

Assessment Criteria

The learner can:

1. select suitable solid mineral fuel appliances meeting installation/standard requirements:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - suitable room/property location
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space and fuel storage
 - suitability of heating system
 - loadings placed on the solid mineral fuel appliance
 - energy efficiency legislation requirements
 - environmental impact
2. calculate the size of solid mineral fuel appliance required for a boiler replacement using the whole house boiler sizing method.

Unit 319

Install, test and commission domestic solid mineral fuel burning appliances

Outcome 2

Be able to install solid mineral fuel appliances

Assessment Criteria

The learner can:

1. carry out a pre-installation inspection to determine that solid mineral fuel appliances can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. position, fix and connect solid mineral fuel appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble the appliance flue system/connection
 - make connections to the heating/hot water system
 - make final electrical connections to the central heating control system
3. take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Unit 319

Install, test and commission domestic solid mineral fuel burning appliances

Outcome 3

Be able to commission solid mineral fuel appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on solid mineral fuel appliances
2. carry out a visual inspection of solid mineral fuel appliances to confirm that they are ready to be commissioned:
 - fuel supply system – correctly assembled, sited and correct fuel supplied
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser (where required)
 - solid mineral fuel appliance – correct positioning and assembly of components such as flue mechanism, ash cleaning mechanism etc.
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - initial lighting of the appliance
 - appliance air leakage test
 - correct operation of burner safety controls
 - initial readings to determine the flue draught
 - flue operational tests – flue spillage (where required, flue draught interference test (where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune controls accordingly
6. carry out checks to ensure that the appliance temperature controls are operating correctly
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for solid mineral fuel appliances.

Unit 319

Install, test and commission domestic solid mineral fuel burning appliances

Outcome 4

Be able to decommission solid mineral fuel appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity supply and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 320

Service and maintain domestic biomass fuel burning appliances

Level: 3
Credit value: 2
UAN: H/502/9414

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the servicing, commissioning and decommissioning of appliances. To be able to diagnose and rectify faults.

Learning outcomes

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

1. be able to service and maintain biomass appliances
2. be able to diagnose faults in biomass appliances
3. be able to rectify faults in biomass appliances.

Guided learning hours

It is recommended that **three** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 320

Service and maintain domestic biomass fuel burning appliances

Outcome 1

Be able to service and maintain biomass appliances

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work to take place
2. safely isolate biomass appliances in order to undertake periodic service and maintenance work
3. carry out a periodic service of a biomass installation to include checks in relation to:
 - visual inspection of the installation for compliance with regulation requirements
 - cleaning of components
 - checking of system water content
 - functional tests on system components
4. complete maintenance records relating to biomass appliances.

Unit 320

Service and maintain domestic biomass fuel burning appliances

Outcome 2

Be able to diagnose faults in biomass appliances

Assessment Criteria

The learner can:

1. use information sources as part of the fault diagnosis procedure
2. carry out fault finding procedures to identify the cause of faults with biomass appliances:
 - defects in flue performance
 - defective fuel supply system
 - failure in the heat exchanger/flue cleaning system
 - failure of the ignition system
 - sensor/microprocessor faults
 - inadequate flow rate through the appliance.

Unit 320

Service and maintain domestic biomass fuel burning appliances

Outcome 3

Be able to rectify faults in biomass appliances

Assessment Criteria

The learner can:

1. carry out fault rectification work on biomass appliances:
 - defects in flue performance
 - defective fuel supply system
 - failure in the heat exchanger/flue cleaning system
 - failure of the ignition system
 - sensor/microprocessor faults
 - inadequate flow rate through the appliance
2. re-commission appliances following completion of fault repair activities
3. complete maintenance report forms following rectification work.

Unit 321

Install, test and commission domestic biomass fuel burning appliances

Level: 3

Credit value: 3

UAN: K/502/9415

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in customer requirements by selecting suitable biomass appliances meeting installation, commissioning and decommissioning standard requirements.

Learning outcomes

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

1. be able to select biomass appliances to meet customers' needs
2. be able to install biomass appliances
3. be able to commission biomass appliances
4. be able to decommission biomass appliances.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 321

Install, test and commission domestic biomass fuel burning appliances

Outcome 1

Be able to select biomass appliances to meet customers' needs

Assessment Criteria

The learner can:

1. select suitable biomass appliances meeting installation/standard requirements:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - suitable room/property location
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space and fuel storage
 - suitability of heating system
 - loadings placed on the biomass appliance
 - energy efficiency legislation requirements
 - environmental impact
2. calculate the size of biomass appliance required for a boiler replacement using the whole house boiler sizing method.

Unit 321

Install, test and commission domestic biomass fuel burning appliances

Outcome 2

Be able to install biomass appliances

Assessment Criteria

The learner can:

1. carry out a pre-installation inspection to determine that biomass appliances can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. position, fix and connect biomass appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make/assemble the appliance fuel storage arrangements
 - assemble the fuel delivery system
 - make connections to the heating/hot water system
 - make final electrical connections to the central heating control system
3. take precautions to ensure that the appliance cannot be brought into operation before the installation work is fully completed.

Unit 321

Install, test and commission domestic biomass fuel burning appliances

Outcome 3

Be able to commission biomass appliances

Assessment Criteria

The learner can:

1. use information sources to identify the range of commissioning work required on biomass appliances
2. carry out a visual inspection of biomass appliances to confirm that they are ready to be commissioned:
 - fuel supply system – correctly assembled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser (where required)
 - biomass appliance – correct positioning and assembly of components such as flue mechanism, temperature sensors etc.
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance ignition and cleaning mechanisms
3. carry out operational tests prior to appliance light up:
 - flue flow test (where required)
4. carry out operational tests on initial appliance light up:
 - initial function of appliance burner
 - correct operation of burner safety controls
 - initial readings to determine the flue draught
 - flue operational tests – flue spillage (where required, flue draught interference test (where required)
5. carry out appliance combustion efficiency tests and adjust/fine tune controls accordingly
6. carry out checks to ensure that the appliance temperature controls are operating correctly
7. carry out checks to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
8. complete the details contained in a commissioning record for biomass appliances.

Unit 321

Install, test and commission domestic biomass fuel burning appliances

Outcome 4

Be able to decommission biomass appliances

Assessment Criteria

The learner can:

1. liaise with other persons to determine the decommissioning work to be carried out
2. arrange for temporary heating to be available (if required) for the duration of decommissioning work
3. isolate the appliance from the supply source:
 - turn off the electricity supply and make safe
 - turn off the water supply to the system
4. drain and safely dispose of the system contents:
 - central heating/hot water system
5. take precautions to ensure that the appliance cannot be brought back into operation before the decommissioning work is complete
6. advise other persons that the appliance has been successfully decommissioned.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Level: 3

Credit value: 7

UAN: R/502/9411

Unit aim(s)

This knowledge unit provides learning in operating principles linked to legislation covering energy efficiency, installation requirements, fault finding, commissioning and decommissioning. Plus equipment needed to meet manufactures requirements.

Learning outcomes

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

1. know the types of biomass appliance and their operating principles
2. know the energy efficiency legislation applicable to biomass appliances
3. know the factors to be considered when selecting biomass appliances to meet customers' needs
4. know the installation requirements of biomass appliances
5. know the range of equipment used to commission biomass appliances
6. know the commissioning requirements of biomass appliances
7. know the decommissioning requirements of biomass appliances.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Permitted reference material

The learner is permitted to use the following material during their assessment for this unit:

- Domestic Building Services Compliance Guide 2010 edition

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 1

Know the types of biomass appliance and their operating principles

Assessment Criteria

The learner can:

1. identify the operating principles of a biomass appliance:
 - log burner – batch type appliance
 - wood pellet burner – fully automatic
2. define the purpose of components of a biomass appliance:
 - log burner:
 - fuel store; heat exchanger; heat exchanger cleaning mechanism; ash removal; fire bed/combustion chambers; primary/secondary air control; air supply (suction) fan; flue gas exhaust control; flue gas temperature sensor; lambda sensor; combustion controller (PCB)
 - wood pellet burner:
 - fuel store; fuel supply system – suction and drive feed systems; heat exchanger; heat exchanger cleaning mechanism; automatic ignition system; automatic heat exchanger/flue cleaning mechanism; automatic ash removal system; combustion air fan; flue gas temperature sensor; lambda sensor; combustion controller (PCB)
3. clarify the operating principles of biomass appliances:
 - automatic wood pellet burning stoves
 - automatic wood pellet burning boilers
 - batch fed wood log burning stoves
 - batch fed wood log burning boilers.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 2

Know the energy efficiency legislation applicable to biomass appliances

Assessment Criteria

The learner can:

1. specify the types of biomass appliance that must be installed to meet the requirements of energy efficiency legislation:
 - new properties
 - replacement of boilers in existing properties
2. state the limitation on the installation of biomass appliances laid down by the Clean Air Act
3. specify the level of central heating controls to be provided in heating and hot water systems incorporating biomass appliances:
 - new properties
 - when carrying out replacement of existing fossil fuel burning appliances.

Unit 322 Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 3 Know the factors to be considered when selecting biomass appliances to meet customers' needs

Assessment Criteria

The learner can:

1. define the factors which affect the selection of biomass appliances in dwellings
2. state the criteria used when selecting biomass appliances:
 - customers needs/preference
 - provision of suitable flueing arrangements
 - restrictions placed on boilers installed in certain rooms
 - bathrooms/shower rooms; bedroom/bedsitting rooms; understairs cupboards; loft spaces; garages; externally sited appliances
 - proximity of combustible materials to the appliance
 - building layout and features – suitable appliance space and fuel storage
 - suitability of heating system:
 - use of underfloor heating systems: use of buffer tanks (accumulators)
 - loadings placed on the biomass appliance
 - energy efficiency legislation requirements
 - environmental impact
3. define the processes used when calculating the size of replacement existing boilers using the whole house boiler sizing method.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 4

Know the installation requirements of biomass appliances

Assessment Criteria

The learner can:

1. specify the requirements of a pre-installation inspection to determine that the biomass appliance can be correctly installed:
 - appliance location/position
 - hearth provision
 - flueing arrangements and termination
 - appliance ventilation provision
 - fuel supply arrangements
 - heating/hot water system provision
 - electrical connection arrangements
2. state how to position, fix and connect biomass appliances to manufacturer requirements:
 - assemble and position the appliance
 - make connections to, or assemble, the appliance flue system/connection
 - make/assemble the appliance fuel storage storage arrangements
 - assemble the fuel delivery system
 - make connections to the heating/hot water system
 - make final electrical connections to the central heating control system.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 5

Know the range of equipment used to commission biomass appliances

Assessment Criteria

The learner can:

1. specify the equipment used to determine flue draught readings:
 - draught gauge
2. specify the equipment used to carry out combustion analysis of a biomass appliance and its method of use:
 - electronic test equipment
3. define the maintenance and calibration requirements of test equipment used to commission biomass appliances.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 6

Know the commissioning requirements of biomass appliances

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on biomass appliances
2. state the checks to be carried out during a visual inspection of a biomass appliance to confirm that it is ready to be commissioned:
 - fuel storage provision – correctly assembled, sited and correct fuel supplied
 - fuel supply system – correctly assembled and ready for operation
 - air supply – combustion and ventilation
 - flue system including hearth, proximity of combustible materials, flue termination and provision of flue draught stabiliser (where required)
3. state the checks to be carried out during a visual inspection of a biomass appliance to confirm that it is ready to be commissioned:
 - biomass appliance – correct positioning and assembly of components such as flue mechanisms, temperature sensors etc.
 - water connections to the appliance – provision of suitable heating/hot water system controls, checked filled and ready for operation
 - electrical connection to the appliance – electrical testing has taken place and the appliance is ready for operation
 - appliance ignition and cleaning mechanisms
4. specify the range of operational tests to be carried out prior to appliance light up:
 - flue flow test (where required)
5. specify the range of operational tests to be carried out on initial appliance light up:
 - initial function of appliance burner
 - correct operation of burner safety controls
 - initial readings to determine the flue draught
 - flue operational tests – flue spillage (flue draught interference test, where required)
6. specify the range of tests to be carried out to determine the appliance combustion efficiency and adjust/fine tune the burning rate accordingly
7. specify the checks to be carried out to ensure that the appliance temperature controls are operating correctly
8. specify the range of checks to be carried out to ensure that connected water heating systems are functioning correctly:
 - hot water systems
 - central heating systems
9. define the actions to take in the event that the appliance/component cannot be correctly commissioned:
 - use of the unsafe situations procedure
 - provision of suitable warning notices

10. propose the range of information that would be detailed on a commissioning record for a biomass appliance
11. state the procedure for notifying works carried out to the relevant authority
12. propose the points to be covered when handing over a completed installation to the end-user.

Unit 322

Understand the installation and commissioning principles of biomass fuel burning appliances

Outcome 7

Know the decommissioning requirements of biomass appliances

Assessment Criteria

The learner can:

1. specify working methods that reduce the periods during which biomass appliances are not available to building users
2. state the information that needs to be provided to other persons before decommissioning work takes place
3. define how to temporarily decommission biomass appliances
4. define the work sequences for permanently decommissioning biomass appliances
5. specify the procedures for safely draining and disposing of system contents:
 - central heating/hot water system
 - fuel and ash system
6. specify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system:
 - safe isolation of the fuel supply system
 - safe isolation of the heating/hot water system
 - safe isolation of the heating/hot water electrical control system
 - temporary capping of pipework sections
 - use of warning notices and signs.

Unit 323

Understand the service and maintenance principles of biomass fuel burning appliances

Level: 3

Credit value: 3

UAN: Y/502/9412

Unit aim(s)

This knowledge unit provides learning in service and maintenance requirements. Fault diagnostics in flue, fuel, heat source and electrics. Define the work action and sequences required to rectify those faults.

Learning outcomes

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

1. know the requirements for the routine service of biomass appliances
2. know the how to diagnose faults in biomass appliances
3. know how to rectify faults in biomass appliances.

Guided learning hours

It is recommended that **22** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 323

Understand the service and maintenance principles of biomass fuel burning appliances

Outcome 1

Know the requirements for the routine service of biomass appliances

Assessment Criteria

The learner can:

1. define which documentation needs to be available to enable routine service and maintenance work on biomass appliances
2. specify methods of safely isolating biomass appliances to prevent them being brought into operation before the work has been fully completed
3. clarify the typical routine service and maintenance requirements for biomass appliances (log and pellet burners):
 - visual inspection requirements
 - cleaning of components
 - checking of system water content
 - functional tests
4. clarify the industry requirements for the recording and reporting of routine service and maintenance work on biomass appliances.

Unit 323

Understand the service and maintenance principles of biomass fuel burning appliances

Outcome 2

Know how to diagnose faults in biomass appliances

Assessment Criteria

The learner can:

1. specify the information that needs to be available to enable fault diagnosis
2. define the work action and sequences required to diagnose biomass appliance faults:
 - defects in flue performance
 - defective fuel supply system
 - failure in the heat exchanger/flue cleaning system
 - failure of the ignition system
 - sensor/microprocessor faults
 - inadequate flow rate through the appliance
3. define the actions to take in the event that the appliance/component fault cannot be rectified:
 - use of the unsafe situations procedure
 - provision of suitable warning notices.

Unit 323

Understand the service and maintenance principles of biomass fuel burning appliances

Outcome 3

Know how to rectify faults in biomass appliances

Assessment Criteria

The learner can:

1. define the work action and sequences required to rectify biomass appliance faults:
 - defects in flue performance
 - defective fuel supply system
 - failure in the heat exchanger/flue cleaning system
 - failure of the ignition system
 - sensor/microprocessor faults
 - inadequate flow rate through the appliance
2. specify the procedures to re-commission appliances following completion of fault repair activities
3. specify the information that needs to be recorded on a maintenance report form following rectification work.

Unit 324

Understand the fundamental principles and requirements of environmental technology systems

Level: 3

Credit value: 2

UAN: K/602/3138

Unit aim(s)

This knowledge unit provides learning in the fundamental working principles along with regulatory requirement relating to renewable energy. Be able to distinguish the potential type of building features that will meet the requirements to install renewable energy and water conservation along with typical advantages and disadvantages.

Learning outcomes

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

1. know the fundamental working principles of micro-renewable energy and water conservation technologies
2. know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist
3. know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies
4. know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 324

Understand the fundamental principles and requirements of environmental technology systems

Outcome 1

Know the fundamental working principles of micro-renewable energy and water conservation technologies

Assessment Criteria

The learner can:

1. identify the fundamental working principles for each of the following heat producing micro-renewable energy technologies:
 - solar thermal (hot water)
 - ground source heat pump
 - air source heat pump
 - biomass
2. identify the fundamental working principles for each of the following electricity producing micro-renewable energy technologies:
 - solar photovoltaic
 - micro-wind
 - micro-hydro
3. identify the fundamental working principles of the following co-generation technologies:
 - micro-combined heat and power:
 - (heat-led)
4. identify the fundamental working principles for each of the following water conservation technologies:
 - rainwater harvesting
 - greywater re-use.

Unit 324 Understand the fundamental principles and requirements of environmental technology systems

Outcome 2 Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist

Assessment Criteria

The learner can:

1. clarify the fundamental requirements for the potential to install a solar water heating system to exist
2. clarify the fundamental requirements for the potential to install a solar photovoltaic system to exist
3. clarify the fundamental requirements for the potential to install a ground source heat pump system to exist
4. clarify the fundamental requirements for the potential to install an air source heat pump system to exist
5. clarify the fundamental requirements for the potential to install a biomass system to exist
6. clarify the fundamental requirements for the potential to install a micro wind system to exist
7. clarify the fundamental requirements for the potential to install a micro hydro system to exist
8. clarify the fundamental requirements for the potential to install a micro-combined heat and power (heat led) system to exist
9. clarify the fundamental requirements for the potential to install a rainwater harvesting/greywater re-use system to exist.

Unit 324

Understand the fundamental principles and requirements of environmental technology systems

Outcome 3

Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies

Assessment Criteria

The learner can:

1. confirm what would be typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power:
 - (heat-led)
 - rainwater harvesting
 - greywater re-use
2. confirm which sections of the current Building Regulations/building standards apply in relation to the deployment of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power:
 - (heat-led)
 - rainwater harvesting
 - greywater re-use.

Unit 324

Understand the fundamental principles and requirements of environmental technology systems

Outcome 4

Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies

Assessment Criteria

The learner can:

1. identify typical advantages associated with each of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power:
 - (heat-led)
 - rainwater harvesting
 - greywater re-use
2. Identify typical disadvantages associated with each of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power:
 - (heat-led)
 - rainwater harvesting
 - greywater re-use.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Level: 3

Credit value: 4

UAN: F/602/3100

Unit aim(s)

This knowledge unit provides learning in health and safety: risks, regulations and standards relating to installation, testing and commissioning system types and layouts, the components and their operating principles within the systems, requirements for component selection, sizing, installation, testing and commissioning, the requirements for the connection of solar heated water to combination boilers and how to measure solar performance.

Learning outcomes

There are **14** learning outcomes to this unit. The learner will:

1. know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work
2. know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work
3. know the types and layouts of solar thermal hot water system
4. know the purpose of components used within solar thermal hot water system installations
5. know the types and key operating principles of solar collectors
6. know the information requirements to enable system component selection and sizing
7. know the fundamental techniques used to select, size and position components for solar thermal hot water systems
8. know how the performance of solar hot water systems is measured
9. know the preparatory work required for solar thermal hot water system installation work
10. know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits
11. know the requirements for installing solar collector arrays
12. know the requirements for installing solar thermal hot water system pipework
13. know the requirements to test and commission solar thermal hot water system installations
14. know the requirements to handover solar thermal hot water systems.

Guided learning hours

It is recommended that **35** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 325 **Know the requirements to install, commission and handover solar thermal hot water systems**

Outcome 1 Know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work

Assessment Criteria

The learner can:

1. confirm which aspects of solar thermal hot water system installation work pose risk of:
 - electrocution/electric shock
 - burns
 - toxic poisoning
 - injury through flash to steam of system heat transfer fluid
 - a fall from height
 - personal injury through component/equipment handling
2. confirm safe systems of work, for solar thermal hot water system installation work, in relation to prevention of:
 - electrocution/electric shock
 - burns
 - toxic poisoning
 - injury through flash to steam of system heat transfer fluid
 - a fall from height
 - personal injury through component/equipment handling.

Unit 325 Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 2 Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work

Assessment Criteria

The learner can:

1. interpret building regulation/building standards guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:
 - maintaining the structural integrity of the building
 - maintaining the fire resistant integrity of the building
 - the prevention of moisture ingress (building water-tightness)
 - notification of work requirements
 - control of temperature in primary and secondary circuits:
 - including primary circuits connected to unvented hot water storage systems
 - energy conservation
 - testing and commissioning requirements
 - compliance certification
2. Interpret industry recognised water regulation/byelaw guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:
 - prevention of contamination of the wholesome water supply
 - energy conservation
 - safe operation
 - testing and commissioning requirements.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 3

Know the types and layouts of solar thermal hot water system

Assessment Criteria

The learner can:

1. identify the following solar thermal hot water systems types:
 - fully filled (active)
 - drainback (active)
 - passive (thermosiphon)
2. identify the following solar thermal hot water system storage vessel types and collector circuit arrangements:
 - direct (fully filled) DHW storage cylinder only
 - indirect, sealed collector circuit, DHW storage cylinder only (solar primary coil only)
 - indirect, sealed collector circuit, DHW storage cylinder only (dual coil)
 - indirect, sealed collector circuit, pre-heat cylinder and DHW storage cylinder
 - indirect, sealed collector circuit, thermal store.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 4

Know the purpose of components used within solar thermal hot water system installations

Assessment Criteria

The learner can:

1. confirm the purpose of the following solar thermal hot water system components:
 - differential temperature controller
 - cylinder sensor(s)
 - solar collector sensor
 - drain back vessel
 - flow meter
 - flow regulator (mechanical)
 - expansion vessel.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 5

Know the types and key operating principles of solar collectors

Assessment Criteria

The learner can:

1. identify the following types of solar collector:
 - unglazed collector
 - flat plate glazed collector
 - roof integrated glazed collector
 - evacuated tube collector – direct flow
 - evacuated tube collector – heat pipe
2. confirm the key operating principles for:
 - flat plate collectors
 - evacuated tube collector – direct flow
 - evacuated tube collector – heat pipe
3. identify the effect that the temperature difference between the solar primary circuit/collector temperature and the ambient temperature has on the relative efficiency of the following types of solar collector:
 - unglazed collector
 - flat plate glazed collector
 - evacuated tube collector.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 6

Know the information requirements to enable system component selection and sizing

Assessment Criteria

The learner can:

1. confirm the information requirements in relation to:
 - building design
 - building dimensions/angles
 - building location and orientation
 - building fabric/material details
 - existing input services
 - existing hot water/heating systems
2. confirm the information requirements in relation to:
 - building occupancy
 - required hot water usage pattern.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 7

Know the fundamental techniques used to select, size and position components for solar thermal hot water systems

Assessment Criteria

The learner can:

- confirm how to determine typical domestic hot water system storage vessel requirements in relation to:
 - daily demand (V_d) (litres/day per person or litres/day per M^2 of floor area)
 - boiler volume (V_b)
 - dedicated solar volume (V_s) (litres per M^2 of collector area or as a % of V_d)
 - total cylinder volume (V_t)
 - solar heat exchange coil surface area (M^2 of surface area in relation to collector flow rate and collector surface area)
- confirm how to determine typical domestic hot water system collector area requirements in relation to:
 - building occupancy
 - proposed angle of collector installation
 - proposed orientation of collector installation
 - shading that may affect collector performance
- confirm how to determine the annual irradiation yield as a % of optimum in relation to:
 - collector orientation
 - collector angle
 - collector over shading
- state typical recommended solar primary circuit circulation rates
- confirm how to determine solar primary circuit pipe size requirements in relation to:
 - primary circuit circulation rates
 - collector area
 - primary circuit pipework length
- confirm how to determine total solar primary circuit water content volume
- confirm how to determine total solar primary circuit expansion vessel size requirements in relation to:
 - primary circuit water content volume
 - collector height above cylinder
- identify typical sizing requirements for drainback vessels in relation to:
 - net collector area
 - total volume of the system
- confirm how to determine solar primary circuit dynamic pressure drop and circulating pump size requirements for:
 - fully filled systems
 - drainback systems.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 8

Know how the performance of solar hot water systems is measured

Assessment Criteria

The learner can:

1. define the meaning of the term 'solar fraction'
2. identify factors that affect the solar fraction.

Unit 325 Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 9 Know the preparatory work required for solar thermal hot water system installation work

Assessment Criteria

The learner can:

1. state the requirements in relation to:
 - authorisation for the work to proceed
 - the availability of appropriate access to all required work areas
2. confirm the requirements of pre-installation checks in relation to:
 - the suitability of the proposed location and position of the solar collector(s) for optimum collection capacity
 - the suitability of the building structure and the building fabric
 - in relation to the installation of system components
 - verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system energy load and usage
 - the inspection of existing hot water/heating system installations
 - water quality
 - the availability of a suitable electrical input service
 - the proposed siting of key internal system components.

Unit 325 **Know the requirements to install, commission and handover solar thermal hot water systems**

Outcome 10 Know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits

Assessment Criteria

The learner can:

1. confirm how to determine the suitability of combination boilers to receive pre-heated water
2. confirm the pipework layout and components required for connecting a solar thermal hot water system to a combination boiler to include the:
 - arrangements for prevention of backflow
 - arrangements for ensuring that the combination boiler cold inlet supply water is provided at an appropriate temperature
 - arrangements for allowing stored hot water to be used directly from the store when the temperature of the stored water is appropriate.

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 11

Know the requirements for installing solar collector arrays

Assessment Criteria

The learner can:

- confirm the positioning and fixing requirements and where appropriate the weathering requirements for the following solar collector types:
 - flat plate, surface mounted, inclined roof with single lap roof covering
 - flat plate, surface mounted, inclined roof with double lap roof covering
 - flat plate, integrated, inclined single lap roof covering
 - flat plate, integrated, inclined double lap roof covering
 - evacuated tube, inclined single lap roof covering
 - evacuated tube, inclined double lap roof covering
 - frame mounted, inclined (roof, wall or ground)
 - frame mounted, horizontal (roof or ground)
- confirm the pipework layout, component requirements and component positioning requirements for the following system types and collector array connection arrangements:
 - fully filled system, collector array connected in series
 - fully filled system, collector array connected in parallel
 - fully filled system, collector array connected with east/west split
 - drainback system, single collector array
- confirm the requirements to achieve durable weather-tightness of buildings where collector array connection pipework passes through the building fabric
- state when specialist equipment is required in relation to preventing irradiation reaching collector absorbers during installation.

Unit 325 Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 12 Know the requirements for installing solar thermal hot water system pipework

Assessment Criteria

The learner can:

1. propose suitable pipework materials in relation to:
 - system operating temperatures
 - system operating pressures
 - system chemicals
2. confirm the requirements for pipework supports in relation to:
 - suitable materials
 - spacing of pipework supports
3. state suitable pipework jointing methods in relation to:
 - system operating temperatures
 - system operating pressures
 - system chemicals
4. confirm the requirements for pipework insulation for solar thermal hot water system installation work in relation to:
 - system operating temperatures
 - system efficiency and performance
 - potential exposure of the insulation to ultra-violet rays/light
 - potential exposure of the insulation to adverse weather
 - the sections of installations that must be insulated
 - the sections of installations that must not be insulated
 - resistance to vermin attack
5. confirm the requirements for installing pressure relief valve discharge pipework in relation to:
 - routing of pipework
 - termination of pipework..

Unit 325

Know the requirements to install, commission and handover solar thermal hot water systems

Outcome 13

Know the requirements to test and commission solar thermal hot water system installations

Assessment Criteria

The learner can:

- confirm the requirements to prepare for testing and commissioning in relation to:
 - compliance with the system design and specification
 - compliance with system/component manufacturer requirements
 - suitability of electrical supply circuit arrangements
 - flushing the system of installation debris
 - selection of suitable heat transfer fluid
 - filling and venting the hydraulic circuits
 - checking system water quality
 - protection against freezing
 - provision of system labelling
- state what specialist equipment is required in relation to:
 - the introduction and checking of system freeze protection fluids
 - setting system pressure
 - checking the corrosion protection of the system
- confirm the testing requirements for hydraulic circuits within solar thermal hot water system installations in relation to:
 - hydraulic test pressure
 - hydraulic test duration
- confirm the commissioning requirements for a fully-filled indirect sealed collector circuit installation in relation to:
 - setting of the expansion vessel charge pressure
 - setting of the system fluid level
 - setting of mechanical controls
 - setting of electrical controls and temperature sensors
 - system functional tests
- confirm the commissioning requirements for a fully-filled drainback installation in relation to:
 - setting of the system fluid level
 - setting of mechanical controls
 - setting of electrical controls and temperature sensors
 - system functional tests
- confirm the commissioning requirements for multiple collector arrays connected in series
- state the recording requirements for the commissioning of solar thermal hot water system installations.

Unit 325 **Know the requirements to install, commission and handover solar thermal hot water systems**

Outcome 14 Know the requirements to handover solar thermal hot water systems

Assessment Criteria

The learner can:

1. confirm the pre-handover checks that need to be carried out
2. confirm industry handover procedures in relation to the:
 - provision of written information
 - provision of diagrammatic information
 - provision of verbal information/demonstration relating to system operation and use.

Unit 326

Install, commission and handover 'active' solar thermal hot water systems

Level: 3

Credit value: 2

UAN: L/602/3102

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in how to plan and prepare for installation. To install, test, commission and hand over an active solar thermal hot water system.

Learning outcomes

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

1. be able to plan and prepare for the installation of 'active' solar thermal hot water system
2. be able to install solar thermal hot water system components
3. be able to test and commission an 'active' solar thermal hot water system
4. be able to handover an 'active' solar thermal hot water system.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 326

Install, commission and handover 'active' solar thermal hot water systems

Outcome 1

Be able to plan and prepare for the installation of 'active' solar thermal hot water system

Assessment Criteria

The learner can:

1. undertake pre-installation checks for a solar hot water system installation to include checks relating to:
 - authorisation for the work to proceed
 - verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load
 - the availability of appropriate access to all required work areas
 - the inspection of existing domestic hot water/heating system installations
 - the availability of a suitable electrical input service
 - the proposed siting of key internal system components
 - the suitability of the building structure in relation to the proposed installation
 - the suitability of the proposed location and position of the solar collector panel(s) for optimum collection capacity
 - the suitability of the building fabric in relation to the installation of the solar collector panel(s)
2. confirm that the tools, materials and equipment required for the installation work are available and are in a safe, usable condition.

Unit 326

Install, commission and handover 'active' solar thermal hot water systems

Outcome 2

Be able to install solar thermal hot water system components

Assessment Criteria

The learner can:

1. install in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, key system components on either a fully-filled or drainback, 'active' solar thermal hot water system to include as a minimum the positioning, fixing and connection of the following components:
 - fully-filled systems:
 - solar collector
 - expansion vessel
 - solar circulating pump
 - drainback systems:
 - solar collector
 - drainback vessel
 - solar circulating pump.

Unit 326

Install, commission and handover 'active' solar thermal hot water systems

Outcome 3

Be able to test and commission an 'active' solar thermal hot water system

Assessment Criteria

The learner can:

1. prepare a fully-filled or drainback solar thermal hot water system for testing and commissioning to include checks/actions to confirm:
 - compliance with the system design and specification
 - compliance with system/component manufacturer requirements
 - the suitability of electrical supply circuit arrangements
 - correct flushing the system of installation debris
 - correct filling and venting the hydraulic circuits
 - protection of the system against freezing
 - adequate provision of system labelling
2. test the system for hydraulic soundness using appropriate test equipment in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures
3. identify the commissioning requirements for the installation in relation to:
 - the system/component manufacturer(s) requirements
 - system design/specification requirements
 - the client/end user requirements
 - statutory regulations and/or industry recognised procedures
4. commission a fully-filled or drainback system in accordance with manufacturer's guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures
5. complete relevant documentation to record the commissioning activities.

Unit 326

Install, commission and handover 'active' solar thermal hot water systems

Outcome 4

Be able to handover an 'active' solar thermal hot water system

Assessment Criteria

The learner can:

1. undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer's guidance, the system design/specification, client's requirements, regulatory requirements and/or industry recognised requirements
2. explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures
3. identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements
4. obtain acceptance by the end user of the system according to the industry agreed handover procedures
5. ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer's guidance and industry recognised procedures.

Unit 327

Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

Level: 3

Credit value: 2

UAN: Y/602/3104

Unit aim(s)

This knowledge unit provides learning in inspection, servicing, maintenance and the diagnostic and rectification of faults.

Learning outcomes

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

1. know the requirements for the routine service and maintenance of 'active' solar thermal hot water systems
2. know how to diagnose faults in 'active' solar thermal hot water system installations
3. know how to rectify faults in 'active' solar thermal hot water systems.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 327

Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

Outcome 1

Know the requirements for the routine service and maintenance of 'active' solar thermal hot water systems

Assessment Criteria

The learner can:

1. confirm which documentation needs to be available to enable routine service and maintenance work on 'active' solar thermal hot water systems
2. confirm the typical routine service and maintenance requirements for fully filled systems in relation to:
 - visual inspection requirements
 - cleaning of components
 - checking of system water content
 - functional tests
3. confirm the typical routine service and maintenance requirements for drainback systems in relation to:
 - visual inspection requirements
 - cleaning of components
 - checking of system water content
 - functional tests
4. confirm the industry requirements for the recording and reporting of routine service and maintenance work on solar thermal hot water systems.

Unit 327

Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

Outcome 2

Know how to diagnose faults in 'active' solar thermal hot water system installations

Assessment Criteria

The learner can:

1. confirm the information that needs to be available to enable fault diagnosis
2. confirm the work action and sequences required to diagnose the following faults:
 - loss of system pressure without evidence of discharge
 - discharge from pressure relief valve on the solar primary circuit
 - insulation melting on solar collector circuit pipework
 - overheating of solar collector circuit
 - lack of circulation within the solar collector circuit
 - poor or no system performance
 - system noise and/or vibration.

Unit 327

Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

Outcome 3

Know how to rectify faults in 'active' solar thermal hot water systems

Assessment Criteria

The learner can:

1. confirm the work action and sequences required to rectify the following faults:
 - loss of system pressure without evidence of discharge
 - discharge from pressure relief valve on the solar primary circuit
 - insulation melting on solar collector circuit pipework
 - overheating of solar collector circuit
 - lack of circulation within the solar collector circuit
 - poor or no system performance
 - system noise and/or vibration.

Unit 328

Inspect, service and maintain 'active' solar thermal hot water systems

Level: 3

Credit value: 2

UAN: K/602/3107

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in inspection, servicing and maintenance, as well as diagnostic and rectification of faults.

Learning outcomes

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

1. be able to undertake the routine service and maintenance of an 'active' solar thermal hot water system
2. be able to undertake fault diagnosis work on 'active' solar thermal hot water system installations
3. be able to undertake fault rectification work on 'active' solar thermal hot water system installations.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 328

Inspect, service and maintain 'active' solar thermal hot water systems

Outcome 1

Be able to undertake the routine service and maintenance of an 'active' solar thermal hot water system

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work
2. undertake a visual service and maintenance inspection of a fully-filled or drainback, 'active' solar thermal hot water system installation to include checks in relation to:
 - compliance with manufacturer's installation instructions
 - compliance with statutory regulations
 - condition of system components including cleanliness
 - correct positioning of system components
 - security of fixing of system components
3. undertake routine servicing of relevant components on a fully-filled or drainback, 'active' solar thermal hot water system to include:
 - checking the system water levels
 - checking provision for the expansion of system water
 - checking for protection of the system water against freezing
 - cleaning of system components
 - adjustment of system controls
4. undertake routine service and maintenance functional tests on a fully-filled or drainback solar thermal hot water system to confirm:
 - safe operation
 - efficient operation
 - the correct functioning of
 - system components/controls
5. complete the relevant service and maintenance records in accordance with industry recognised procedures.

Unit 328

Inspect, service and maintain 'active' solar thermal hot water systems

Outcome 2

Be able to undertake fault diagnosis work on 'active' solar thermal hot water system installations

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault diagnosis work
2. identify the cause of a minimum of four separate faults from the following list:
 - loss of system pressure without evidence of discharge
 - discharge from pressure relief valve on the solar primary circuit
 - insulation melting on solar collector circuit pipework
 - overheating of solar collector circuit
 - lack of circulation within the solar collector circuit
 - poor or no system performance
 - system noise and/or vibration
3. agree with the relevant person(s) fault rectification procedures for the faults identified.

Unit 328

Inspect, service and maintain 'active' solar thermal hot water systems

Outcome 3

Be able to undertake fault rectification work on 'active' solar thermal hot water system installations

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault rectification work
2. take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work
3. take relevant precautionary actions to minimise the risk of injury to self or others during the fault rectification work
4. rectify a minimum of two separate faults from the following list:
 - loss of system pressure without evidence of discharge
 - discharge from pressure relief valve on the solar primary circuit
 - insulation melting on solar collector circuit pipework
 - overheating of solar collector circuit
 - lack of circulation within the solar collector circuit
 - poor or no system performance
 - system noise and/or vibration
5. undertake post-rectification functional tests in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Level: 3

Credit value: 2

UAN: D/602/3072

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in how to plan and prepare for installation. To install, test, commission, and hand over air or ground source heat pumps.

Learning outcomes

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

1. be able to plan and prepare for the installation of heat pumps (non-refrigerant circuits)
2. be able to install air and ground source heat pump units (non-refrigerant circuits)
3. be able to test and commission a ground source heat pump installation (non-refrigerant circuits)
4. be able to test and commission an air source heat pump installation (non-refrigerant circuits)
5. be able to handover an air or ground source heat pump installation.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Outcome 1

Be able to plan and prepare for the installation of heat pumps (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. undertake pre-installation checks for a heat pump installation to include checks relating to:
 - authorisation for the work to proceed
 - the availability of appropriate access to all required work areas
 - the availability and collation of all relevant information
 - verification of the suitability of the proposed location of the fan coil unit (air source heat pumps only)
 - verification that the collector circuit is appropriate to the heat pump rating (ground source heat pumps only)
 - verification that the heat pump rating is suitable for the emitter circuit load (heating and/or heating and hot water)
 - verification of the suitability of the proposed location of the heat pump unit
 - verification that the emitter circuit design or existing installation is compatible with the proposed heat pump installation.
 - verification that the buffer tank size (where relevant) is appropriate
 - verification of the suitability of the availability of a suitable electrical input service
 - the proposed siting of key internal system components
 - the suitability of the building structure in relation to the proposed installation
2. confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Outcome 2

Be able to install air and ground source heat pump units (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. install, in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, an air source heat pump to include as a minimum the connection of the heat pump unit to the hydraulic emitter circuit
2. install, in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, a ground source heat pump to include as a minimum the connection of the heat pump unit to the collector circuit.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Outcome 3

Be able to test and commission a ground source heat pump installation (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. prepare a ground source heat pump system for testing and commissioning to include checks/actions to confirm:
 - compliance with the system design and specification
 - compliance with system/component manufacturer requirements
 - the suitability of electrical supply circuit arrangements
 - correct flushing the system of installation debris
 - correct filling and venting the hydraulic circuits
 - protection of the system against freezing
2. test the collector circuit for hydraulic soundness using appropriate test equipment in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures
3. identify the commissioning requirements for the installation in relation to:
 - the system/component manufacturer(s) requirements
 - system design/specification requirements
 - the client/end user requirements
 - statutory regulations and/or industry recognised procedures
4. commission the installation in accordance with manufacturer's guidance, design requirements, client's requirements, statutory requirements and/or industry recognised procedures
5. complete relevant documentation to record the commissioning activities.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Outcome 4

Be able to test and commission an air source heat pump installation (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. prepare an air source heat pump system for testing and commissioning to include checks/actions to confirm:
 - compliance with the system design and specification
 - compliance with system/component manufacturer requirements
 - the suitability of electrical supply circuit arrangements
 - correct flushing the system of installation debris
 - correct filling and venting the hydraulic circuits
 - protection of the system against freezing
2. identify the commissioning requirements for the installation in relation to:
 - the system/component manufacturer(s) requirements
 - system design/specification requirements
 - the client/end user requirements
 - statutory regulations and/or industry recognised procedures
3. commission the installation in accordance with manufacturer's guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures.

Unit 329

Install, commission and handover heat pumps non-refrigerant circuits

Outcome 5

Be able to handover an air or ground source heat pump installation

Assessment Criteria

The learner can:

1. undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer's guidance, the system design/specification, client's requirements, regulatory requirements and/or industry recognised requirements
2. explain and demonstrate, to the end user, the operation and use of the system using manufacturer's guidance and industry agreed handover procedures
3. identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements
4. obtain acceptance by the end user of the system according to the industry agreed handover procedures
5. ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer's guidance and industry recognised procedures.

Unit 330

Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

Level: 3

Credit value: 2

UAN: F/602/3078

Unit aim(s)

This knowledge unit provides learning in servicing, maintenance, and the diagnostic and rectification of faults.

Learning outcomes

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

1. know the requirements for the non-refrigerant circuit routine service and maintenance of heat pump system installations
2. know how to diagnose faults in heat pump system installations
3. know how to rectify non-refrigerant circuit faults in heat pump system installations.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 330

Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

Outcome 1

Know the requirements for the non-refrigerant circuit routine service and maintenance of heat pump system installations

Assessment Criteria

The learner can:

1. confirm which documentation needs to be available to enable routine service and maintenance work on heat pump system installations
2. confirm typical routine service and maintenance requirements for an air source heat pump installation in relation to:
 - visual inspection requirements
 - cleaning of components
 - checking of system water content
 - functional tests
3. confirm typical routine service and maintenance requirements for a ground source heat pump installation in relation to:
 - visual inspection requirements
 - cleaning of components
 - checking of system water content
 - functional tests
4. confirm the industry requirements for the recording and reporting of routine service and maintenance work on heat pump system installations
5. state the action(s) to take in the event of a failure or suspected failure of the refrigerant circuit and/or a suspected refrigerant circuit defect.

Unit 330

Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

Outcome 2

Know how to diagnose faults in heat pump system installations

Assessment Criteria

The learner can:

1. confirm the information that needs to be available to enable fault diagnosis
2. confirm the work action and sequences required to diagnose the following faults:
 - heat pump low pressure trip/alarm activated by a collector circuit malfunction
 - heat pump high pressure trip/alarm activated by an emitter circuit malfunction
 - poor or no collector circuit performance
 - insufficient heat output to emitter circuit
 - domestic hot water heat up is satisfactory but space heating is not operating
 - system noise and/or vibration.

Unit 330

Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

Outcome 3

Know how to rectify non-refrigerant circuit faults in heat pump system installations

Assessment Criteria

The learner can:

1. confirm the work action and sequences required to rectify the following faults:
 - heat pump low pressure trip/alarm activated by a collector circuit malfunction
 - heat pump high pressure trip/alarm activated by an emitter circuit malfunction
 - poor or no collector circuit performance
 - insufficient heat output to emitter circuit
 - domestic hot water heat up is satisfactory but space heating is not operating
 - system noise and/or vibration.

Unit 331

Inspect, service and maintain heat pump installations non-refrigerant circuits

Level: 3

Credit value: 2

UAN: L/602/3083

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in inspection, servicing and maintenance, diagnostic and rectification of faults.

Learning outcomes

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

1. be able to undertake the non-refrigerant circuit routine service and maintenance of an air source heat pump system installation
2. be able to undertake the non-refrigerant circuit routine service and maintenance of an ground source heat pump system installation
3. be able to undertake non-refrigerant circuit fault diagnosis work on an air or ground source heat pump system installation
4. be able to undertake non-refrigerant circuit fault rectification work on an air or ground source heat pump system installation.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an externally set assignment.

Unit 331

Inspect, service and maintain heat pump installations non-refrigerant circuits

Outcome 1

Be able to undertake the non-refrigerant circuit routine service and maintenance of an air source heat pump system installation

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work
2. undertake a visual service and maintenance inspection of an air source heat pump installation to include checks in relation to:
 - compliance with manufacturer's installation instructions
 - compliance with statutory regulations
 - condition of system components including cleanliness
 - checking the system fluid levels
 - checking the system pressure levels
 - checks to ensure that electrical controls and temperature sensors are set correctly
 - leakage and/or dampness
 - correct positioning of system components
 - pipework insulation is of the correct grade, in good condition and is firmly in place
 - provision of information and safety labels
 - security of fixing of system components
3. undertake routine servicing of relevant components an air source heat pump installation to include checks in relation to:
 - checking for protection of the system water against freezing
 - cleaning and lubrication of system components
 - adjustment of system controls
4. undertake routine service and maintenance functional tests on a air source heat pump installation to confirm:
 - safe operation
 - efficient operation
 - the correct functioning of system components/controls
 - no undue noise or vibration
5. complete the relevant service and maintenance records in accordance with industry recognised procedures.

Unit 331

Inspect, service and maintain heat pump installations non-refrigerant circuits

Outcome 2

Be able to undertake the non-refrigerant circuit routine service and maintenance of a ground source heat pump system installation

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work
2. undertake a visual service and maintenance inspection of a ground source heat pump installation to include checks in relation to:
 - compliance with manufacturer's installation instructions
 - compliance with statutory regulations
 - condition of system components including cleanliness
 - checking the system fluid levels
 - checking the system pressure levels
 - checks to ensure that electrical controls and temperature sensors are set correctly
 - leakage and/or dampness
 - correct positioning of system components
 - pipework insulation is of the correct grade, in good condition and is firmly in place
 - provision of information and safety labels
 - security of fixing of system components
3. undertake routine servicing of relevant components a ground source heat pump installation to include checks in relation to:
 - checking for protection of the system water against freezing
 - cleaning and lubrication of system components
 - adjustment of system controls
4. undertake routine service and maintenance functional tests on a ground source heat pump installation to confirm:
 - safe operation
 - efficient operation
 - the correct functioning of system components/controls
 - no undue noise or vibration
5. complete the relevant service and maintenance records in accordance with industry recognised procedures.

Unit 331

Inspect, service and maintain heat pump installations non-refrigerant circuits

Outcome 3

Be able to undertake non-refrigerant circuit fault diagnosis work on an air or ground source heat pump system installation

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault diagnosis work
2. identify the cause of a minimum of four separate faults from the following list:
 - heat pump low pressure trip/alarm activated by a collector circuit malfunction
 - heat pump high pressure trip/alarm activated by an emitter circuit malfunction
 - poor or no collector circuit performance
 - insufficient heat output to emitter circuit
 - domestic hot water heat up is satisfactory but space heating is not operating
 - system noise and/or vibration
3. agree, with the relevant person(s), fault rectification procedures for the faults identified.

Unit 331

Inspect, service and maintain heat pump installations non-refrigerant circuits

Outcome 4

Be able to undertake non-refrigerant circuit fault rectification work on an air or ground source heat pump system installation

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault rectification work
2. take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work
3. take relevant precautionary actions to minimize the risk of injury to self or others during the fault rectification work
4. rectify a minimum of **two** separate faults from the following list:
 - heat pump low pressure trip/alarm activated by a collector circuit malfunction
 - heat pump high pressure trip/alarm activated by an emitter circuit malfunction
 - poor or no collector circuit performance
 - insufficient heat output to emitter circuit
 - domestic hot water heat up is satisfactory but space heating is not operating
 - system noise and/or vibration
5. undertake post-rectification functional tests in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Level: 3

Credit value: 4

UAN: Y/602/3054

Unit aim(s)

This knowledge unit provides learning in health and safety risks and safe systems of work associated with heat pumps, regulations and standards, relating to installation, testing and commissioning, and the purpose and operational characteristics, different types, fundamental principles of selection, design, layouts, and the preparation of work needed.

Learning outcomes

There are **12** learning outcomes to this unit. The learner will:

1. know the health and safety risks and safe systems of work associated with heat pump system installation work (non-refrigerant circuits)
2. know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for heat pump installation work
3. know the purpose and operational characteristics of heat pump unit and heat pump system components
4. know the different types of heat pump units and system arrangements for hydraulic emitter circuits
5. know the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps
6. know the fundamental design principles for ground source 'closed loop' heat pump collector circuit design, component sizing and installation
7. know the layouts of 'open loop' water filled heat pump collector circuits
8. know the fundamental design considerations and principles that are specific to air source heat pumps
9. know the preparatory work required for heat pump installation work
10. know the requirements to install and test heat pump systems (non-refrigerant circuits)
11. understand the requirements to commission heat pump system installations (non-refrigerant circuits)
12. understand the requirements to handover heat pump system installations.

Guided learning hours

It is recommended that **35** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 332 **Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits**

Outcome 1 Know the health and safety risks and safe systems of work associated with heat pump system installation work (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. confirm which aspects of heat pump installation work pose risk of:
 - electrocution/electric shock
 - burns
 - toxic poisoning personal injury through component/equipment handling
2. confirm safe systems of work for heat pump installation work in relation to prevention of:
 - electrocution/electric shock
 - burns
 - toxic poisoning
 - personal injury through component/equipment handling.

Unit 332 Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 2 Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for heat pump installation work

Assessment Criteria

The learner can:

1. interpret building regulation/building standards guidance documentation as relevant to heat pump installation work to identify the requirements in relation to:
 - maintaining the structural integrity of the building
 - maintaining the fire resistant integrity of the building
 - the prevention of moisture ingress (building water tightness)
 - notification of work requirements
 - physical installation requirements
 - energy conservation
 - testing and commissioning requirements
 - compliance certification
2. interpret industry recognised water regulation/byelaw guidance documentation as relevant to heat pump installation work to identify the requirements in relation to:
 - the physical installation of the system
 - energy conservation
 - safe operation
 - testing and commissioning requirements
3. state the requirements of the current fluorinated greenhouse gases regulations in relation to:
 - the competence of personnel installing heat pumps where the refrigerant circuit has been assembled and tested by the product manufacturer
 - the competence of personnel installing heat pumps where the refrigerant circuit is to be assembled and tested in the location where the heat pump is to be installed and operated
 - the competence of personnel undertaking leakage checking on heat pump refrigerant circuits
 - the competence of personnel undertaking recovery of fluorinated greenhouse gases from heat pump refrigerant circuits.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 3

Know the purpose and operational characteristics of heat pump unit and heat pump system components

Assessment Criteria

The learner can:

- confirm the purpose and operational characteristics of the following components:
 - evaporator
 - low pressure switch
 - compressor
 - high pressure switch
 - condenser
 - dryer/receiver
 - sight glass
 - expansion valve
 - expansion valve phial
 - refrigerant four way valve
 - brine pump
 - emitter circuit electro-mechanical valves
 - fan coil
 - integrated buffer tank
 - ground loop heat exchanger
- confirm how the vapour compression refrigerant circuit within a heat pump unit operates.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 4

Know the different types of heat pump units and system arrangements for hydraulic emitter circuits

Assessment Criteria

The learner can:

1. recognise the following heat source/heat sink heat pump packages that can be deployed with a hydraulic 'heat sink' emitter circuit:
 - outside air/water
 - exhaust air/water
 - brine (closed loop)/water
 - water (open loop)/water
 - DX (closed loop)/water
2. identify the different types of heat pump unit within the categories:
 - ground source – packaged (indoor)
 - ground source – packaged (outdoor)
 - air source - external air, packaged (indoor)
 - air source - external air, packaged (outdoor)
 - air source - external air, internal heat pump unit with brine circuit between fan coil unit and heat pump unit
3. confirm the meaning of the terms:
 - monovalent system
 - bivalent system
4. identify the following monovalent hydraulic emitter circuits:
 - heating only
 - heating with buffer tank
 - heating with buffer tank and indirect stored domestic hot water
 - heating with buffer tank and indirect stored domestic hot water with solar coil
 - heating with thermal store
5. identify the following parallel bivalent hydraulic emitter circuits that incorporate a secondary heat source other than an immersion heater:
 - heating with buffer tank
 - heating with buffer tank and indirect stored domestic hot water
 - heating with buffer tank and indirect stored domestic hot water with solar coil
 - heating with buffer tank and thermal store
6. confirm the arrangements for connecting buffer tanks:
 - in series
 - in parallel.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 5

Know the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps

Assessment Criteria

The learner can:

1. confirm the meaning of the term 'coefficient of performance'
2. confirm the relationship between coefficient of performance and the:
 - heat pump input temperature
 - heat pump emitter temperature
3. confirm the effect that ambient temperature can have on:
 - coefficient of performance
 - heat pump output
4. confirm the meaning of the term 'seasonal performance factor'
5. identify the factors that can affect the seasonal performance factor
6. confirm the meaning of the term 'system efficiency'
7. identify the factors that can affect the 'system efficiency'
8. confirm why achieving minimum heat loss from the building is particularly important when designing a heat pump system
9. state the effect that over-sizing of a heat pump has on:
 - system performance/efficiency
 - heat pump operation
10. state the effect that under-sizing of a heat pump has on:
 - system performance/efficiency
 - heat pump operation
11. confirm how to identify heat pump hydraulic flow rate requirements
12. confirm how to use manufacturer's data to select heat pump units:
 - output charts
 - other data
13. confirm the meaning of the term 'bivalent points' in relation to heat pump output charts
14. confirm how 'bivalent points' are used to determine auxiliary heat requirements
15. confirm how heat pump output capacity is affected by:
 - heat pump input temperature
 - heat pump output temperature
16. identify the suitability of the following types of hydraulic heating system emitter for suitability with heat pump systems:
 - underfloor heating
 - fan assisted convector heaters
 - standard panel radiators
17. state the typical mean water temperature recommended when designing a hydraulic emitter circuit that incorporates:
 - underfloor heating

- fan assisted convector heaters
 - standard panel radiators
18. confirm how correction factors are used to determine panel radiator output requirements in relation to mean water temperature and room temperature difference (degrees centigrade)
 19. confirm the potential benefits of including a buffer tank in the system design
 20. identify the potential disadvantages of including a buffer tank in the system design
 21. confirm the typical allowance in litres (l) per kilowatt (kW) of heat pump output that would be allowed for sizing a buffer tank when there is no requirement for heat during compressor 'off' periods
 22. confirm using available external temperature, heat load and system flow temperature data, the required size (heat output in kW) of a heat pump to be connected to a hydraulic heat emitter circuit using a monovalent system design
 23. state the typical annual operating hours for a heat pump that is being used for:
 - heating only
 - heating and domestic hot water
 24. state how heat pump annual operating hours may vary in relation to the:
 - type of building
 - geographical location of the installation.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 6

Know the fundamental design principles for ground source 'closed loop' heat pump collector circuit design, component sizing and installation

Assessment Criteria

The learner can:

1. identify the following brine filled heat pump collector circuit configurations:
 - ground 'closed' loop horizontal
 - ground 'closed' loop compact collector
 - ground 'closed' loop slinky
 - ground 'closed' loop vertical borehole
 - lake 'closed' loop
 - vertical borehole closed' loop
2. confirm the requirements of horizontal 'closed' loop brine filled hydraulic heat pump collector circuits in relation to:
 - suitable pipework materials
 - below ground jointing
 - protection against frost damage
 - protection against mechanical damage
 - separation distances to avoid thermal interference
 - separation distances from other services and adjacent buildings
 - achieving balanced loop/collector circuits
3. confirm the typical requirements of vertical borehole 'closed' loop brine filled hydraulic heat pump collector circuits in relation to:
 - suitable pipework materials
 - below ground jointing
 - protection against frost damage
 - protection against mechanical damage
 - separation distances to avoid thermal interference
 - separation distances from other services and adjacent buildings
 - achieving balanced loop/collector circuits
4. identify the typical components required in relation to:
 - single circuit 'closed' loop collector circuits
 - multi-circuit 'closed' loop collector circuits
 - brine circuits between outside air source units and internal heat pump units
5. confirm the typical layout of components in relation to:
 - single circuit collector circuits
 - multi-circuit collector circuits
 - brine circuits between outside air source units and internal heat pump units
6. confirm which factors determine the year round energy available in watts (w) per M² of ground area

7. confirm how to determine the energy requirement (refrigeration capacity) from the ground loop (kW) using the total heat pump capacity (kW) and the electrical energy input rating (kW)
8. confirm how the specific heat extraction capacity (in W/M² for horizontal/vertical trench collectors and W/M for vertical borehole collectors) of the ground collector circuit can be affected by the:
 - ground conditions/soil types
 - type of backfill material
 - geographical location – ground rest temperature
 - ground loop configuration
 - annual heat pump operating hours
9. confirm how the total ground area (M²) requirements for horizontal collector loops is determined using the following data:
 - refrigeration capacity (kW)
 - specific extraction output (w/M²)
10. confirm how the pipe length (M) requirement for a horizontal 'loop' collector circuit is determined using the following data:
 - total ground area (M²)
 - collector loop pipe spacing (M)
11. confirm how the pipe length (M) requirement for a 'slinky' collector circuit is determined using the following data:
 - total ground area (M²)
 - centre to centre spacing of the slinky collector (M)
12. confirm how the typical collector length (M) requirement for a vertical borehole collector circuit is determined using the following data:
 - heat pump refrigeration capacity (kW)
 - ground condition
 - annual heat pump operating hours
13. confirm how a collector circuit brine pump size (kg/h) is determined using the following data:
 - design flow rate
 - brine viscosity
 - heat pump refrigeration capacity (kW)
 - specific thermal capacity of brine (kj/kg)
 - temperature difference between brine circuit flow and return pipework (degrees centigrade).

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 7

Know the layouts of 'open loop' water filled heat pump collector circuits

Assessment Criteria

The learner can:

1. identify the following 'open loop' water filled heat pump collector circuit configurations:
 - ground 'open' loop vertical borehole
 - lake 'open' loop.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 8

Know the fundamental design considerations and principles that are specific to air source heat pumps

Assessment Criteria

The learner can:

1. identify the factors that need to be considered when selecting and positioning air source heat pump fan coil units in relation to:
 - operating noise (including the potential effect on neighbouring properties)
 - air turbulence during operation
2. identify the design options to provide for the defrost cycle for an air source heat pump
3. confirm how to size a buffer tank to provide for an air source heat pump defrost cycle.

Unit 332 Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 9 Know the preparatory work required for heat pump installation work

Assessment Criteria

The learner can:

1. confirm the common requirements of pre-installation checks for air or ground source heat pump unit installations connected to hydraulic emitters circuits in relation to:
 - authorisation for the work to proceed
 - the availability and collation of all relevant information
 - verification of the suitability of the hydraulic emitter circuit for connection to the heat pump unit
 - verification that the heat output capacity of the heat pump unit is matched to the required proportional contribution of the total building heat load
 - verification that the buffer tank sizing is correct
 - the availability of appropriate access to all required work areas
 - the availability and condition of a suitable electrical input service
 - adequate provision for the siting of key internal system components
 - the suitability of the building structure in relation to the proposed installation
2. confirm the pre-installation checks that are specific to the positioning of fan coil units.

Unit 332

Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 10

Know the requirements to install and test heat pump systems (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. confirm the requirements for moving and handling heat pump units to avoid damage to the unit
2. confirm the requirements to avoid undue noise and/or vibration transmission from the heat pump unit to the building structure during the operation of the heat pump
3. identify the requirements where brine circuit pipework passes through the external building fabric in relation to:
 - provision for movement
 - protection against freezing
 - prevention of water ingress
4. confirm the charging and flushing requirements for closed loop collector circuits in relation to:
 - purging of air and installation debris
 - addition of antifreeze protection and suitable biocides
 - checking flow rates
5. state what equipment is needed for system charging and flushing
6. confirm the hydraulic test requirements for:
 - closed loop collector circuits
 - hydraulic emitter circuits.

Unit 332 **Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits**

Outcome 11 Understand the requirements to commission heat pump system installations (non-refrigerant circuits)

Assessment Criteria

The learner can:

1. confirm the conditions that are required to implement commissioning activities for ground source heat pump systems
2. confirm the commissioning requirements for ground source heat pump systems in relation to:
 - setting of mechanical controls
 - setting of electrical controls and temperature sensors
 - functional tests
3. confirm the conditions that are required to implement commissioning activities for air source heat pump systems
4. confirm the commissioning requirements for air source heat pump systems in relation to:
 - setting of mechanical controls
 - setting of electrical controls and temperature sensors
 - functional tests.

Unit 332 Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

Outcome 12 Understand the requirements to handover heat pump system installations

Assessment Criteria

The learner can:

1. confirm the pre-handover checks that need to be carried out for a ground source heat pump system installation
2. confirm the industry handover procedures for a ground source heat pump system installation in relation to the:
 - provision of written information
 - provision of diagrammatic information
 - provision of verbal information/demonstration relating to system operation and use
3. confirm the pre-handover checks that need to be carried out for an air source heat pump system installation
4. confirm the industry handover procedures for an air source heat pump system installation in relation to the:
 - provision of written information
 - provision of diagrammatic information
 - provision of verbal information/demonstration relating to system operation and use.

Unit 333

Inspect, service and maintain rainwater harvesting and greywater reuse systems

Level: 3

Credit value: 2

UAN: A/602/3130

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in inspection, servicing and maintenance, diagnostic and rectification of faults.

Learning outcomes

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

1. be able to undertake the routine service and maintenance of rainwater harvesting and greywater reuse systems
2. be able to undertake fault diagnosis work on rainwater harvesting and greywater reuse systems installations
3. be able to undertake fault rectification work on rainwater harvesting and greywater reuse systems installations.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- externally set assignment.

Unit 333

Inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 1

Be able to undertake the routine service and maintenance of rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the work
2. undertake a visual service and maintenance inspection of a rainwater harvesting or greywater reuse system installation to include checks in relation to:
 - compliance with manufacturer's installation instructions
 - compliance with statutory regulations
 - condition of system components including cleanliness
 - correct positioning of system components
 - security of fixing of system components
3. undertake routine servicing of relevant components on a rainwater harvesting or greywater reuse system to include:
 - checking the system water levels
 - checking the system water quality
 - cleaning of system components
 - adjustment of system controls
4. undertake routine service and maintenance functional tests on a rainwater harvesting or greywater reuse system to confirm:
 - safe operation
 - efficient operation
 - the correct functioning of system components/controls
5. complete the relevant service and maintenance records in accordance with industry recognised procedures.

Unit 333

Inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 2

Be able to undertake fault diagnosis work on rainwater harvesting and greywater reuse systems installations

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault diagnosis work
2. diagnose the cause of a minimum of four separate faults on a rainwater harvesting and/or greywater reuse system from the following list:
 - poor or no flow into storage tank
 - system pump fails to operate
 - back-up water supply fails to operate
 - water quality is unacceptable
 - undue system noise or vibration
3. agree with the relevant person(s) fault rectification procedures for the faults identified.

Unit 333

Inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 3

Be able to undertake fault rectification work on rainwater harvesting and greywater reuse systems installations

Assessment Criteria

The learner can:

1. obtain the relevant information required to enable the fault rectification work
2. take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work
3. take relevant precautionary actions to minimise the risk of injury to self or others during the fault rectification work
4. rectify a minimum of two separate faults on a rainwater harvesting and/or greywater reuse system from the following list:
 - poor or no flow into storage tank
 - system pump fails to operate
 - back-up water supply fails to operate
 - water quality is unacceptable
 - undue system noise or vibration
5. undertake post-rectification functional tests in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition.

Unit 334

Install, commission and handover rainwater harvesting and greywater reuse systems

Level: 3

Credit value: 2

UAN: K/602/3110

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in how to plan and prepare for installation. To install, test, commission, and hand over rainwater harvesting and greywater systems

Learning outcomes

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

1. be able to plan and prepare for the installation of rainwater harvesting and greywater reuse systems
2. be able to install rainwater harvesting and greywater reuse system components
3. be able to test and commission rainwater harvesting and greywater reuse systems
4. be able to handover rainwater harvesting and greywater reuse systems.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- externally set assignment.

Unit 334

Install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 1

Be able to plan and prepare for the installation of rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. undertake pre-installation checks for a rainwater harvesting or greywater reuse system installation to include checks relating to:
 - the suitability of the proposed installation in relation to:
 - yield
 - usage
 - any special features
 - the suitability of the building structure and the building fabric in relation to the installation of system components
 - the inspection of the existing water supply installation
 - the inspection of the existing rainwater and/or greywater installation
 - the availability of a suitable electrical input service
 - the proposed siting of key internal system components
2. confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition.

Unit 334

Install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 2

Be able to install rainwater harvesting and greywater reuse system components

Assessment Criteria

The learner can:

1. install in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, key system components on either a rainwater harvesting or greywater reuse system to include as a minimum the positioning, fixing and connection of the following components:
 - storage tank (connection to tank only)
 - system control unit (water connections only)
 - pump.

Unit 334

Install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 3

Be able to test and commission rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. prepare a rainwater harvesting or greywater reuse system for testing and commissioning to include checks/actions to:
 - confirm compliance with the system design and specification
 - confirm compliance with system/component manufacturer requirements
 - confirm the suitability of electrical supply circuit arrangements
 - flushing the system of installation debris
 - filling the storage tank
 - confirm the provision of appropriate marking and labelling to system pipework and components
2. test a rainwater harvesting or greywater reuse distribution system for hydraulic soundness using appropriate test equipment in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures
3. undertake the relevant test procedure to check that cross-connections have not been introduced
4. identify the commissioning requirements for a rainwater harvesting or greywater reuse installation in relation to:
 - the system/component manufacturer(s) requirements
 - system design/specification requirements
 - the client/end user requirements
 - statutory regulations and/or industry recognised procedures
5. commission a rainwater harvesting and greywater reuse system in accordance with manufacturer's guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures
6. complete relevant documentation to record the rainwater harvesting or greywater reuse system commissioning activities.

Unit 334

Install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 4

Be able to handover rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. undertake relevant checks on either a rainwater harvesting or greywater reuse system to ensure that the system is ready for handover and compliant with manufacturer's guidance, the system design/specification, client's requirements, regulatory requirements and/or industry recognised requirements
2. explain and demonstrate to the end user the operation and use of either a rainwater harvesting or greywater reuse system using manufacturer's guidance and industry agreed handover procedures
3. identify and explain to the end user any aspects of the rainwater harvesting or greywater reuse system that varies from the agreed specifications and requirements
4. obtain acceptance by the end user of the rainwater harvesting or greywater reuse system according to the industry agreed handover procedures
5. ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer's guidance and industry recognised procedures.

Unit 335

Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

Level: 3

Credit value: 2

UAN: M/602/3111

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in inspection, servicing and maintenance, diagnostic and rectification of faults.

Learning outcomes

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

1. know the requirements for the routine service and maintenance of rainwater harvesting and reuse systems
2. know how to diagnose faults in rainwater harvesting and greywater reuse systems
3. know how to rectify faults in rainwater harvesting and greywater reuse systems.

Guided learning hours

It is recommended that **15** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 335

Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 1

Know the requirements for the routine service and maintenance of rainwater harvesting and reuse systems

Assessment Criteria

The learner can:

1. confirm which documentation needs to be available to enable routine service and maintenance work on rainwater harvesting and greywater reuse systems
2. confirm the typical routine service and maintenance requirements for a rainwater harvesting system in relation to:
 - visual inspection requirements
 - cleaning of components
 - functional tests
3. confirm the typical routine service and maintenance requirements for greywater reuse systems in relation to:
 - visual inspection requirements
 - cleaning of components
 - functional tests
4. confirm the relevant guideline values for the general monitoring of water quality in rainwater harvesting and greywater reuse systems in relation to:
 - dissolved oxygen (stored rainwater)
 - suspended solids
 - colour
 - turbidity
 - pH
 - residual chlorine
 - residual bromine
5. state what equipment is required to monitor water quality in rainwater harvesting and greywater reuse systems
6. confirm the industry requirements for the recording and reporting of routine service and maintenance work on rainwater harvesting and greywater reuse systems.

Unit 335

Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 2

Know how to diagnose faults in rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. confirm the information that needs to be available to enable fault diagnosis
2. confirm the work action and sequences required to diagnose the following faults:
 - poor or no flow into storage tank
 - system pump fails to operate
 - back-up water supply fails to operate
 - water quality is unacceptable
 - undue system noise or vibration.

Unit 335

Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

Outcome 3

Know how to rectify faults in rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. confirm the work action and sequences required to rectify the following faults:
 - poor or no flow into storage tank
 - system pump fails to operate
 - back-up water supply fails to operate
 - water quality is unacceptable
 - undue system noise or vibration.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Level: 3

Credit value: 4

UAN: T/602/3109

Unit aim(s)

This knowledge unit provides learning in health and safety risks and safe systems of work associated with heat pumps, regulations and standards relating to installation, testing and commissioning, the purpose and characteristics, different types, fundamental principles of selection, design layouts, and the preparation of work needed.

Learning outcomes

There are **12** learning outcomes to this unit. The learner will:

1. know the health and safety risks and safe systems of work associated with rainwater harvesting and greywater reuse system installation work
2. know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work
3. know the types and layouts of rainwater harvesting and greywater reuse system used for single premises installations
4. know the purpose of components used within rainwater harvesting and greywater reuse systems
5. know the information requirements to enable rainwater harvesting and greywater reuse system component selection and sizing
6. know the fundamental techniques used to select, size and position components for rainwater harvesting and greywater reuse systems
7. know options and requirements for the treatment of water in biological, physical, biomechanical and hybrid rainwater harvesting/greywater recycling systems
8. know the preparatory work required for rainwater harvesting and greywater recycling system installation work
9. know the requirements for installing rainwater harvesting and greywater reuse storage tanks
10. know the requirements for installing rainwater harvesting and greywater recycling system pipework
11. know the requirements to test and commission rainwater harvesting and greywater re-use system installations
12. know the requirements to handover rainwater harvesting and greywater recycling systems.

Guided learning hours

It is recommended that **35** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test.

Unit 336 Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 1 Know the health and safety risks and safe systems of work associated with rainwater harvesting and greywater reuse system installation work

Assessment Criteria

The learner can:

1. confirm which aspects of rainwater harvesting and greywater reuse system installation work pose risk of:
 - electrocution/electric shock
 - infection
 - toxic poisoning
 - asphyxiation
 - personal injury through component/equipment handling
2. confirm safe systems of work for rainwater harvesting and greywater reuse system installation work in relation to prevention of:
 - electrocution/electric shock
 - infection
 - toxic poisoning
 - asphyxiation
 - personal injury through component/equipment handling.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 2

Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work

Assessment Criteria

The learner can:

1. interpret building regulation/building standards guidance documentation as relevant to rainwater harvesting and greywater reuse system installation work to identify the requirements in relation to:
 - notification of the work
 - maintaining the structural integrity of the building
 - maintaining the fire resistant integrity of the building
 - the prevention of moisture ingress (building water-tightness)
 - cold water supply requirements:
 - water quality
 - water efficiency
 - roof drainage system installation
 - rainwater and greywater storage tank installation
 - compliance certification
2. interpret industry recognised water regulation/byelaw guidance documentation as relevant to rainwater harvesting and greywater reuse system installation work to identify the requirements in relation to:
 - notification of the work
 - backflow and contamination prevention requirements
 - marking and labelling requirements
 - use of the harvested/reused water.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 3

Know the types and layouts of rainwater harvesting and greywater reuse system used for single premises installations

Assessment Criteria

The learner can:

1. identify the following rainwater harvesting systems types:
 - gravity supply
 - direct pumped
 - pumped to storage cistern
 - gravity distribution
2. identify the following greywater reuse systems types:
 - direct reuse
 - short retention
 - basic physical/chemical
 - biological
 - bio-mechanical
 - hybrid
3. confirm where in system layouts the following backflow prevention arrangements for wholesome back up water supply are required:
 - type AA air gap
 - type AB air gap.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 4

Know the purpose of components used within rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

1. confirm the purpose of the following rainwater harvesting and greywater reuse system components:
 - anti-surge valve
 - calmed inlet
 - inlet filter
 - level sensor/float switch
 - module (including pump and air gap)
 - pump control unit
 - system control unit
 - expansion vessel (direct systems)
 - water level gauge.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 5

Know the information requirements to enable rainwater harvesting and greywater reuse system component selection and sizing

Assessment Criteria

The learner can:

1. confirm the information requirements in relation to:
 - building design
 - building dimensions
 - building location and orientation
 - building fabric/material details
 - existing wholesome water
 - supply systems
 - existing rainwater and waste
 - water systems
 - proposed use of the harvested
 - rainwater/greywater
2. confirm the information requirements in relation to:
 - building occupancy
 - demand/usage
 - any special features.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 6

Know the fundamental techniques used to select, size and position components for rainwater harvesting and greywater reuse systems

Assessment Criteria

The learner can:

- confirm how to determine the storage capacity (litres) of a greywater reuse system within a single premises using the simplified approach in relation to:
 - occupancy
 - greywater yield
 - greywater demand/usage
- confirm how to determine the storage capacity (litres) of a rainwater harvesting system within a single premises using the simplified approach in relation to:
 - roof plan area (tiled pitched roofs)
 - average annual rainfall depth for the location
 - building occupancy
- confirm which materials are typically suitable for the manufacture of rainwater harvesting and greywater reuse tanks and cisterns
- confirm the requirements for durability in relation to the materials selected for rainwater harvesting and greywater reuse system tanks and components
- confirm the design requirements for rainwater harvesting and greywater reuse storage tank/cistern installation in relation to:
 - prevention of stagnation of the stored water
 - provision of covers and vents
 - prevention of contamination/microbial growth
 - keeping the stored water dark and cold
 - provision and sizing of an overflow
 - prevention of surcharging via overflow pipework
 - termination of overflows from rainwater harvesting storage tanks
 - termination of overflows from greywater reuse storage tanks
 - proximity to trees
 - contaminated ground
 - groundwater levels
 - ground strength and stability
 - proximity to utilities and foundations
- confirm the options for providing a back-up water supply within a rainwater harvesting or greywater reuse system
- confirm the requirements of pump installation within a rainwater harvesting or greywater reuse system in relation to:
 - prevention of dry-running
 - prevention of sound and vibration transfer
 - prevention of overheating

- provision of non-return valves
 - provision of isolating valves
 - provision of a pump failure alarm
 - provision of controls
 - provision for monitoring
8. confirm which materials are suitable for rainwater harvesting and greywater reuse system collection and distribution pipework and fittings
 9. state typical collection and distribution system pipe sizes for rainwater harvesting and greywater reuse systems for pipework between the storage tank and the system control unit.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 7

Know options and requirements for the treatment of water in biological, physical, biomechanical and hybrid rainwater harvesting/greywater recycling systems

Assessment Criteria

The learner can:

1. state when the inclusion of a water treatment arrangement in rainwater harvesting and greywater recycling systems:
 - is a regulatory requirement
 - may be beneficial or good practice
2. confirm the working principles of a UV disinfection system
3. confirm the typical installation arrangements for a UV disinfection system in relation to:
 - water sample points
 - filters
 - flow restrictors
 - isolation valves
4. confirm the options for the chemical treatment of water in rainwater harvesting and greywater recycling systems.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 8

Know the preparatory work required for rainwater harvesting and greywater recycling system installation work

Assessment Criteria

The learner can:

1. state the requirements in relation to:
 - authorisation for the work to proceed
 - the availability of appropriate access to all required work areas
2. confirm the requirements of pre-installation checks in relation to the:
 - suitability of the proposed installation in relation to:
 - yield
 - usage
 - suitability of the building structure and the building fabric in relation to the installation of system components
 - inspection of the existing water supply installation
 - inspection of the existing rainwater and/or greywater installation
 - availability of a suitable electrical input service
 - proposed siting of key internal system components.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 9

Know the requirements for installing rainwater harvesting and greywater reuse storage tanks

Assessment Criteria

The learner can:

1. confirm the requirements to maintain the structural integrity of the tank if holes need to be cut within a storage tank during the installation process
2. confirm the requirements for mounting and supporting above ground tanks and cisterns.

Unit 336 **Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems**

Outcome 10 Know the requirements for installing rainwater harvesting and greywater recycling system pipework

Assessment Criteria

The learner can:

1. confirm the requirement of the connection arrangement where rainwater and greywater overflow and drainage pipework connects to the underground drainage system
2. confirm which jointing methods are acceptable for rainwater and greywater pipework collection pipework
3. confirm which jointing methods are acceptable for rainwater and greywater pipework distribution pipework.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 11

Know the requirements to test and commission rainwater harvesting and greywater re-use system installations

Assessment Criteria

The learner can:

- confirm the requirements to prepare for testing and commissioning in relation to:
 - compliance with the system design and specification
 - compliance with system/component manufacturer requirements
 - suitability of electrical supply circuit arrangements
 - flushing the system of installation debris
 - filling the storage tank
 - provision of marking and labelling to system pipework and components
- confirm the testing requirements for hydraulic testing of the distribution system in relation to:
 - test pressure
 - test duration
 - permitted leakage
 - pass criteria
- confirm the test procedure to check that cross-connections have not been introduced
- confirm the typical commissioning requirements for a rainwater harvesting system installation in relation to:
 - setting of the system fluid levels
 - setting of mechanical controls
 - setting of electrical controls
 - system functional tests
 - water quality checks
- confirm the commissioning requirements for a greywater re-use system installation in relation to:
 - setting of the system fluid levels
 - setting of mechanical controls
 - setting of electrical controls
 - system functional tests
 - water quality checks
- state the recording requirements for the commissioning of rainwater harvesting and greywater re-use system installations.

Unit 336

Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

Outcome 12

Know the requirements to handover rainwater harvesting and greywater recycling systems

Assessment Criteria

The learner can:

1. confirm the pre-handover checks that need to be carried out
2. confirm industry handover procedures in relation to the:
 - provision of written information
 - provision of diagrammatic information
 - provision of verbal information/demonstration relating to system operation and use.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Level: 3

Credit value: 19

UAN: T/502/8381

Unit aims

The aim of this unit is to assess the competence of individuals to recognised national occupational standards. The unit supports workforce development and describes the competencies necessary to install, commission and decommission gas pipework.

The scope of work covered by this unit is the installation of gas pipework up to 35 mm (1¼ inch) diameter (where the volume of the pipework does not exceed 0.035 cubic metre) from a meter outlet connection to gas appliance connection point, including 'installation pipework and appliance connector pipework' or in the case of non metered installations from the Emergency Control Valve (EVC) located either inside or outside the property to the appliance connection point, supplied with 2nd or 3rd family gases.

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

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

1. be able to design gas systems for installing gas pipework
2. be able to plan and prepare work activities for installing domestic gas cookers, tumble dryers and leisure appliances
3. be able to de-commission domestic gas pipework to industry standards
4. be able to install, exchange, and remove gas pipework to industry standards
5. be able to pre-commission and commission gas pipework to industry standards
6. be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work
7. be able to resolve problems which could affect the de-commissioning, installation and commissioning process
8. be able to install, commission and de-commission gas pipework up to 35mm (1¼) diameter in domestic and small commercial premises.

Guided learning hours

It is recommended that **115** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.5 Install Gas Pipework up to 35mm BS6891.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 1

Be able to design gas systems for installing gas pipework

Assessment Criteria

The learner can:

1. identify and record the customer's job requirements
2. compare the customer's job requirements with statutory and industry requirements and identify any conflicting issues
3. survey the work site:
 - consult site diagrams for any key structural features that could affect the installation
 - record details of any features that may affect the installation
4. check that the proposed positioning of the pipework meets the manufacturer's and industry standard's requirements for:
 - location
 - clearances
5. check that the availability of input services:
 - gas
 - electricitymeet the appliance manufacturer's and industry standard's requirements for the pipework installation
6. check and ensure the design of the proposed installation is in compliance with industry standards
7. prepare a range of design options to meet both customer and industry requirements
8. present design options to the customer using variety of media:
 - written
 - oral
 - drawings
9. consult with the customer and obtain agreement to the design option that best meets all the requirements.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 2

Be able to plan and prepare work activities for installing domestic gas cookers, tumble dryers and leisure appliances

Assessment Criteria

The learner can:

1. produce a risk assessment and method statement that incorporates:
 - safety provisions on the work site
 - access to the work site
 - movement of people on site
 - the movement and safe storage of installation materials, tools and equipment for the job
2. survey the work site for:
 - any pre-installation damage
 - defects to existing building features
 - record details of any features that may affect the installation
3. advise the property occupier of any defects found in the survey
4. protect the work site and the building fabric against possible damage being caused during:
 - de-commissioning
 - installation
5. obtain confirmation from the customer before the job starts to ensure that they agree the planned work
6. check and confirm that all materials, tools and equipment are available as required and are fit for purpose needed for:
 - de-commissioning
 - installation
 - commissioning
7. check and confirm that the proposed siting of the gas supply meets the appliance manufacturer's and industry standards requirements for:
 - location
 - siting
 - clearances
8. check and confirm that:
 - the gas supply
 - earthing supply
 - provision of ventilationmeets industry standard requirements in relation to other services
9. confirm that the proposed siting of the gas supply meets industry standard's requirements in relation to other services i.e. electricity supply
10. carry out all necessary checks and tests to confirm:
 - the gas supply
 - electricity supplymeet the manufacturer's and industry requirements for the installation

11. calculate and confirm the correct sizing of pipework to ensure minimum pressure loss across installation
12. check the existing installation for unsafe:
 - appliances
 - system componentsapply the gas industry unsafe situations procedures to any identified.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 3

Be able to de-commission domestic gas pipework to industry standards

Assessment Criteria

The learner can:

1. check that the:
 - gas supply
 - electricity supplyare in a condition that enables safe appliance de-commissioning
2. use the correct tools and equipment for de-commissioning activities
3. use designated safe:
 - isolation methods
 - tests
 - proceduresto de-commission gas and systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system components
 - earthing system components
6. after permanent removal of pipework, mark any live gas pipes with a notice to indicate the pipe contains gas.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 4

Be able to install, exchange, and remove gas pipework to industry standards

Assessment Criteria

The learner can:

1. carry out preparatory work to meet the installation requirements
2. carry out the installation processes minimising damage to:
 - customer property
 - building features
3. select and use the correct tools and equipment for installation activities
4. remove existing gas and earthing system components as required by the installation plan
5. fabricate gas system, fittings and components as required by the installation plan
6. position the pipework and confirm it meets the:
 - location
 - siting
 - clearancesrequired by the appliance manufacturer's and industry standard's specification
7. provide adequate ventilation for:
 - new
 - replacementpipework installations and systems
8. provide adequate support(s) for pipework installation to conform with industry standard's specification
9. position and protect pipework installation in and through walls to meet industry standards for sleeving and purpose designed channels
10. position and protect pipework installation in multi-occupancy dwellings to meet industry standard's requirements. use of fire stops, sleeving, purposed designed shafts.
11. position and protect pipework installation in protected shafts containing:
 - stairs
 - lifts
 - other protected fire escape routesto meet industry standard requirements
12. position and protect external installations to meet industry standards and requirements
13. ensure existing gas systems are clean and free of debris
14. fix and connect gas pipework, valves, fittings and components to the supply
15. mark any live gas pipes with a notice to indicate the pipe contains gas
16. install additional emergency control valve (AECV) to the supply
17. connect earthing system components to the gas supply.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 5

Be able to pre-commission and commission gas pipework to industry standards

Assessment Criteria

The learner can:

- confirm that the complete appliance installation complies with:
 - manufacturer's specification
 - industry standards
 - Gas Safety (Installation and Use) Regulations
 - British Standards
 - Building Regulations
- check that conditions within the gas system will permit safe commissioning
- select and use the correct tools and equipment for commissioning activities
- use tightness testing and purging procedures to confirm:
 - the integrity of the installed gas system
 - existing appliance(s)
- use purging procedures to confirm the safe supply of gas to the installed gas system
- use electrical testing procedures to confirm the integrity of the installed earthing system
- apply protective coating to pipework and to joints after gas tightness testing has been completed
- reconfirm that the ventilation requirements meet industry standards for the installation
- check and confirm the operation of the installed gas valves and components to ensure they function safely and operate in accordance with manufacturer's instructions
- instruct the property occupier on the correct operation of the:
 - gas system
 - valves
 - componentsproviding them with a copy of any user instructions
- take precautionary actions to prevent the unauthorised use of:
 - uncommissioned gas appliances
 - gas systems
 - electrical systems
 - componentsby isolation procedures and use of warning notices.

Unit 337 Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 6 Be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work during:
 - planning
 - de-commissioning
 - installation
 - commissioningto minimise disturbance to the job
2. use:
 - normative documents
 - industry standards
 - British Standards
 - manufacturer's instructions for the appliance to ensure the work is completed in accordance with the specification
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the line manager responsible for the job
5. advise the designated persons of any unsafe situations and actions required to remedy those situations
6. complete documentation to confirm the safe commissioning of the gas system and components
7. complete records and documentation confirming the safe commissioning of gas systems and components
8. complete gas system de-commissioning records.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 7

Be able to resolve problems which could affect the de-commissioning, installation and commissioning process

Assessment Criteria

The learner can:

1. rectify and report deficiencies in gas and earthing input services
2. resolve problems in accordance with approved procedures where pre-commissioning checks and tests reveal gas system or component defects
3. resolve problems in accordance with approved procedures when gas systems and components being commissioned do not meet design requirements
4. resolve problems in accordance with approved procedures when the gas system and components cannot be restored to full performance.

Unit 337

Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

Outcome 8

Be able to install, commission and de-commission gas pipework up to 35mm (1¼) diameter in domestic and small commercial premises

Assessment Criteria

The learner can:

1. describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process
2. explain safe access and working at heights procedures
3. specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
4. describe the methods of working which protect the building décor, customer property and existing systems and components
5. state the care and maintenance requirements of tools and equipment, and checks for safe condition
6. state the tools, equipment, materials and components required for the gas system installation, commission and de-commission, – ordering, supplying, advising, checking and delivery procedures
7. explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
8. describe the potential hazards that could arise from all de-commissioning, installation and commissioning activities and the checks to be carried out before work takes place
9. explain the steps to take should materials, components, tools and equipment not be available at the site, to commence the de-commissioning, installation and commissioning activity
10. demonstrate how and where to access the required information, ie. normative documents, industry standards guidance documents, British Standards and manufacturer's instructions applicable to the gas system and appliance, to ensure the work is done to the specification and industry standards
11. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
12. describe how to measure and record installation and site details for prefabrication purposes
13. explain how to confirm that the gas supply and earthing system requirements are adequate for the installation of the new gas system and components, or for extending the system or adding components to
14. explain how to confirm that the provision of ventilation meets the industry standard's requirements for the installation ie. in voids, shafts, ducts
15. calculate correct sizing of pipework to ensure minimum pressure loss across installation
16. state checks and tests to confirm suitability of the gas supply
17. state checks and tests to confirm suitability of the earthing system, including the installation and positioning of the main equipotential bonding
18. state safe isolation methods, tests and procedures for temporary and permanent de-commissioning of gas systems, earthing systems and components, including the use of temporary continuity bonds
19. explain the precautions to ensure that de-commissioned gas and earthing systems do not prove a safety hazard

20. describe measures to prevent de-commissioned gas systems being brought into operation utilising safety and warning notices
21. describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas system operation
22. summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required
23. state the industry practices and work standards for fabricating and installing gas pipework, valves, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
24. identify and describe the types of pipe materials suitable for carrying gas - steel, malleable iron, copper, Corrugated Stainless Steel Tube (CSST), polyethylene and lead
25. identify and describe the types of pipe fittings suitable for carrying gas – capillary, compression, push-fit, union joints and screwed joints
26. state the industry practices and work standards for jointing materials and fittings suitable for carrying gas, including connecting to lead composition pipes
27. describe the safety precautions to take when jointing materials and fittings - including COSHH
28. explain the industry practices and methods of bending pipe materials suitable for carrying gas, i.e. bending methods of copper pipe, Corrugated Stainless Steel Tube (CSST) and stainless steel flexible pipe (anacondas)
29. explain the industry practices and methods of bending copper pipework to set measured distances to include; double sets/offset bends, 90 degree bends, crank sets/passover bends
30. state the positioning and fixing requirements for gas pipework, valves, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
31. describe how installation of gas pipework meets the industry standard's requirements for; location, siting, clearance requirements and relationship to other services, i.e. electricity supply
32. state industry practices and work standards of providing adequate support(s) for pipework installation to conform with industry standard's requirements
33. produce a plan showing the positioning, protection and fixing methods for gas pipework, valves, systems and components in; floors, ducts, through walls, buried in walls, multi-occupancy buildings and protected shafts containing stairs, lifts or other protected fire escape routes, to comply with industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations, i.e. sleeving, purposed designed channels, fire stops, purposed designed shafts
34. state the industry practices and work standards for pipe installation within suspended and joisted floors including methods of lifting and replacing floorboards and chipboard flooring
35. state the industry practices and work standards for pipe installation in concrete floors
36. explain the installation and protection of external installations to meet industry standards requirements, i.e. protection against mechanical damage, minimum depth below ground level
37. describe the procedures and work methods for connecting to input services including; gas, earthing and ventilation systems
38. describe the procedures and work methods of connecting pipework, valves and components to both new and existing gas systems and appliances
39. describe the procedures and work methods to ensure correct gas pipe identification
40. describe the process and procedures, equipment and legislative requirements for applying tightness testing and purging to gas appliances, systems and components
41. describe the process and procedures, equipment and legislative requirements for applying electrical tests to earthing systems and components to ensure safe functioning, i.e. earth continuity checks
42. state the procedures for checking the correct operation and performance of gas systems, valves and components and checking against the design specification to ensure safe functioning
43. explain the routines and sequences for commissioning gas systems, valves and components
44. state how to complete all installation and commissioning documentation and records to be left with the property occupier including; benchmark, landlord/home owner gas safety record

45. explain system handover procedures and demonstrate the operation of gas systems, valves and components to end users
46. summarise the steps to take when problems arise in the work activities
47. describe job management structures and methods of reporting and recording job progress or problems delaying progress
48. describe how to safely collect and dispose of system contents that may be hazardous to health or the environments, i.e. waste products including asbestos and insulation materials
49. demonstrate how and where to access the required information, i.e. industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment, i.e. special waste regulations, hazardous waste regulations, control of asbestos at work regulations
50. explain how to isolate unsafe gas appliances, gas systems and components and apply the gas industry unsafe situations procedure.

Level: 3

Credit value: 21

UAN: H/502/8487

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in demonstrating the use of tools, the safety of gas control operation and explain actions for unsafe procedures, how to carry out chimney performance checks, working safe with electrical systems and components, combustion and atmosphere sampling devices and calculate ventilation requirements.

Learning outcomes

There are **12** learning outcomes to this unit. The learner will:

1. be able to demonstrate the use of common tools used in the gas utilisation industry
2. be able to demonstrate that gas safety controls are operating correctly and explain the actions required when unsafe or ineffective operation is found
3. know the construction and operation of chimneys used for domestic gas appliances
4. be able to demonstrate how to carry out chimney performance checks
5. be able to identify and complete the correct notices, forms and labels used in domestic gas utilisation
6. be able to demonstrate how to work correctly and safely with electrical systems and components used in domestic gas utilisation
7. be able to demonstrate the correct use of combustion and atmosphere sampling analysers
8. be able to demonstrate safe lifting and handling techniques when moving equipment, materials and appliances associated with gas utilisation activities
9. be able to demonstrate the safe use of steps and ladders used in domestic gas utilisation activities
10. be able to demonstrate selection and use of correct Personal Protective Equipment (PPE) for domestic gas utilisation activities
11. be able to install and commission a small domestic gas installation
12. be able to calculate the requirements for permanent ventilation in domestic gas utilisation environments.

Guided learning hours

It is recommended that **120** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- Independent Summative Assessments (ISA).

Unit 338

Specific core installation and maintenance

Outcome 1

Be able to demonstrate the use of common tools used in the gas utilisation industry

Assessment Criteria

The learner can:

1. demonstrate the correct and safe use of tools for drilling, securing and cutting brick, concrete, block, studded, timber framed and dry lined walls:
 - basic hand tools
 - battery operated tools
 - RCD adaptors
 - power tools including visual inspection of drills, circular saws and jig saws
 - visual inspections of tools including checking the condition of flexes cables and plugs
2. checking that PAT Certificates are in date
3. demonstrate the correct use of tools for measuring, cutting, securing and jointing pipework and other materials used in gas installation activities:
 - measuring devices
 - cutting devices and saws
 - metallic and non metallic pipes
 - soldered joints
 - screwed joints
 - compression joints
4. demonstrate the correct and safe use of the following tools used to test systems:
 - pressure gauges
 - voltage indicators
 - continuity testers
 - electrical multi-meters
 - plug in socket testers
 - electrical proving units
 - thermometers
5. make good materials and surfaces to include brick, concrete, block, studded, timber framed, tiled and dry lined.

Unit 338

Specific core installation and maintenance

Outcome 2

Be able to demonstrate that gas safety controls are operating correctly and explain the actions required when unsafe or ineffective operation is found

Assessment Criteria

The learner can:

1. safely diagnose correct, unsafe or ineffective operation of:
 - flame protection devices, to include:
 - vapour pressure
 - thermoelectric
 - flame rectification
 - flame conduction
 - controls to include:
 - atmosphere sensing device
 - spillage detection device
 - pressure regulators
 - low pressure cut off
 - thermal cut off
 - gas cocks/valves
 - cooker hotplate lid control
 - electric solenoid valve
 - excess flow valves
 - thermoelectric valve
 - interrupter devices
 - multifunction control
 - thermostats to include:
 - bi metallic
 - liquid expansion
 - vapour pressure
 - electrical thermostats
 - thermistors
2. demonstrate actions to be taken when defective or unsafe control operation is identified.

Unit 338

Outcome 3

Specific core installation and maintenance

Know the construction and operation of chimneys used for domestic gas appliances

Assessment Criteria

The learner can:

1. classify gas appliances according to their chimney types:
 - flueless
 - open chimney
 - room sealed chimney.

Unit 338

Specific core installation and maintenance

Outcome 4

Be able to demonstrate how to carry out chimney performance checks

Assessment Criteria

The learner can:

1. carry out checks on open chimney systems:
 - visual checks throughout the length
 - confirmation of correct type
 - adequate cross sectional area
 - catchment space measurement
 - chimney flow test
 - chimney spillage test
2. carry out checks on room sealed chimney systems:
 - confirmation of correct type and installation
 - correct terminal location and protection
 - testing operation to include case seal integrity for positive and negative appliance designs.

Unit 338

Outcome 5

Specific core installation and maintenance

Be able to identify and complete the correct notices, forms and labels used in domestic gas utilisation

Assessment Criteria

The learner can:

1. identify correct application and complete the following records, forms and labels:
 - Landlord/Home Owner Gas Safety Record
 - Gas Safety Inspection Form
 - Benchmark Maintenance Report
 - service/maintenance checklist(s)
 - Chimney /Hearth Notice Plate
2. select and attach appropriate labels applicable to domestic gas work:
 - un-commissioned appliance label
3. balanced compartment label.

Unit 338

Specific core installation and maintenance

Outcome 6

Be able to demonstrate how to work correctly and safely with electrical systems and components used in domestic gas utilisation

Assessment Criteria

The learner can:

1. using Ohms Law, calculate:
 - current and power
 - voltage
 - resistance
2. assemble simple series and parallel circuits
3. identify the type of electrical installation as:
 - TT
 - TN-S
 - TN-C-S
4. connect a domestic gas appliance to a fixed domestic electrical installation:
 - cable type and sizing calculation
 - fuse rating calculation
 - fused spur connection
 - wiring a three pin plug
5. safely carry out preliminary electrical safety checks:
 - earth continuity
 - polarity
 - short circuit
 - resistance to earth
 - RCD operation test
6. demonstrate the safe isolation of electrical supplies connected to gas appliances or controls
7. read and interpret appliance wiring diagrams to establish:
 - sequence of electrical operation
 - correct appliance and component wiring
8. differentiate between main and supplementary electrical bonding connections
9. demonstrate the procedure for safe electrical isolation:
 - use of locking devices
 - circuit protection device retention
 - voltage indicating device
 - use of proving unit
 - confirmation of safety – absence of electricity

10. identify electrical faults and defects on domestic gas installations, initiating actions as required:
 - inadequate earthing provision
 - incorrect cable types and position
 - clearances from other services
 - failed components
 - incorrect polarity
 - inadequate circuit protection conductors
 - defective automatic disconnection device
 - appliance connections
11. complete electrical installation certificate.

Unit 338

Outcome 7

Specific core installation and maintenance

Be able to demonstrate the correct use of combustion and atmosphere sampling analysers

Assessment Criteria

The learner can:

1. demonstrate the correct use of combustion performance analysers and atmosphere sampling analysers interpreting:
 - CO, CO₂, O₂ readings, CO/CO₂ ratios in a flueway
 - CO, CO₂, O₂ readings in the atmosphere
 - visually and by the use of combustion performance analysis identify complete and incomplete combustion for Type 'A', 'B' and 'C' gas appliances
2. complete the required checks using a combustion/atmosphere analyser in the event of 'carbon monoxide detector' activation.

Unit 338

Specific core installation and maintenance

Outcome 8

Be able to demonstrate safe lifting and handling techniques when moving equipment, materials and appliances associated with gas utilisation activities

Assessment Criteria

The learner can:

1. risk assess the work site and work activities to be undertaken
2. assess loads to be handled and moved, to include:
 - size of loads
 - weight of loads
 - shape of loads
 - configuration of loads
 - need for assistance
3. prepare to lift and handle loads, to include:
 - using correct PPE
 - communication to others
 - ensuring a clear path
4. lift and move loads in accordance with best practice and safe systems of work:
 - correct kinetic techniques
 - assisted lift needing two people
5. simple mechanical lifting device.

Unit 338

Outcome 9

Specific core installation and maintenance

Be able to demonstrate the safe use of steps and ladders used in domestic gas utilisation activities

Assessment Criteria

The learner can:

1. risk assess the work site and work activities to be undertaken
2. prepare the site location where steps and/or ladders need to be used
3. inspect ladders and steps for defects
4. position and erect steps and ladders in accordance with regulations and safe working practice
5. secure ladders by approved methods to ensure no slippage or movement may occur during use
6. use steps and ladders for work activities in accordance with regulations and safe working practice.

Unit 338

Specific core installation and maintenance

Outcome 10

Be able to demonstrate selection and use of correct Personal Protective Equipment (PPE) for domestic gas utilisation activities

Assessment Criteria

The learner can:

1. select PPE needed for specific activities:
 - gloves
 - protective foot ware
 - eye protectors
 - ear protection
 - high visibility clothing
 - knee protectors
 - dust masks
2. carry out gas installation or maintenance work wearing PPE as determined by each specific task.

Unit 338

Specific core installation and maintenance

Outcome 11

Be able to install and commission a small domestic gas installation

Assessment Criteria

The learner can:

1. install a domestic gas meter, pipework and domestic appliance:
 - selecting correct materials and fittings
 - demonstrate the correct method of jointing materials and fittings
 - demonstrate the correct method of installing securing and supporting domestic meters and regulators
 - demonstrate the correct method of installing a domestic appliance
2. demonstrate tightness testing, purging and commissioning procedures including the procedure for resetting and sealing a regulator
3. carry out a gas rate check and confirm it complies with manufacturers instructions
4. demonstrate the correct method of removal of domestic meters and regulators:
 - permanent removal
 - temporary removal
5. identify correct and incorrect methods of connecting the main equipotential bonding
6. demonstrate action to meet the main equipotential bonding requirements for both permanent and temporary meter removal:
 - method of bonding connection
 - positioning of bond
 - sizing of bond.

Unit 338

Specific core installation and maintenance

Outcome 12

Be able to calculate the requirements for permanent ventilation in domestic gas utilisation environments

Assessment Criteria

The learner can:

1. calculate the correct ventilation requirements for a range of domestic appliance installations in accordance with BS5440:
 - open chimney appliances
 - flueless appliances
 - appliances in compartments
 - multiple appliance installations
 - ventilation pathways via other rooms
2. specify ventilation vents/grilles and methods
3. measure existing vents and grilles to ensure that they are the correct type and provide the correct supply of air.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Level: 3

Credit value: 13

UAN: J/502/9390

Unit aim(s)

This knowledge unit provides learning in legislation, (natural gas and LPG) characteristic of combustion and basic principles of requirements for ventilation, chimneys, check and set pressures and gas rates relating to meters and appliances, and effective flue operation and identifying and responding to unsafe gas situations.

Learning outcomes

There are **14** learning outcomes to this unit. The learner will:

1. know the gas legislation that applies to the domestic mechanical services industry
2. know how domestic NG and LPG supplies are metered, regulated and controlled
3. know how to take pressure readings in domestic gas systems and check meter regulators
4. know the operating principles of appliance gas safety devices and controls
5. know how to install NG and LPG gas pipework and fittings
6. know how to test for tightness of a gas pipework system and purge the system
7. know the characteristics, combustion process and the types of burners used with natural gas and LPG
8. know the ventilation requirements of gas appliances installed in dwellings
9. know the standards of chimneys and flue systems to be used with gas appliances
10. know how to re-establish gas supplies and relight appliances
11. know how to check and set appliance burner pressures and gas rates
12. know how to test gas appliance flue systems for effective operation
13. know how to identify and respond to unsafe gas situations
14. know the general requirements of LPG systems.

Guided learning hours

It is recommended that **120** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- Independent Summative Assessments (ISA).

Unit 339 Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 1 Know the gas legislation that applies to the domestic mechanical services industry

Assessment Criteria

The learner can:

1. define the types of statutory legislation and guidance information that applies to gas installation and maintenance work in the industry:
 - gas safety legislation
 - approved codes of practice
 - industry standards for NG and LPG
 - manufacturer installation and service/maintenance instructions
2. identify laid down responsibilities under gas safety legislation:
 - business registration and competence
 - personnel registration and competence
 - landlords
 - consumers – private householders and tenants
3. analyse and interpret the requirements of specific gas safety legislation
4. define the range of information that would be contained within a commissioning record for a gas system or component
5. identify the procedure for notifying works carried out to the approved gas registration provider.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 2

Know how domestic NG and LPG supplies are metered, regulated and controlled

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the installation of gas meters and regulators:
 - gas operative responsibilities
 - meter housing and compartment labels
 - medium pressure installations
2. describe the installation, operation and positioning requirements for Emergency Control Valves (ECV) to include:
 - natural gas/LPG meter installations
 - remote meter installations
 - multiple occupancy meter installations
 - Meter Inlet Valves (MIV)
3. explain the installation, operation and positioning requirements for appliance isolation valves (AIV)
4. describe the associated labels required for ECV's
5. identify the gas supply route to domestic properties:
 - the natural gas network
 - components of the network
 - pressure tiers within the network
6. define the methods of entry and layout features of natural gas service pipework to domestic dwellings:
 - minimum depth of service pipework
 - types of domestic gas meter housings and compartments:
 - surface mounted meter boxes
 - semi-concealed meter boxes
 - built-in meter boxes
 - purpose built meter housings
 - medium pressure installations
 - multi-occupancy installation - remote meters
 - primary meter installations
 - use of secondary meters
 - use of pre-payment meters
 - use of meter labels – secondary and primary meters
7. state the operation and accuracy of gas positive displacement meters
8. identify the procedure to take when a fault is diagnosed on an emergency control valve

9. define the characteristics of meters used in domestic dwellings:
 - U6
 - E6
 - semi-concealed
 - inferential
 - rotary
 - positive displacement
10. define the operating principles of domestic regulators and governors:
 - the construction of a regulator
 - the operation of a gas meter regulator
 - identification of medium pressure meter and regulator installation
 - maintaining correct installation operating pressures
 - checking and/or setting correct installation operating pressures.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 3

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

Assessment Criteria

The learner can:

1. specify the procedures for taking pressure readings in domestic gas supply systems:
 - measurement of pressure
 - types of pressure gauges
 - use of pressure gauges
 - procedures for taking pressure readings:
 - static pressure at the meter
 - working pressure at the meter
 - working pressure at appliances
2. identify the factors which can affect the pressure readings at meter regulators:
 - factors affecting pressure loss
 - effects of low flow rates and high flow rates on regulator outlet pressures (19 – 23 mbar)
 - effects of pressure absorption across the primary meter installation
3. describe the process for setting:
 - meter regulators low and medium pressure
 - LPG regulators
4. state the procedures to take when incorrect pressure readings are encountered in gas supply systems.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 4

Know the operating principles of appliance gas safety devices and controls

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to gas safety devices and controls
2. define the types of gas control devices used for gas appliances and their operating principles:
 - pressure regulators
 - low pressure cut-off valves
 - thermal cut-off valves
 - gas cocks/valves
 - cooker hotplate lid control valves
 - electric solenoid valves
 - excess flow valves
3. define the types and operating principles of flame protection devices used in gas appliances:
 - vapour pressure devices
 - thermoelectric valves
 - flame conduction and rectification systems
 - interrupter devices
 - atmosphere sensing devices
 - spillage detection devices
 - multifunctional control valves
4. define the types and operating principles of thermostats used to control heat emitted from gas appliances:
 - bimetallic
 - liquid expansion
 - vapour pressure
 - electrical control
 - electrical overheat/limit
 - thermistors.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 5

Know how to install NG and LPG gas pipework and fittings

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the installation of gas pipework and fittings
2. clarify the materials suitable for gas pipework and fittings:
 - standards for pipework and fittings
 - materials used:
 - copper
 - low carbon steel
 - steel semi-rigid
3. identify the acceptable jointing methods for pipework used for domestic gas supplies:
 - cleansing agents
 - jointing methods:
 - copper to copper
 - mild steel to mild steel
 - copper to mild steel
 - steel semi-rigid pipework and termination
 - application of unions and compression fittings
 - movable appliance hoses
 - hoses
4. calculate gas pipe sizes for domestic NG and LPG supply systems:
 - supply from meter to appliance branches
 - supply from main branch connection to appliance termination
5. clarify the circumstances in which polyethylene pipework may be used for domestic gas supply pipework
6. specify the correct positioning, support and fixing requirements for gas supply pipework:
 - copper pipework
 - mild steel pipework
 - steel semi-rigid pipework
 - requirements for sleeving pipework:
 - through building features such as walls and into meter boxes
 - external surface mounted installation pipework
 - ventilation size requirements for pipework installed within ducts
 - ventilation requirements for protected shafts and voids
 - accommodation for thermal movement of pipework

7. specify the installation requirements for gas supply pipework:
 - exterior pipework
 - pipework installed between joists in suspended floors or roof spaces:
 - solid timber; metal web; timber engineered; installed across solid timber joists fitted with flooring
 - installed in floors or walls:
 - sheathing requirements; buried in concrete floors/walls; installed behind dry lined walls; installed within stud partition walls; installed under the base of a wall or foundation
8. specify the provision of safety and control measures to gas supply pipework:
 - positioning requirements adjacent to other services
 - corrosion protection
 - gas pipe identification
 - main equipotential bonding (minimum cross sectional area)
 - disconnection of pipes and fittings – use of temporary continuity bond
9. specify the requirements for pipework to multi-occupancy dwellings:
 - safety requirements for fire stopping in buildings containing flats or maisonettes
 - safety requirements for pipework inside a protected shaft or other fire escape route
10. state the precautions to be taken when making new connections into an existing gas pipework system:
 - breaking gas connections to an appliance
 - fixing requirements for installation pipework when connected to a meter not securely restrained
11. state the precautions to be taken when using an exposed flame for soldering joints on existing gas pipework systems.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 6

Know how to test for tightness of a gas pipework system and purge the system

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the tightness testing of gas installations
2. define the acronyms and symbols used within the industry standards for tightness testing
3. state the types of pressure gauge suitable for carrying out a tightness test and identify the requirements for the accuracy of reading
4. identify the points when tightness testing of an installation should be carried out:
 - before work commences on existing systems
 - on completion of work on new and existing gas systems
 - following the report of a gas escape
5. clarify how differing system types and configurations impacts on the tightness testing procedure:
 - maximum installation volume for individual tightness tests (0.035M³):
 - calculating pipe volume; fittings volume; meter volume
 - pipe diameter up to (35mm)
 - inlet pressure exceeds 75 mbar without meter inlet valve
 - different meter types:
 - diaphragm U6/G4/U16/G10; ultrasonic E6; single dwellings; multiple dwellings with emergency control valves only
 - anti tamper devices
6. determine the tightness testing procedures for gas supply systems:
 - testing new installation pipework (no meter connected)
 - testing new installations (meter connected) with or without appliances connected
 - testing existing installations (meter connected) with or without appliances connected
 - testing existing medium pressure fed installations without a meter inlet valve fitted
7. specify the actions to take to investigate and repair suspected leakage from gas supplies and components:
 - use of gas detection equipment
 - use of leak detection fluid
8. specify the actions to be taken when a smell of gas persists following a gas tightness test:
 - when the emergency control valve/additional emergency control valve/meter inlet valve is turned off
 - when a leaking installation cannot be repaired
9. describe the requirements to issue gas testing and purging certificates
10. state the purging methods and requirements for systems that have undergone tightness testing:
 - volume 0.2 M³ or less
 - volume over 0.2 M³.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 7

Know the characteristics, combustion process and the types of burners used with natural gas and LPG

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the burner settings of gas appliances
2. define the different types of gases used to supply appliances in domestic dwellings:
 - chemical symbols:
 - Methane (CH₄)
 - Propane (C₃H₈)
 - Butane (C₄H₁₀)
 - gas characteristics
 - viscosity
 - families of gas:
 - 1st, 2nd and 3rd families
 - relative density of gases compared to air
 - explosive mixtures
3. identify the combustion process with gases used in dwellings:
 - the combustion equation
 - air requirements for combustion
 - main constituents of complete combustion
 - main constituents of incomplete combustion:
 - carbon monoxide; soot deposits
 - flammability limits of gases
 - causes of incomplete combustion
 - calorific values of gases:
 - gross; net; British Thermal Units (BTU's); Kilowatts (kW); use of conversion charts
 - Wobbe number of gases
4. identify the potential effects of carbon monoxide when incomplete combustion takes place:
 - effects of exposure to carbon monoxide on the human body
 - symptoms of CO poisoning
 - advice to give to a person who describes symptoms of being affected by products of combustion
5. state typical ambient levels of carbon dioxide and identify critical levels and the potential effects on the gas combustion process

6. specify the measures necessary to ensure that exposure to carbon monoxide does not take place/is minimised:
 - primary measures – correct appliance installation and maintenance
 - secondary measures – use of carbon monoxide detectors
 - types of CO detectors available and standards of manufacture
 - the positioning requirements for carbon monoxide detectors
 - the associated maintenance requirements of CO detectors
 - other sources of carbon monoxide in dwellings
 - causes of activation of CO detectors and indicators
7. define the layout features and operating principles of gas appliance burners:
 - pre and post aerated burners
 - premix burners
 - forced draught burners
 - radiant burners
8. define the key terms related to gas appliance burners:
 - flame speed
 - ignition temperature
 - venturi
 - burner head
 - burner (flame) retention
9. identify how to diagnose faults in gas appliance burners:
 - flame picture
 - sooting
 - discolouration
 - flame chilling
 - linting
 - condition of the burner
 - air supply faults
 - condition and size of injectors
10. clarify the reasons for burner faults that result in incomplete combustion:
 - gas rate/pressure settings
 - effects of excessive pressure at the appliance (flame lift)
 - aeration
 - vitiation
 - light back
 - flame chilling.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 8

Know the ventilation requirements of gas appliances installed in dwellings

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the ventilation requirements of gas appliances
2. calculate the ventilation requirements for open flued and flueless gas appliances:
 - adventitious air supplies
 - gross and net calorific values of appliances
 - for multiple appliance installations in the same room/space:
 - multiple open flued and flueless appliances
 - open flued and flueless appliances
3. calculate the ventilation required for appliances located in compartments:
 - open flued appliances
 - room sealed appliances
4. identify the types of grilles and vents available for ventilation:
 - types of grilles and vents
 - sizing of grilles and vents (free area availability)
5. calculate the free area of unmarked grilles and vents
6. specify the acceptable locations for ventilation to appliances:
 - restrictions to ventilator/grille locations
 - installation of vents through walls (including cavity walls)
 - ventilation paths via other rooms
 - ventilation paths to compartments including ducts
 - siting of ventilation:
 - wall
 - window
 - floor/ceiling (ducted and un-ducted)
7. clarify the effect that other heat producing appliances and other types of extraction have on the requirement for ventilation of gas appliances:
 - oil or solid fuel appliances and flue systems
 - passive stack ventilation
 - extractor fans
 - cooker hoods
 - tumble driers
8. specify the ventilation requirements of open flued and flued decorative effect space heaters:
 - single appliances
 - in rooms with multiple appliances
 - oil and solid fuel appliances.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 9

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

Assessment Criteria

The learner can:

1. interpret the legislation that applies to chimneys and flues that serve gas appliances:
 - gas safety legislation
 - exchange of information and planning requirements for chimneys
2. state how gas appliances are classified according to the type of chimney or flue used:
 - flueless
 - open flued:
 - natural draught
 - forced (fanned) draught
 - room sealed:
 - natural draught
 - forced (fanned) draught
 - vertex type appliances
3. identify the working principles of flue systems serving gas appliances:
 - open flued chimneys
 - room sealed - natural draught
 - room sealed – fanned draught
 - vertex type flues
4. state the types and general layout features of chimney and flue construction:
 - rigid chimney types:
 - brick/masonry
 - pre-cast flue blocks
 - metallic (single and double wall flues)
 - flexible metallic liner installation
 - use of flue box systems
 - shared (common) chimney systems - SE and U ducts
5. specify the requirements for new and existing chimney/flue installation:
 - minimum cross sectional area of new chimney installations to serve appliances
 - types of flue liners – during construction (salt glazed, clay etc):
 - poured/pumped concrete flue liners; pre-cast flue blocks; flexible flue liners
 - restrictions on the use of poured concrete liners

6. specify the requirements for new and existing chimney/flue installation:
 - pre-cast flue design:
 - minimum cross sectional area of new gas flue blocks; minimum requirement of vertical flue blocks before off sets; jointing material for pre-cast flue blocks; minimum flue size diameter for connecting pre-cast transfer blocks to termination point; effects of temperature on installation requirements for pre-cast flues
 - flexible flue liners:
 - sealing and support requirements for flexible flue liners in chimneys; flexible liner components; termination of flue liners
7. define the design requirements of flues used with gas appliances:
 - requirements of designer, builder, provider or installer when installing gas chimneys
 - requirements for chimney/hearth certificates
 - chimney system design:
 - distance requirements when passing through combustible material
 - special requirements for chimneys passing adjacent to combustible material or through other dwellings
 - temperature effects and condensation problems caused by flue pipe runs
8. define the design requirements of flues used with gas appliances:
 - requirements for the catchment space to open flued space heaters
 - open flued chimney system:
 - parts of an open flue chimney system
 - room-sealed chimney system:
 - parts of a room sealed flue chimney system
 - natural and fanned draught
9. specify the requirements for the provision of hearths to gas appliances
10. specify the requirements for the termination of flue systems serving gas appliances:
 - room sealed flue positions
 - condensing appliances
 - terminal guard requirements
 - open flue terminal positions:
 - flue/chimney outlet locations/terminal positions - before 2001
 - flue chimney outlet locations/terminal positions - after 2001
 - methods of dealing with down-draught on steeply pitched roofs
11. specify the requirements for installing chimney fans to open flues/chimney systems:
 - requirements prior to installing fans in secondary flues
 - additional safety requirements when fans are installed in secondary flues
 - requirements for fan dilution and shared open flue, fanned draught systems in domestic dwellings
12. specify the flueing requirements for balanced compartments used with open flued appliances:
 - compartment construction
 - ducted air positioning
 - cross sectional areas of air inlet ducts.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 10

Know how to re-establish gas supplies and relight appliances

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to re-establishing gas supplies and relighting appliances
2. state the correct action to be taken when a non-commissioned appliance is identified
3. state the actions to be taken if pipework and appliances are not commissioned when the gas supply to the property is re-established
4. identify the procedures for re-establishing gas supplies and relighting appliances.

Unit 339 Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 11 Know how to check and set appliance burner pressures and gas rates

Assessment Criteria

The learner can:

1. identify the methods of determining and/or setting gas appliance working pressures:
 - fixed rated appliances
 - range rated appliances
2. identify the methods of determining gas rates at appliances:
 - use of manufacturer data (appliance input)
 - use of meter test dial/index for calculation of gas consumption rate
3. calculate the gas consumption rates for gas appliances:
 - imperial rated meters
 - metric rated meters
4. identify and rectify faults discovered during testing:
 - excessive pressure loss at the appliance
 - incorrect gas consumption rates at appliances
 - effects of meter pressure absorption under full load conditions.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 12

Know how to test gas appliance flue systems for effective operation

Assessment Criteria

The learner can:

1. specify the key points to be checked in the visual inspection of a flue system prior to undertaking commissioning of the gas appliance/flue system:
 - open flue systems
 - room sealed flue systems – natural draught and fan assisted
 - vertex type appliances
2. state the factors that can affect flue system performance:
 - downdraught conditions
 - wind effects at the appliance termination
 - passive stack ventilation
 - extraction fans sited in the vicinity of open flued appliances
3. specify the testing procedures that should be performed to check the correct operation of an existing chimney flue/gas appliance:
 - flue flow test
 - spillage test
 - flue testing procedures with appliances sited in the vicinity of extraction fans
 - testing fanned draught open-flue systems and associated safety controls
4. specify the testing procedures for room sealed fanned draught flue installations:
 - checking case seals /case integrity
 - checking flue pipe/air inlet connections for leakage
 - checking/testing of positive pressure case appliances
5. specify the testing procedures for gas appliances that require commissioning by analysis of the flue combustion products:
 - types of portable combustion gas analysers
 - flue gas samples to be taken during the commissioning process
 - sources of information required to determine correct flue gas products and ratios.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 13

Know how to identify and respond to unsafe gas situations

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to situations relating to unsafe gas supplies or appliances:
 - gas operative advice
 - gas user advice
 - responsibilities of the gas user
 - reporting gas escapes
 - actions that can be undertaken by the gas transporter
 - action of the LPG supplier
 - rights of entry to properties
 - turning off emergency controls
 - elimination of ignition sources
 - reduction of gas concentrations via ventilation
2. identify the correct procedure for prioritising actions in the event of an unsafe situation:
 - gas emergency priorities:
 - protect life
 - protect property
 - secure the escape
 - leave the site safe
3. clarify the types of unsafe situation that may be found with appliances and installations and how to respond to them:
 - Immediately Dangerous (ID) situations:
 - actions to take; 'Do not use' notices and labels; warning notice forms; RIDDOR reportable Installations; RIDDOR reporting forms and information required
 - At Risk (AR) situations:
 - actions to take; concern for safety notices and labels
 - Not to Current Standards (NCS) situations:
 - actions to take; advice notices; notification criteria for each category of NCS; methods of notification
4. identify the use of general notices and warning labels to avoid the occurrence of unsafe situations:
 - meter labelling requirements
 - compartment labelling
 - appliance commissioning certificates
 - appliance service certificates
 - landlords safety certificates.

Unit 339

Understand core gas safety principles for natural gas within domestic building services engineering

Outcome 14

Know the general requirements of LPG systems

Assessment Criteria

The learner can:

1. interpret the gas safety legislation that applies to the installation of LPG pipework and appliances
2. describe the additional characteristic and properties of LPG:
 - origins of LPG
 - boiling point of LPG
 - types of gasses
 - vapour pressure curves
 - vaporisation and off takes
 - auto refrigeration and excessive off takes
3. identify the methods of supplying LPG gases to permanent dwellings:
 - bottled supplies
 - bulk storage
4. state the typical operating pressures within LPG systems for permanent dwellings
5. define the methods of entry and layout features of LPG service pipework to domestic dwellings fed from bulk storage and bottled supplies:
 - pipework materials, jointing, layout and routing
 - regulator types and positioning requirements
 - types of flexible connections and hoses
 - operation and positioning of LPG emergency control valves and isolation valves
6. state the methods of checking and setting domestic LPG regulators
7. interpret the gas safety legislation that applies to the tightness testing of LPG installations
8. specify the tightness test procedure for LPG systems
9. specify the purging requirements for LPG systems that have undergone tightness testing.

Unit 340

Maintain gas warm air central heating systems and appliances

Level: 3

Credit value: 11

UAN: T/502/8302

Unit aim(s)

The aim of this unit is to assess the competence of individuals to recognised national occupational standards. The unit supports workforce development and describes the competencies necessary to maintain gas warm air heating systems and appliances.

The scope of work covered by this Unit is the maintenance, commission and decommission of gas warm air central heating systems and appliances up to and including the appliance isolation (service) point supplied with 2nd or 3rd family gases.

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

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

1. be able to plan and prepare work activities for maintaining warm air central heating
2. be able to de-commission warm air central heating to industry standards
3. be able to maintain warm air central heating to industry standards
4. be able to pre-commission and commission warm air central heating to industry standards
5. be able to use and communicate data and information to carry out de-commissioning, maintenance and commissioning work
6. be able to resolve problems which could affect the de-commissioning, maintenance and commissioning process
7. be able to maintain gas warm air central heating systems and appliances.

Guided learning hours

It is recommended that **54** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.11 Maintain Gas Warm Air Central Heating Appliances.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 1

Be able to plan and prepare work activities for maintaining warm air central heating

Assessment Criteria

The learner can:

1. produce a risk assessment and method statement which incorporates:
 - safety provisions in the work site
 - access to the work site
 - movement of the workforce and members of the public
 - movement and safe storage of materials, tools and equipment for the job
2. survey the work site for:
 - any pre-maintenance damage
 - defects to existing building featuresand record it
3. advise the property occupier of any defects found
4. protect the work site and the building fabric against possible damage being caused during the de-commissioning and maintenance process
5. obtain confirmation from the property occupier before the job starts, to ensure that they agree the planned work
6. check and confirm all materials, tools and equipment necessary for the de-commissioning, maintenance and commissioning process are available as required and are fit for purpose
7. check and confirm that the proposed position of the appliance meets the manufacturer's and industry standard's requirements for:
 - location
 - siting
 - clearances
8. check the existing duct system of the appliance to ensure it meets manufacturer's and industry standard's requirements
9. confirm that the:
 - gas supply
 - electricity supply
 - ventilation and where required, chimney/flue suitabilitymeets the appliance manufacturer's and industry standard's requirements for the installation
10. carry out all necessary checks and tests to confirm the:
 - gas supply
 - electricity supply
 - chimney /flue system(where required)meet the manufacturer's and industry requirements for the installation
11. check location of condensate disposal is in compliance with appliance manufacturers and industry standards requirements as necessary
12. check existing installation for any unsafe appliances and system components and apply the gas industry unsafe situations procedures as required.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 2

Be able to de-commission warm air central heating to industry standards

Assessment Criteria

The learner can:

1. check that conditions within the:
 - gas
 - electricitysystems will permit safe de-commissioning
2. use the correct tools and equipment for de-commissioning activities
3. use designated:
 - safe isolation methods
 - tests
 - proceduresto de-commission gas and electricity systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system components
 - electricity system componentsas required.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 3

Be able to maintain warm air central heating to industry standards

Assessment Criteria

The learner can:

1. carry out preparatory work to meet the maintenance requirements
2. remove existing gas and electricity system components as required by the maintenance activities
3. carry out the maintenance process in accordance with:
 - manufacturer's specification
 - industry standards
4. carry out the maintenance process minimising damage to:
 - customer property
 - building features
5. use the correct tools and equipment for maintenance work activities
6. re-position the appliance and confirm it meets the:
 - location
 - siting
 - clearancesrequired by the manufacturer's and industry standard's specification
7. check existing ventilation for appliances and system meets industry requirements for the installation
8. ensure existing gas systems are clean and free of debris
9. re-connect:
 - gas
 - electricitysystem components to the appliance
10. use tightness testing and purging procedures to confirm the integrity of the re-connected gas system and appliance
11. use electrical testing procedures to confirm the integrity of the re-installed electrical system and appliance
12. use industry standard checks and testing procedures to confirm the integrity of the existing chimney system and appliance flue seals where required.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 4

Be able to pre-commission and commission warm air central heating to industry standards

Assessment Criteria

The learner can:

- confirm the complete appliance installation complies with:
 - the manufacturer's specification
 - industry standards
 - Gas Safety (Installation and Use) Regulations
 - British Standards and Building Regulations
- check that conditions within the:
 - gas
 - electricitysystems will permit safe commissioning
- use the correct tools and equipment for commissioning activities
- check that the gas system operating pressures meet industry standards
- check the appliance in accordance with industry standard's and manufacturer's requirements for:
 - operating pressure
 - heat input
- check the combustion performance as required:
 - visually
 - by flue gas analysis
- test chimney performance and reconfirm it performs according to:
 - manufacturer's instructions
 - industry standards
- check that the location of any condensate disposal method complies with:
 - appliance manufacturers instructions
 - industry standards
- check that the ventilation requirements meet current industry standards for the installation
- check the operation of the:
 - gas appliance
 - gas system
 - gas componentsto ensure they function safely and operate in accordance with manufacturer's instructions
- check the:
 - electrical system
 - electrical componentsfunction safely and operate in accordance with the manufacturer's instructions
- explain to the property occupier the correct operation of the:
 - appliance
 - gas systemand provide them with their copy of the appliance literature

13. take precautionary actions by isolation procedures and use of warning notices to prevent the unauthorised use of uncommissioned:
- gas appliances
 - gas systems
 - electrical systems and components.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 5

Be able to use and communicate data and information to carry out de-commissioning, maintenance and commissioning work

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work in order to minimise disturbance to the job during:
 - planning
 - de-commissioning
 - installation
 - commissioning processes
2. use normative documents:
 - industry standards
 - British Standards
 - manufacturer's instructions for the applianceto ensure the work is completed in accordance with their requirements
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the job supervisor
5. advise the designated persons of any unsafe situations and actions required to remedy those situations
6. check that the customer is satisfied with the finished job
7. complete records and documentation confirming the safe maintenance of:
 - gas appliances
 - systems
 - components
8. complete commissioning and de-commissioning records for:
 - gas appliance
 - gas systemand ensure they are stored securely.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 6

Be able to resolve problems which could affect the de-commissioning, maintenance and commissioning process

Assessment Criteria

The learner can:

1. rectify and report deficiencies in gas and electric input services
2. resolve problems in accordance with approved procedures where pre-maintenance checks and tests reveal gas appliance, gas system or component defects
3. resolve problems in accordance with approved procedures when gas appliances, gas systems and components being commissioned do not meet design requirements
4. resolve problems in accordance with approved procedures when the gas appliance, the gas system or component cannot be restored to full performance.

Unit 340

Maintain gas warm air central heating systems and appliances

Outcome 7

Be able to maintain gas warm air central heating systems and appliances

Assessment Criteria

The learner can:

1. describe the health, safety and environmental factors that need to be incorporated in risk assessment for the domestic maintenance process
2. outline methods for safe access and working at heights
3. specify tools and equipment necessary to provide safe access to work at heights, or in confined spaces
4. explain the methods of working which protect the building décor, customer property and existing systems and components
5. state the care and maintenance requirements of tools and equipment, and checks for safe condition
6. specify the tools, equipment, materials and components required for the gas appliance and gas system de-commissioning, maintenance and commissioning – ordering, supplying, advising, checking and delivery procedures
7. explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
8. describe the potential hazards that could arise from all de-commissioning, maintenance and commissioning activities and the checks to be carried out before work takes place
9. explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, maintenance and commissioning activity
10. explain how and where to access the required information, ie normative documents, industry standards guidance documents, British Standards and manufacturer's instructions applicable to the appliance, to ensure the work is done to the specification and industry standards
11. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
12. describe how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for existing gas appliances, systems, or components
13. describe how to confirm that the existing duct system is adequate for the warm air central heating appliance, system and components
14. state safe isolation methods, tests, and procedures to de-commission gas and electricity systems or components
15. explain the procedures for temporary and permanent de-commissioning of appliances and systems including use of temporary continuity bonds
16. explain the precautions to ensure that de-commissioned appliances or systems do not prove a safety hazard
17. explain measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices
18. define the need to liaise with others whose procedures or routines may be affected by the suspension of the gas appliance and gas system operation
19. define the points in the de-commissioning, maintenance and re-commissioning process where co-operation and liaison with other trades and property occupier may be required
20. identify the types of warm air central heating appliances to ensure correct heater selection; downflow, upflow, horizontal flow and slot-fit

21. state the industry practices and work standards for fabricating and installing warm air central heating gas appliances, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
22. identify the positioning and fixing requirements for warm air central heating gas appliances, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
23. identify the positioning and fixing requirements for warm air central heating appliances, systems and components in; airing cupboards, compartments, roof spaces, slot-fit and under stairs installations in order to comply with the manufacturer's and industry standard's requirements
24. define the positioning and fixing requirements for the installation of; warm air ducting, return air ducting, plenums, plenum adaptors, transfer grilles, registers and grilles
25. explain the industry practices and work standards for connecting to input services including; gas, electric, ventilation and chimney systems, including natural and fanned air supply
26. define the industry practices and work standards for connecting warm air central heating gas appliances and components to both new and existing gas, electric, ventilation and chimney systems
27. explain the industry practices and manufacturer's requirements for the positioning and the installation of condensate drain for condensing warm air units
28. describe the process and procedures, equipment and legislative requirements for applying tightness testing and purging to appliances, gas systems and components
29. specify the process and procedures, equipment and legislative requirements for applying electrical tests to appliances, systems and components to ensure safe functioning, e.g. preliminary electrical safety checks
30. define the routines and sequences of the maintenance process of warm air central heating domestic gas appliances, gas systems and components in accordance with manufacturer's specification and industry standards
31. define the routines and sequences for re-commissioning warm air central heating domestic gas appliances, gas systems and components in accordance with manufacturer's specification and industry standards
32. state the procedures for checking the correct operation and performance of warm air central heating gas appliances, gas systems and components and checking against the design specification
33. state the procedures for checking the correct operation and performance of warm air central heating gas appliances, gas systems and components to ensure safe functioning
34. state the procedures for checking and confirming the gas system operating pressures
35. state the procedures for checking and confirming the appliance operating pressure and the heat input
36. describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance
37. describe the tests and checks to confirm the integrity, suitability and performance of the chimney system
38. explain the tests and checks to confirm the suitability and performance of the ventilation system
39. explain how to complete all maintenance documentation and records to be left with the property occupier i.e., Benchmarks, Landlord/Home Owner Gas Safety Record, Maintenance Report Form, etc.
40. describe the measures to prevent un-commissioned gas systems being brought into operation utilising safety and warning notices
41. explain the system handover procedures and demonstrating the operation of replacement systems and components to end users
42. explain the steps to take when problems arise in the work activities
43. describe job management structures and methods of reporting and recording job progress or problems delaying progress
44. describe how to safely collect and dispose of system contents that may be hazardous to health or the environments e.g. waste products such as asbestos, insulation etc

45. demonstrate how and where to access the required information, i.e. industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment e.g. Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations etc
46. explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure.

Unit 341

Install domestic gas warm air central heating appliances

Level: 3

Credit value: 12

UAN: F/502/8299

Unit aim(s)

The aim of this unit is to assess the competence of individuals to recognised national occupational standards. The unit supports workforce development and describes the competencies necessary to install, commission and decommission domestic gas warm air central heating appliances.

The scope of work covered by this unit is from the appliance isolation valve to and including the appliance. Electrical connection (where necessary) will be made to an existing 13 amp 240 volt plug socket or fused socket outlet or a suitable connection point on the heating wiring system. The range of warm air appliances (up to 70 kW net input), providing whole house or selective heating, covered by this unit are:

- Up flow
- Down flow
- Cross (horizontal) flow.

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

There are **eight** learning outcomes to this unit. The learner will be able to:

1. be able to design gas systems for installing domestic gas warm air central heating appliances
2. be able to plan and prepare work activities for installing domestic gas warm air central heating appliances
3. be able to de-commission domestic gas warm air central heating appliances
4. be able to install, exchange, and remove domestic gas warm air central heating appliances
5. be able to pre-commission and commission domestic gas warm air central heating appliances
6. be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work
7. be able to resolve problems which could affect the de-commissioning, installation and commissioning process
8. be able to install domestic gas warm air central heating appliances.

Guided learning hours

It is recommended that **54** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.10 Install Gas Warm Air Systems and Appliances.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 341

Install domestic gas warm air central heating appliances

Outcome 1

Be able to design gas systems for installing domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

1. identify and record the customer's job requirements
2. compare the customer's job requirements with statutory and industry requirements and identify any conflicting issues
3. survey the work site:
 - consult site diagrams for any key structural features that could affect the installation
 - record details of any features that may affect the installation
4. check that the proposed positioning of the appliance meets the manufacturer's and industry standard's requirements for:
 - location
 - clearances
5. check that the availability of input services:
 - gas
 - electricitymeet the appliance manufacturer's and industry standard's requirements for the pipework installation
6. check the:
 - size
 - location
 - availabilityof new or existing warm air and return air duct systems are suitable for the installation of warm air central heating appliances, systems and components
7. check the:
 - size
 - location
 - availabilityof plenum adaptors, transfer grilles, registers and grilles are suitable for the installation of warm air central heating appliances, systems and components
8. check and ensure the design of the proposed installation is in compliance with industry standards
9. prepare a range of design options to meet both customer and industry requirements
10. present design options to the customer using variety of media:
 - written
 - oral
 - drawings
11. consult with the customer and obtain agreement to the design option that best meets all the requirements.

Unit 341 **Install domestic gas warm air central heating appliances**

Outcome 2 Be able to plan and prepare work activities for installing domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

1. produce a risk assessment and method statement that incorporates:
 - safety provisions
 - access at the work site
 - movement of people on site
 - movement and safe storage of installation materials, tools and equipment
2. survey the work site for:
 - any pre-installation damage
 - defects to existing building features
 - record details of any features that may affect the installation
3. advise the property occupier of any defects found
4. protect the work site and the building fabric against possible damage being caused during:
 - de-commissioning
 - installation
5. obtain confirmation from the customer before the job starts to ensure that they agree the planned work
6. check and confirm that all materials, tools and equipment are available as required and are fit for purpose needed for:
 - de-commissioning
 - installation
 - commissioning
7. carry out checks, tests and confirm that:
 - the gas supply
 - electricity supply
 - the provision of ventilationmeets industry standard's requirements in relation to other services
8. check the existing installation for unsafe:
 - appliances
 - system componentsapply the gas industry unsafe situations procedures to any identified unsafe situations
9. confirm that the proposed siting of the gas supply meets industry standard's requirements in relation to other services, i.e. electricity supply
10. check and confirm that the proposed siting of the gas supply meets the appliance manufacturer's and industry's requirements for:
 - location
 - siting
 - clearance.

Unit 341

Install domestic gas warm air central heating appliances

Outcome 3

Be able to de-commission domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

1. check that the:
 - gas supply
 - electricity supplyare in a condition that enables safe appliance de-commissioning
2. use the correct tools and equipment for de-commissioning activities
3. use designated safe:
 - isolation methods
 - tests
 - proceduresto de-commission gas and systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system components
 - electricity system components.

Unit 341

Install domestic gas warm air central heating appliances

Outcome 4

Be able to install, exchange, and remove domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

1. carry out preparatory work to meet the manufacturer's installation requirements
2. install the appliance minimising damage to:
 - customer property
 - building features
3. use the correct tools and equipment for the installation
4. remove any existing gas and electricity system components required for the installation
5. fabricate gas and electricity system components required by the installation
6. position the appliance and confirm it meets the:
 - location
 - siting
 - clearancesrequired by the manufacturer's and industry standard's specification
7. provide the required ventilation for the appliance installation in accordance with manufacturers instructions
8. ensure existing gas system is clean and free of debris
9. connect the gas and electricity supply components to the appliance
10. use tightness testing and purging procedures to confirm the integrity of the installed appliance and gas system
11. use electrical testing procedures to confirm the integrity of the installed electrical system and appliance
12. carry out precautionary actions to prevent the unauthorised use of potentially unsafe gas appliances by following isolation procedures and use of warning notices.

Unit 341 **Install domestic gas warm air central heating appliances**

Outcome 5 Be able to pre-commission and commission domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

1. confirm that the complete appliance installation complies with the:
 - manufacturer's specification
 - industry standards
 - Gas Safety (Installation and Use) Regulations
 - British Standards
 - Building Regulations
2. check that the condition of the gas and electricity systems will allow safe commissioning
3. use the correct tools and equipment for commissioning
4. check and confirm the gas system operating pressures meet industry standards
5. check and confirm the appliance:
 - operating pressure
 - heat inputmeet industry standard's and manufacturer's requirements
6. check the combustion performance visually
7. confirm the operation of the gas appliance and components to ensure they function safely and operate in accordance with manufacturer's instructions
8. confirm the electrical system and components function safely and operate in accordance with the manufacturer's instructions
9. instruct the customer on the correct:
 - operation of the appliance
 - gas systemprovide the customer with a copy of the appliance user instructions.

Unit 341

Install domestic gas warm air central heating appliances

Outcome 6

Be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work during the:
 - planning
 - de-commissioning
 - installation
 - commissioningprocesses to minimise disturbance to the job
2. use:
 - normative documents
 - industry standards
 - British Standards
 - information from manufacturer's instructionsfor the appliance to ensure the work is completed in accordance with the specification
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the line manager responsible for the job
5. identify and advise persons that need to be informed of any unsafe situations and actions required to remedy those situations
6. complete documentation to confirm the safe commissioning of the gas appliance and components
7. complete gas appliance and system de-commissioning records
8. submit details of installation and exchange appliance(s) to a Gas Work Notification Scheme.

Unit 341

Install domestic gas warm air central heating appliances

Outcome 7

Be able to resolve problems which could affect the de-commissioning, installation and commissioning process

Assessment Criteria

The learner can:

1. report deficiencies in:
 - gas supply services
 - electricity supply services
2. resolve problems in accordance with approved procedures where pre-commissioning checks and tests reveal:
 - gas appliance
 - gas supply

component defects
3. resolve problems in accordance with approved procedures when:
 - gas appliances
 - gas systems
 - components

which are being commissioned, do not meet design requirements
4. report problems in accordance with approved procedures when the:
 - gas appliance
 - gas system
 - component

cannot be restored to full performance.

Unit 341 Install domestic gas warm air central heating appliances

Outcome 8 Be able to install domestic gas warm air central heating appliances

Assessment Criteria

The learner can:

Legislative and Safety Knowledge

- 1 a interpret regulations and guidance governing health and safety in the workplace, environmental protection and the use of risk assessments
- 1 b interpret legislation covering the general responsibilities of the installer for their own safety and that of others
 - The Gas Safety (Installation and Use) Regulations 1998 and associated Approved Code of Practice Guidance
 - Regulation 26 Gas appliances
 - Regulation 28 - Access
 - Regulation 29 – Manufacturer’s instructions
 - Regulation 33 – Testing of appliances
 - Regulation 34 – Use of appliances

Installing, commissioning and de-commissioning cookers, tumble dryers and leisure appliances knowledge

- 2. implement the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process
- 3. apply safe access and working at heights
- 4. select and use the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
- 5. apply the methods of working which protect the building décor, customer property and existing systems and components
- 6. demonstrate the care and maintenance requirements of tools and equipment, and checks for safe condition
- 7. select and use the tools, equipment, materials and components required for the gas appliance and gas system de-commission, installation and commission – ordering, supplying, advising, checking and delivery procedures
- 8. demonstrate how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
- 9. describe the potential hazards that could arise from all de-commissioning, installation and commissioning activities and the checks to be carried out before work takes place
- 10. explain the steps to take, should materials, components, tools and equipment not be available at the site to commence the de-commissioning, installation and commissioning activity

11. demonstrate how and where to access the required information, ie normative documents, industry standards guidance documents, British Standards and manufacturer's instructions applicable to the appliance, to ensure the work is done to the specification and industry standards
12. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
13. demonstrate how to measure and record installation and site details for prefabrication purposes
14. evaluate and confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for installation of the new gas appliance, gas system and components
15. evaluate and confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for extending the system
16. perform isolation methods, tests, and procedures to de-commission gas and electricity systems or components
17. apply procedures for temporary and permanent de-commissioning of appliances and systems including use of temporary continuity bonds
18. explain the precautions to ensure that de-commissioned appliances or systems do not prove a safety hazard
19. apply measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices
20. describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas appliance and gas system operation
21. summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required
22. apply the industry practices and work standards for fabricating and installing domestic warm air central heating appliances and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
23. apply the procedures and work methods for connecting to input services including; gas, electric, ventilation and chimney systems
24. apply the procedures and work methods of connecting warm air central heating appliances and components to both new and existing gas, electricity, ventilation and chimney systems
25. demonstrate the process and procedures, equipment and legislative requirements for applying tightness testing and purging to appliances, gas systems and components
26. demonstrate the process and procedures, equipment and legislative requirements for applying electrical tests to appliances, systems and components to ensure safe functioning ie preliminary electrical safety checks
27. apply the routines and sequences for commissioning domestic warm air central heating appliances and components in accordance with manufacturer's specification and industry standards
28. apply the procedures for checking the correct operation and performance of domestic warm air central heating appliances and components and checking against the design specification
29. apply the procedures for checking the correct operation and performance of domestic warm air central heating appliances and components to ensure safe functioning
30. apply the procedures for checking and confirming the gas system operating pressures
31. apply the procedures for checking and confirming the appliance operating pressure and the heat input
32. perform the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance
33. perform the tests and checks to confirm the integrity, suitability and performance of the chimney system
34. perform the tests and checks to confirm the suitability and performance of the ventilation system

35. demonstrate how to complete all installation and commissioning documentation and records to be left with the property occupier, i.e. Benchmarks, Landlord/Home Owner Gas Safety Record, Chimney/Hearth Notice Plate
36. apply measures to prevent un-commissioned gas appliances and gas systems being brought into operation utilising safety and warning notices
37. demonstrate the system handover procedures and demonstrating the operation of domestic warm air central heating appliances and components to end users
38. summarise the steps to take when problems arise in the work activities
39. describe job management structures and methods of reporting and recording job progress or problems delaying progress
40. describe how to safely collect and dispose of system contents that may be hazardous to health or the environment i.e. waste products such as asbestos, insulation, electrical/electronic items and those containing fluorinated gases as in gas refrigeration appliances
41. demonstrate how and where to access the required information, i.e. Industry Regulations regarding the safe disposal of system contents that may be hazardous to health or the environment i.e. Special Waste Regulations, Hazardous Waste Regulations, Fluorinated Greenhouse Gases Regulations (F gas), Control of Asbestos at Work Regulations
42. demonstrate how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure.

Unit 342

Maintain gas water heating and wet central heating appliances

Level: 3

Credit value: 16

UAN: T/502/8459

Unit aims

The aim of this unit is to assess the competence of individuals to recognised National Occupational Standards. The unit supports workforce development and describes the competencies necessary to maintain domestic water heating and wet central heating gas appliances.

The scope of work covered by this unit is the maintenance, commission and decommissions of water heating and wet central heating domestic gas appliances up to and including the appliance isolation (service) point supplied with 2nd or 3rd family gases.

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

There are **seven** learning outcomes to this unit. The learner will be able to:

1. be able to plan and prepare work activities for maintaining water heating and wet central heating appliances
2. be able to de-commission water heating and wet central heating appliances to industry standards
3. be able to maintain domestic water heating and wet central heating appliances to industry standards
4. be able to pre-commission and commission water heating and wet central heating appliances to industry standards
5. be able to use and communicate data and information to carry out de-commissioning, maintenance and commissioning work
6. be able to resolve problems which could affect the de-commissioning, maintenance and commissioning process
7. be able to maintain water heating and wet central heating appliances.

Guided learning hours

It is recommended that **75** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.5 Maintain Gas Water Heating and Wet Central Heating Appliances.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 1

Be able to plan and prepare work activities for maintaining water heating and wet central heating appliances

Assessment Criteria

The learner can:

1. produce a risk assessment and method statement which incorporates:
 - safety provisions on the work site
 - access to the work site
 - movement of people on the site
 - movement and safe storage of materials, tools and equipment for the job
2. survey the work site for:
 - any pre-maintenance damage
 - defects to existing building featuresand record it
3. advise the property occupier of any defects found
4. protect the work site and the building fabric against possible damage being caused during the de-commissioning and maintenance process
5. obtain confirmation from the property occupier before the job starts to ensure that they agree the planned work
6. check and confirm all materials, tools and equipment necessary for the de-commissioning, maintenance and commissioning process are available as required and are fit for purpose
7. check and confirm that the siting of the appliance meets the manufacturer's and industry standard's requirements for:
 - location
 - siting and clearances
8. confirm that the:
 - gas supply, electricity supply ventilation and where required chimney/flue suitability meet the appliance manufacturer's and industry standard's requirements for the installation
9. carry out all necessary checks and tests to confirm the:
 - gas supply
 - electricity supply
 - chimney /flue system(where required)meet the manufacturer's and industry requirements for the installation
10. check location of condensate disposal is in compliance with appliance manufacturers and industry standards requirements as necessary
11. check existing installation for any unsafe appliances and system components and apply the gas industry unsafe situations procedures as required.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 2

Be able to de-commission water heating and wet central heating appliances to industry standards

Assessment Criteria

The learner can:

1. check that conditions within the:
 - gas
 - electricitysystems will permit safe de-commissioning
2. use the correct tools and equipment for de-commissioning activities
3. use designated:
 - safe isolation methods
 - tests
 - proceduresto de-commission gas and electricity systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system components
 - electricity system componentsas required.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 3

Be able to maintain domestic water heating and wet central heating appliances to industry standards

Assessment Criteria

The learner can:

1. carry out preparatory work to meet the maintenance requirements
2. remove existing gas and electricity system components as required by the maintenance activities
3. carry out the maintenance process in accordance with:
 - manufacturer's specification
 - industry standards
4. carry out the maintenance process, minimising damage to:
 - customer property
 - building features
5. use the correct tools and equipment for maintenance work activities
6. re-position the appliance and confirm it meets the:
 - location
 - siting
 - clearancesrequired by the manufacturer's and industry standard's specification
7. check existing ventilation for appliances and system meets industry requirements for the installation
8. ensure existing gas systems are clean and free of debris
9. re-connect:
 - gas
 - electricitysystem components to the appliance
10. use tightness testing and purging procedures to confirm the integrity of the re-connected gas system and appliance
11. use electrical testing procedures to confirm the integrity of the re-installed electrical system and appliance
12. use industry standard checks and testing procedures to confirm the integrity of the existing chimney system and appliance flue seals where required.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 4

Be able to pre-commission and commission water heating and wet central heating appliances to industry standards

Assessment Criteria

The learner can:

1. confirm the complete appliance installation complies with:
 - the manufacturer's specification
 - industry standards
 - Gas Safety (Installation and Use) Regulations,
 - British Standards and Building Regulations
2. check that conditions within the:
 - gas
 - electricitysystems will permit safe commissioning
3. use the correct tools and equipment for commissioning activities
4. check that the gas system operating pressures meet industry standards
5. check the appliance in accordance with industry standards and manufacturer's requirements for:
 - operating pressure
 - heat input
6. check the combustion performance as required:
 - visually
 - by flue gas analysis
7. test chimney performance and reconfirm it performs according to (where required):
 - manufacturer's instructions
 - industry standards
8. check that the ventilation requirements meet current industry standards for the installation
9. check the operation of the:
 - gas appliance
 - gas system
 - gas componentsto ensure they function safely and operate in accordance with manufacturer's instructions
10. check the:
 - electrical system
 - electrical componentsfunction safely and operate in accordance with the manufacturer's instructions
11. explain to the property occupier the correct operation of the:
 - appliance
 - gas systemand provide them with their copy of the appliance literature
12. take precautionary actions by isolation procedures and use of warning notices to prevent the unauthorised use of uncommissioned:

- gas appliances
- gas systems
- electrical systems and components.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 5

Be able to use and communicate data and information to carry out de-commissioning, maintenance and commissioning work

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work in order to minimise disturbance to the job during:
 - planning
 - de-commissioning
 - installation commissioning processes
2. use normative documents, such as:
 - industry standards
 - British Standards
 - manufacturer's instructions for the applianceto ensure the work is done to specification
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the job supervisor
5. advise the designated persons of any unsafe situations and actions required to remedy those situations
6. check that the customer is satisfied with the finished job
7. complete records and documentation confirming the safe maintenance of:
 - gas appliances
 - systems
 - components
8. complete commissioning and de-commissioning records for:
 - gas appliance
 - gas system as requiredand ensure they are stored securely.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 6

Be able to resolve problems which could affect the de-commissioning, maintenance and commissioning process

Assessment Criteria

The learner can:

1. rectify and report deficiencies in gas and electric input services
2. resolve problems in accordance with approved procedures where pre-maintenance checks and tests reveal gas appliance, gas system or component defects
3. resolve problems in accordance with approved procedures when gas appliances, gas systems and components being commissioned do not meet design requirements
4. resolve problems in accordance with approved procedures when the gas appliance, the gas system or component cannot be restored to full performance.

Unit 342

Maintain gas water heating and wet central heating appliances

Outcome 7

Be able to maintain water heating and wet central heating appliances

Assessment Criteria

The learner can:

1. describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic maintenance process
2. explain safe access and working at heights procedures
3. specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
4. describe the methods of working which protect the building décor, customer property and existing systems and components
5. state the care and maintenance requirements of tools and equipment, and checks for safe condition
6. state the tools, equipment, materials and components required for the gas system de-commissioning, maintenance and commissioning – ordering, supplying, advising, checking and delivery procedures
7. explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
8. describe the potential hazards that could arise from all de-commissioning, maintenance and commissioning activities and the checks to be carried out before work takes place
9. explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, maintenance and commissioning activity
10. demonstrate how and where to access the required information, ie normative documents, industry standards guidance documents, British Standards and manufacturer's instructions applicable to the gas system and appliance, to ensure the work is done to the specification and industry standards
11. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
12. describe how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for existing gas appliances, systems, or components
13. state safe isolation methods, tests, and procedures to de-commission gas and electricity systems or components
14. state safe isolation methods, tests, and procedures for temporary and permanent de-commissioning of gas systems, earthing systems and components, including the use of temporary continuity bonds
15. explain the precautions to ensure that de-commissioned gas and earthing systems do not prove a safety hazard
16. describe measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices
17. explain how to liaise with others whose procedures or routines may be affected by the suspension of the gas appliance and gas system operation
18. describe the points in the de-commissioning, maintenance and re-commissioning process where co-operation and liaison with other trades and property occupier may be required
19. state the industry practices and work standards for fabricating and installing water heating and wet central heating gas appliances, systems and components to comply with the

- manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
20. state the positioning and fixing requirements for water heating and wet central heating gas appliances, systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
 21. state the positioning and fixing requirements for water heating and wet central heating gas appliances, systems and components in; airing cupboards, compartments, roof spaces and external installations in order to comply with the manufacturer's specification and industry standards
 22. explain the industry practices and manufacturer's requirements for the positioning and the installation of condensate drain for condensing boilers
 23. describe the procedures and work methods for connecting to input services including; gas, electric, ventilation and chimney systems
 24. state the procedures and work methods of connecting water heating and wet central heating gas appliances and components to both new and existing gas, water, electric, ventilation and chimney systems
 25. explain the process and procedures, equipment and legislative requirements for applying tightness testing and purging to appliances, gas systems and components
 26. describe the process and procedures, equipment and legislative requirements for applying electrical safety tests to appliances, systems and components to ensure safe functioning
 27. describe the routines and sequences of the maintenance process of water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturer's specification and industry standards
 28. describe the routines and sequences for re-commissioning water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturer's specification and industry standards
 29. explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components and checking against the design specification
 30. explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components to ensure safe functioning
 31. explain the procedures for checking that the hot water performance of water heating gas appliances and combination boilers complies with the manufacturer's specification i.e., there is sufficient pressure and flow rate and correct temperatures are achieved
 32. state the procedures for checking and confirming the gas system operating pressures
 33. describe the procedures for checking and confirming the appliance operating pressure and the heat input
 34. describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance
 35. describe the tests and checks to confirm the integrity, suitability and performance of the chimney system
 36. describe the tests and checks to confirm the suitability and performance of the ventilation system
 37. explain how to complete all maintenance documentation and records to be left with the property occupier i.e., Benchmarks, Landlord/Home Owner Gas Safety Record, Maintenance Report Form etc
 38. describe the measures to prevent un-commissioned gas systems being brought into operation utilising safety and warning notices
 39. explain the system handover procedures and demonstrating the operation of replacement systems and components to end users
 40. explain the steps to take when problems arise in the work activities
 41. describe job management structures and methods of reporting and recording job progress or problems delaying progress

42. describe how to safely collect and dispose of system contents that may be hazardous to health or the environment, e.g. waste products such as asbestos, insulation, etc
43. demonstrate how and where to access the required information, i.e. industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment, e.g. Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations, etc
44. explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Level: 3
Credit value: 18
UAN: Y/502/8454

Unit aims

The aim of this unit is to assess the competence of individuals to recognised national occupational standards. The unit supports workforce development and describes the competencies necessary to install, commission and decommission domestic gas water heaters and wet central heating appliances.

The scope of work covered by this unit is from the appliance shut-off valve to and including the appliance, locating and fixing the appliance to the wall, connecting and assembling the chimney components to the appliance, drilling the wall to accommodate the chimney assembly and connecting the appliance to water supplies. Electrical connection will be made either to an existing 13 amp 240 volt plug socket, fused socket outlet or to a suitable connection point on the central heating wiring system.

The range of appliances, fitted in domestic and or small commercial premises, covered by this unit are:

- Instantaneous single and multipoint flued and flueless water heaters
- Back boiler units not exceeding 70 kW net
- Open, balanced and fan assisted, system, combination and condensing boilers not exceeding 70 kW net
- Storage hot water boilers not exceeding 70 kW net
- Swimming pool boilers not exceeding 140 kW

This unit will provide evidence of competence to enable an individual to apply for a 'licence to practice' from the gas industry registrar, currently Gas Safe Register.

Learning outcomes

There are **eight** learning outcomes to this unit. The learner will be able to:

1. be able to design gas systems for installing domestic gas water heaters and wet central heating appliances
2. be able to plan and prepare work activities for installing domestic gas water heaters and wet central heating appliances
3. be able to de-commission domestic gas water heaters and wet central heating appliances
4. be able to install, exchange, and remove domestic gas water heaters and wet central heating appliances
5. be able to pre-commission and commission domestic gas water heaters and wet central heating appliances
6. be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work
7. be able to resolve problems which could affect the de-commissioning, installation and commissioning process
8. be able to carry out installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances.

Guided learning hours

It is recommended that **134** hours should be allocated for this unit. This may be on a full-time or part-time basis.

The relationship between this unit and the national occupational standards

This unit of assessment relates directly to Energy & Utility Skills Sector Performance Standards (approved National Occupational Standards) Gas Utilisation and Gas Safety NOS DSG 3.3 Install Gas Water Heating and Wet Central Heating Appliances.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by EU Skills.

Assessment and grading

This unit is assessed by:

- gas question papers
- gas assignment
- Independent Summative Assessments (ISA)
- a portfolio of evidence.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 1

Be able to design gas systems for installing domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

1. identify and record the customer's job requirements
2. compare the customer's job requirements with statutory and industry requirements and identify any conflicting issues
3. survey the work site:
 - consult site diagrams for any key structural features that could affect the installation
 - record details of any features that may effect the installation
4. check that the proposed positioning of the appliance meets the manufacturer's and industry standard's requirements for:
 - location
 - clearances
5. check that the availability of input services meet the appliance manufacturer's and industry standard's requirements for the appliance installation
6. check the size, location and availability of input services meet the:
 - appliance manufacturer's
 - industry standardsrequirements for the installation of:
 - gas supply
 - electricity supply
 - chimney suitability
 - the provision of ventilation
7. check proposed location of condensate disposal is in compliance with:
 - appliance manufacturer's instructions
 - industry standards
8. check and ensure the design of the proposed installation is in compliance with industry standards
9. prepare a range of design options to meet:
 - customer
 - industry requirements
10. present design options to the customer using a variety of media:
 - written
 - oral
 - drawings
11. consult with the customer and obtain agreement to the design option that best meets all the requirements.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 2

Be able to plan and prepare work activities for installing domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

1. carry out a risk assessment that incorporates:
 - safety provisions
 - access at the work site
 - movement of people on site
 - movement and safe storage of installation materials, tools and equipment
2. survey the work site for:
 - any pre-installation damage
 - defects to existing building features
 - record details of any features that may affect the installation
3. advise the property occupier of any defects found
4. protect the work site and the building fabric against possible damage being caused during:
 - de-commissioning
 - installation
5. obtain confirmation from the customer before the job starts to ensure that they agree the planned work
6. check and confirm that all materials, tools and equipment are available as required and are fit for purpose, needed for:
 - de-commissioning
 - installation
 - commissioning
7. carry out checks and tests to confirm the:
 - gas supply
 - electricity supply
 - provision of ventilationmeet the industry standard's requirements for the installation
8. check existing installation for any unsafe appliances and system components apply the gas industry unsafe situations procedures as required
9. confirm that the proposed siting of the gas supply meets industry standard's requirements in relation to other services, i.e. electricity supply
10. confirm the suitability of the proposed location of condensate disposal as required
11. confirm that the proposed siting of the gas supply meets industry standard's requirements in relation to other services, ie electricity supply
12. check and confirm that the proposed siting of the gas supply meets the appliance manufacturer's and industry's requirements for:
 - location
 - siting
 - clearance.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 3

Be able to de-commission domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

1. check that the:
 - gas supply
 - electricity supplyis in a condition that enables safe appliance de-commissioning
2. use the correct tools and equipment for de-commissioning activities
3. use designated safe:
 - isolation methods
 - tests
 - proceduresto de-commission gas and systems and components
4. take precautionary actions to ensure that temporarily de-commissioned:
 - appliances
 - systems
 - componentsdo not present a safety hazard
5. permanently remove and disconnect:
 - appliances
 - gas system components
 - electricity system components.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 4

Be able to install, exchange, and remove domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

1. carry out preparatory work to meet the manufacturer's installation requirements
2. install the appliance minimising damage to:
 - customer property
 - building features
3. select and use the correct tools and equipment for the installation
4. remove any existing gas and electricity system components required for the installation
5. fabricate gas and electricity system components required by the installation
6. position the appliance and confirm it meets the:
 - location
 - siting
 - clearancesrequired by the manufacturer's and industry standard's specification
7. provide the required ventilation for the appliance installation in accordance manufacturer's instructions
8. ensure existing gas systems are clean and free from debris
9. fix and connect the:
 - gas supply
 - electricity supply componentsto the appliance
10. fix and connect the condensate disposal system as required
11. use tightness testing and purging procedures to confirm the integrity of the installed gas system and appliance
12. use electrical testing procedures to confirm the integrity of the installed electrical system and appliance
13. use industry:
 - standard checks
 - testing proceduresto confirm the integrity of the newly installed or existing chimney system and appliance flue seals
14. carry out precautionary actions to prevent the unauthorised use of:
 - uncommissioned gas appliances
 - gas systems
 - electrical systems
 - componentsby following isolation procedures and use of warning notices.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 5

Be able to pre-commission and commission domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

1. confirm that the complete appliance installation complies with the:
 - manufacturer's specification
 - industry standards
 - Gas Safety (Installation and Use) Regulations
 - British Standards
 - Building Regulations
2. check that the condition of the gas and electricity systems will allow safe commissioning
3. use the correct tools and equipment for commissioning
4. check and confirm the gas system operating pressures meet industry standards
5. check and confirm the appliance:
 - operating pressure
 - heat inputmeet industry standard's and manufacturer's requirements/instructions
6. check the combustion performance by:
 - visual inspection
 - conducting flue gas analysis using an electronic flue gas analyser
7. confirm the operation of the gas appliance and components to ensure they function safely and operate in accordance with manufacturer's instructions
8. test chimney performance and reconfirm it performs according to manufacturer's and industry requirements
9. confirm the electrical system and components function safely and operate in accordance with the manufacturer's instructions
10. instruct the customer on the correct operation of the:
 - appliance
 - gas system
11. provide customer with a copy of the appliance literature
12. check and confirm the operation of the condensate disposal system.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 6

Be able to use and communicate data and information to carry out de-commissioning, installation and commissioning work

Assessment Criteria

The learner can:

1. liaise with the property occupier and other people who will be affected by the work during the:
 - planning
 - de-commissioning
 - installation
 - commissioningprocesses to minimise disturbance to the job
2. use:
 - normative documents
 - industry standards
 - British Standards
 - information from manufacturer's instructionsfor the appliance to ensure the work is completed in accordance with the specification
3. advise of any delays to the work to any persons who are affected by the delay
4. report any delays in the work schedules to the line manager responsible for the job
5. identify and advise persons that need to be informed of any unsafe situations and actions required to remedy those situations
6. complete documentation to confirm the safe commissioning of the gas appliance and components
7. complete gas appliance and system de-commissioning records
8. submit details of installation and exchange appliance(s) to a Gas Work Notification Scheme.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 7

Be able to resolve problems which could affect the de-commissioning, installation and commissioning process

Assessment Criteria

The learner can:

1. report deficiencies in:
 - gas supply services
 - electricity supply services
2. resolve problems in accordance with approved procedures where pre-commissioning checks and tests reveal:
 - gas appliance
 - gas supply
 - component defects
3. resolve problems in accordance with approved procedures when:
 - gas appliances
 - gas systems
 - componentsthat are being commissioned do not meet design requirements
4. report problems in accordance with approved procedures when the:
 - gas appliance
 - gas system
 - componentcannot be restored to full performance.

Unit 343

Install domestic gas water heaters and wet central heating appliances

Outcome 8

Be able to carry out installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

Assessment Criteria

The learner can:

Legislative and Safety Knowledge

- 1 a interpret regulations and guidance governing health and safety in the workplace, environmental protection and the use of risk assessments
- 1 b interpret legislation covering the general responsibilities of the installer for their own safety and that of others
 - The Gas Safety (Installation and Use) Regulations 1998 and associated Approved Code of Practice Guidance:
 - Regulation 26 Gas appliances
 - Regulation 28 - Access
 - Regulation 29 – Manufacturer’s instructions
 - Regulation 33 – Testing of appliances
 - Regulation 34 – Use of appliances

Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances knowledge

2. describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process
3. explain safe access and working at heights
4. specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
5. describe the methods of working which protect the building décor, customer property and existing systems and components
6. state the care and maintenance requirements of tools and equipment, and checks for safe condition
7. state the tools, equipment, materials and components required for the gas appliance and gas system de-commission, installation and commission – ordering, supplying, advising, checking and delivery procedures
8. explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
9. describe the potential hazards that could arise from all de-commissioning, installation and commissioning activities and the checks to be carried out before work takes place
10. explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, installation and commissioning activity
11. demonstrate how and where to access the required information, ie normative documents, industry standards guidance documents, British Standards and manufacturer’s instructions

applicable to the appliance, to ensure the work is done to the specification and industry standards

12. demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturer's instructions
13. explain how to measure and record installation and site details for prefabrication purposes
14. explain how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for installation of the new gas appliance, gas system and components
15. explain how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for extending the system
16. describe isolation methods, tests, and procedures to de-commission gas and electricity systems or components
17. state procedures for temporary and permanent de-commissioning of appliances and systems including use of temporary continuity bonds
18. explain the precautions to ensure that de-commissioned appliances or systems do not prove a safety hazard
19. describe measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices
20. describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas appliance and gas system operation
21. summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required
22. explain the industry practices and work standards for fabricating and installing domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to comply with the manufacturer's specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
23. state the procedures and work methods for connecting to input services including; gas, electric, ventilation and chimney systems
24. state the procedures and work methods of connecting domestic gas cookers, tumble dryers, leisure appliances and components to both new and existing gas, electric, ventilation and chimney systems
25. state the process and procedures, equipment and legislative requirements for applying tightness testing and purging to appliances, gas systems and components
26. state the process and procedures, equipment and legislative requirements for applying electrical tests to appliances, systems and components to ensure safe functioning, i.e. preliminary electrical safety checks
27. explain the routines and sequences for commissioning domestic gas cookers, tumble dryers, leisure appliances, gas systems and components in accordance with manufacturer's specification and industry standards
28. state the procedures for checking the correct operation and performance of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components and checking against the design specification
29. state the procedures for checking the correct operation and performance of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to ensure safe functioning
30. state the procedures for checking and confirming the gas system operating pressures
31. state the procedures for checking and confirming the appliance operating pressure and the heat input
32. describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance
33. describe the tests and checks to confirm the integrity, suitability and performance of the chimney system
34. describe the tests and checks to confirm the suitability and performance of the ventilation system

35. explain how to complete all installation and commissioning documentation and records to be left with the property occupier, i.e., Benchmarks, Landlord/Home Owner Gas Safety Record, Chimney/Hearth Notice Plate
36. describe measures to prevent un-commissioned gas appliances and gas systems being brought into operation utilising safety and warning notices
37. explain the system handover procedures and demonstrating the operation of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to end users
38. summarise the steps to take when problems arise in the work activities
39. describe job management structures and methods of reporting and recording job progress or problems delaying progress
40. describe how to safely collect and dispose of system contents that may be hazardous to health or the environment ie waste products such as asbestos, insulation, electrical/electronic items and those containing fluorinated gases as in gas refrigeration appliances
41. demonstrate how and where to access the required information, i.e. Industry Regulations regarding the safe disposal of system contents that may be hazardous to health or the environment ie Special Waste Regulations, Hazardous Waste Regulations, Fluorinated Greenhouse Gases Regulations (F gas), Control of Asbestos at Work Regulations
42. explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Level: 3
Credit value: 8
UAN: D/502/9696

Unit aim(s)

This knowledge unit provides learning in systems and layouts, design techniques and apply them to systems, installation requirements, fault diagnostics and rectification. Know commissioning requirements and apply them to pipework and system components.

Learning outcomes

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

1. know the types of sanitation system and their layout requirements
2. know the design techniques for sanitation and rainwater systems
3. be able to apply design techniques for sanitation and rainwater systems
4. understand the installation requirements of sanitation system components
5. know the fault diagnosis and rectification procedures for sanitary pipework systems and components
6. be able to diagnose and rectify faults in sanitary pipework systems and components
7. know the commissioning requirements of sanitary pipework systems and components
8. be able to commission sanitary pipework systems and components.

Guided learning hours

It is recommended that **72** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- an online multiple choice test
- an externally set assignment.

Permitted reference material

The learner is permitted to use the following material during their assessment for this unit:

Sanitation

- BS 6465 part 2 - Code of practice for space requirements for 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 H (N in Northern Ireland), freely downloaded at www.planningportal.gov.uk (www.dfpni.gov.uk in Northern Ireland)

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 1 Know the types of sanitation system and their layout requirements

Assessment Criteria

The learner can:

1. state the use of air admittance valves in above ground sanitary pipework systems:
 - types of air admittance valves
 - their suitability of use in the various types of pipework system
 - application on multi-dwelling housing estates
2. clarify the statutory requirements for the provision of sanitary facilities and equipment in dwellings for the disabled:
 - spacing requirements of the human body
 - appliance space requirements for the disabled
3. analyse the working principles and layout features for foul tanks in sanitation systems:
 - cesspits
 - septic tanks
4. state the periodic maintenance and cleaning requirements of foul tanks:
 - cesspits
 - septic tanks
5. analyse the working principles and system layout features of specialist sanitary components:
 - WC macerators
 - waste water lifters
 - sink waste disposals.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 2 Know the design techniques for sanitation and rainwater systems

Assessment Criteria

The learner can:

1. define the factors which affect the selection of sanitation systems for dwellings
2. state the criteria used when selecting sanitation systems and appliances:
 - customers' needs
 - building layout and features
 - suitability of system
 - energy efficiency
 - environmental impact
3. interpret information sources required when undertaking design work for sanitation systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
4. specify the fire stopping arrangements required under statutory legislation as they apply to sanitary pipework passing between fire compartments in a dwelling
5. calculate the sanitary provision requirements for dwellings
6. clarify the method of sizing and selecting the correct gradient for branch pipework used in sanitary pipework systems
7. clarify the methods used when designing a sanitary pipework system:
 - main stack size
 - branch pipework sizes
 - ventilation requirements:
 - air admittance valves
 - ventilating pipes
8. clarify the methods used when designing a rainwater system:
 - roof area calculations
 - gutter type selection
 - outlet positioning
9. calculate the size of sanitary pipework used in single occupancy dwellings:
 - main stack size
 - branch pipework size
 - stack vent size
10. calculate the size of rainwater system components used with single occupancy and multiple terraced properties:
 - outlet requirements
 - gutter requirements

- rainwater pipe requirements
11. clarify how to present design calculations in an acceptable format:
- using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 3 Be able to apply design techniques for sanitation and rainwater systems

Assessment Criteria

The learner can:

1. use information sources when undertaking design work for sanitation systems:
 - statutory regulations
 - industry standards
 - manufacturer technical instructions
 - verbal and written feedback from the customer
2. calculate the size of sanitary pipework used in single occupancy dwellings. simple calculations of:
 - main stack size
 - branch pipework size
 - stack vent size
3. calculate the size of rainwater system components used with single occupancy and multiple terraced properties:
 - outlet requirements
 - gutter requirements
 - rainwater pipe requirements
4. present design calculations in an acceptable format:
 - using basic not to scale line drawings
 - details for insertion into a quotation or tender for work in a small-scale dwelling.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 4 Understand the installation requirements of sanitation system components

Assessment Criteria

The learner can:

1. state the layout features for walk in wet rooms in dwellings
2. specify the installation and fixing methods for components of walk in wet rooms used in dwellings
3. specify the positioning and fixing methods for designer sanitary appliances used in dwellings:
 - glass sanitary appliances
 - antique style sanitary appliances
 - sanitary appliances with floor mounted taps
4. state how to assemble and prepare for the installation of sanitation system components:
 - WC macerator
 - waste water lifter
 - sink waste disposal unit
5. specify the methods for positioning and fixing WC macerators and waste water lifters:
 - reference to manufacturer's instructions
 - vertical lift position
 - use of long radius bends
 - pipework material selection and assembly
6. specify the methods for positioning and fixing sink waste disposal units:
 - reference to manufacturer's instructions
 - trapping and branch discharge pipework requirements.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 5 Know the fault diagnosis and rectification procedures for sanitary pipework systems and components

Assessment Criteria

The learner can:

1. state the methods of obtaining details of system faults from end users
2. interpret manufacturer instructions and industry standards to establish the diagnostic requirements of sanitation system components
3. propose routine checks and diagnostics on sanitation system components as part of a fault finding process:
 - checking for correct operation of system components:
 - WC macerators
 - waste water lifters
 - sink waste disposal units
4. specify methods of repairing faults in sanitation components:
 - WC macerators
 - waste water lifters
 - sink waste disposal units
 - air admittance valves
5. specify methods of safely isolating sanitation system components to prevent them being brought into operation before the work has been fully completed
6. define procedures for diagnosing faults in macerator units.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 6 Be able to diagnose and rectify faults in sanitary pipework systems and components

Assessment Criteria

The learner can:

1. use manufacturer instructions and industry standards to establish the diagnostic requirements of sanitation system components
2. isolate sanitation system components to prevent them being brought into operation before the work has been fully completed
3. carry out diagnostic tests to locate faults in macerator units.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 7 Know the commissioning requirements of sanitary pipework systems and components

Assessment Criteria

The learner can:

1. interpret information sources required to complete commissioning work on sanitation systems
2. state the checks to be carried out during a visual inspection of a sanitation system to confirm that it is ready to be operated
3. identify how to carry out an air test on a sanitary pipework system to industry requirements
4. state how to performance test sanitation systems to test for trap seal retention
5. specify the commissioning procedures for macerator type WCs
6. specify the actions that must be taken when commissioning reveals defects in sanitation systems
7. propose the range of information that would be detailed on a commissioning record for a sanitation system
8. state the procedure for notifying works carried out to the relevant authority
9. propose the points to be covered when handing over a completed system to the end-user.

Unit 344/026 Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

Outcome 8 Be able to commission sanitary pipework systems and components

Assessment Criteria

The learner can:

1. carry out a visual inspection of a sanitation system to confirm that it is ready to be operated
2. perform an air test on a sanitary pipework system to industry requirements
3. carry out a performance test on a sanitary pipework system to check for effective trap seal retention:
 - branch discharge pipework:
 - test for self siphonage
 - test for induced siphonage
 - main discharge stack:
 - test for induced siphonage and compression
4. commission a WC with macerator pump installation.

Unit 345

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

Level: 3

Credit value: 3

UAN: K/502/9298

Unit aim(s)

The aim of this unit is to enable learners to demonstrate occupational competence in the selection of components, the preparation of work sites, to install, commission, diagnose and rectify faults.

Learning outcomes

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

1. be able to select plumbing and heating systems and components for application the workplace
2. be able to prepare work sites for the installation of plumbing and heating systems and components in the workplace
3. be able to install plumbing and heating systems and components in the workplace
4. be able to commission plumbing and heating systems in the workplace
5. be able to diagnose faults in plumbing and heating components in the workplace
6. be able to rectify faults in plumbing and heating components in the workplace.

Guided learning hours

It is recommended that **four** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Summit Skills.

Assessment and grading

This unit will be assessed by:

- observation in a working environment
- a portfolio of evidence.

Unit 345

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

Outcome 1

Be able to select plumbing and heating systems and components for application the workplace

Assessment Criteria

The learner can:

1. obtain details of the customer job requirement:
 - by face to face site visit
 - by taking details from plans, drawings and specifications
2. discuss and agree initial system and component options with the customer:
 - cold water systems
 - hot water systems
 - central heating systems
 - sanitation systems and sanitary appliances
 - gravity rainwater systems
3. calculate the size and quantities of components required for systems installation
4. present design calculations and information to the customer
5. obtain agreement from the customer to progress plumbing and heating work:
 - items of small jobbing (maintenance) type work
 - full system/component installation work
6. apply changes to customer job requirements and obtain customer agreement to those changes.

Unit 345

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

Outcome 2

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

Assessment Criteria

The learner can:

1. use job information to plan the installation work
2. confirm the position of pipework and components with other persons before commencing the installation work
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. arrange for all tools, equipment and materials to be 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.

Unit 345

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

Outcome 3

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
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 345

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

Outcome 4

Be able to commission plumbing and heating systems in the workplace

Assessment Criteria

The learner can:

1. carry out a visual inspection of the system 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:
 - cold water systems
 - hot water systems
 - central heating systems
 - sanitation systems
4. flush the system with cold water on completion of soundness testing
5. rectify any leakage from the system found during the soundness test procedure
6. re-fill the system treating the contents with additives as appropriate
7. operate the system and take performance readings in order to compare them to the design specifications:
 - mechanical component readings
 - electrical component readings
8. adjust system controls to establish that the system operates to its design specifications
9. carry out remedial work to systems when commissioning reveals that the system does not work to the design specifications
10. prepare commissioning records for completed systems
11. instruct the customer in the efficient and effective operation of the system.

Unit 345

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

Outcome 5

Be able to diagnose faults in plumbing and heating components in the workplace

Assessment Criteria

The learner can:

1. use job information to plan the fault diagnosis work
2. comply with health and safety requirements when carrying out fault diagnosis work
3. prepare a safe and unobstructed access route to the work areas to carry out the fault diagnosis work
4. arrange for all required tools, equipment and materials to be available to undertake the fault diagnosis work
5. report any pre-existing damage to the building fabric or customer property to other persons before carrying out the fault diagnosis work
6. provide protection to the building fabric or customer property as the work progresses
7. establish details of the fault from other persons
8. test the component to diagnose the cause of the fault.

Unit 345

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

Outcome 6

Be able to rectify faults in plumbing and heating components in the workplace

Assessment Criteria

The learner can:

1. liaise with other persons to reach agreement on the rectification work to be carried out
2. isolate unsafe components that are not to be rectified and leave the component in a safe condition
3. 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
4. drain the component contents
5. take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete
6. carry out the rectification or replacement of the component to industry requirements
7. reinstate the supply or service to the component
8. test the component for effective operation
9. advise other persons that work on the system or component has been successfully completed
10. complete the details contained in a maintenance record for the system or component.

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