Level 2 NVQ Diplomas in Heating and Ventilating (6188-20/21/22)

Qualification handbook for centres

www.cityandguilds.com
Sptember 2019
Version 2.0

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

Equal opportunities

City & Guilds fully supports the principle of equal opportunities and we are committed to satisfying this principle in all our activities and published material. A copy of our equal opportunities policy statement is available on our website.

Copyright

Publications

City & Guilds publications are available from our website or from our Publications Sales department, using the contact details shown below.

City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)844 543 0000 **www.cityandguilds.com**
F +44 (0)20 7294 2413 **centresupport@cityandguilds.com**

Level 2 NVQ Diplomas in Heating and Ventilating (6188-20/21/22)

Qualification handbook for centres

www.cityandguilds.com
September 2019
Version 2.0

Qualification at glance

Title and Laevel	GLH	TQT	City & Guilds number	Accreditation number
Level 2 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation	696	810	6188-20	600/1806/9
Level 2 NVQ Diploma in Heating and Ventilating Ductwork Installation			6188-21	600/0144/6
Level 2 NVQ Diploma in Planned Reactive Maintenance on Heating and Ventilating Equipment	733	860	6188-22	600/0143/4

Version and date	Change detail	Section
1.1 January 2014	Updated formatting of the Qualification structures.	Error! Reference source not found.
1.2 October 2017	Added TQT details Deleted QCF	**Qualification at a glance & Structure** **Throughout**
2.0 September 2019	GLH & TQT added	Qualification at a glance

City & Guilds

Believe you can

www.cityandguilds.com

Contents

1 Introduction to the qualifications

This document contains the information (please consult the Walled Garden/Online Catalogue for last dates) that centres need to offer the following qualifications:

Qualification title and level	City & Guilds qualification number	Qualification accreditation number	Registration and certification
Level 2 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation	6188-20	600/1806/9	Consult the Walled Garden/Online Catalogue for last dates
Level 2 NVQ Diploma in Heating and Ventilation Ductwork Installation	6188-21	600/0144/6	
Level 2 NVQ Diploma in Planned and Reactive Maintenance on Heating and Ventilating systems	6188-22	600/0143/4	

These qualifications meet the needs of learners in England, Wales and Northern Ireland who want to work as a heating and ventilation engineer installing ductwork systems, industrial and commercial and or planned and reactive maintaining of these systems, equipment and components in buildings, structures and the environment within the Building Services industry.

These qualifications also contribute to the knowledge, understanding, and practical skills regarding Heating and Ventilating Industrial and Commercial, Ductwork and Planned and Reactive Maintenance Systems.

Once candidates have learnt the required skills and knowledge, they will demonstrate their occupational competence in the workplace within this qualification.

These qualifications are part of the SummitSkills Heating and Ventilating Apprenticeship framework and provide a nationally recognised qualification for the Heating and Ventilating industry.

They replace the following City & Guilds qualifications:

- 6088-02 Level 2 NVQ in Heating and Ventilating (Industrial and Commercial Installation) 100/3375/0
- 6128-02 Level 2 Certificate in Heating and Ventilating (Industrial and Commercial Systems Installation) 100/3512/6
- 6088-04 Level 2 NVQ in Heating and Ventilating (Ductwork Installation) 100/3375/0,
- 6128-04, Level 2 Certificate in Heating and Ventilating (Ductwork Systems Installation) 100/3512/6

1.1 Qualification structure

To achieve the **Level 2 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation (6188-20),** learners must achieve 81 credits from the eleven mandatory units in the table shown below.

Learners can also take additional units from the elective units in this table but they will not be counted towards the minimum credit required for achievement of this qualification.

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
Mandatory units					
201	J/602/2479	Understand and carry out safe working practices in building services engineering	10	88	Combination
202	J/602/2482	Understand how to communicate with others within building services engineering	3	28	Knowledge
203	D/602/2486	Understand how to apply environmental protection measures within BSE	4	38	Knowledge
204	J/602/2496	Understand how to apply scientific principles within MES	7	66	Knowledge
205	A/602/2768	Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems	40	356	Combination
208	M/602/2735	Understand industrial and commercial heating system installation techniques	3	28	Knowledge
209	F/602/2738	Understand industrial and commercial chilled water system installation techniques	3	28	Knowledge
210	T/602/2493	Apply safe working practices in building services engineering working environment	2	4	Performance
228	Y/602/2728	Understand industrial and commercial cold water system installation techniques	3	28	Knowledge

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
229	H/602/2733	Understand industrial and commercial hot water system installation techniques	3	28	Knowledge
230	Y/602/2776	Install industrial and commercial heating and ventilating systems	3	4	Performance
Elective units					
223	K/602/2751	Understand industrial and commercial warm air heating installation techniques	2	18	Knowledge
224	F/602/2755	Understand industrial and commercial compressed air system installation techniques	3	28	Knowledge
225	D/602/2780	Install industrial and commercial fire protection systems	2	4	Performance
226	K/602/2782	Install warm air heating systems	2	4	Performance
227	A/602/2785	Install industrial and commercial compressed air systems	2	4	Performance
231	J/602/2949	Understand industrial and commercial fire protection system installation techniques	2	18	Knowledge

To achieve the **Level 2 NVQ Diploma in Heating and Ventilating Ductwork Installation (6188-21),** learners must achieve 64 credits from all twelve mandatory units in the table shown below.

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
Mandatory units					
201	J/602/2479	Understand and carry out safe working practices in building services engineering	10	88	Combination
202	J/602/2482	Understand how to communicate with others within BSE	3	28	Knowledge
203	D/602/2486	Understand how to apply environment protection measures within BSE	4	38	Knowledge
204	J/602/2496	Understand how to apply scientific principles within MES	7	66	Knowledge
210	T/602/2493	Apply safe working practices in building services engineering working environment	2	4	Performance
211	M/602/2721	Install heating and ventilation industrial and commercial ductwork	4	4	Performance

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
212	J/602/2711	Understand industrial and commercial rectangular ductwork installation techniques	9	75	Knowledge
213	L/602/2712	Understand industrial and commercial circular and flat ductwork installation techniques	9	75	Knowledge
214	R/602/2713	Understand industrial and commercial air handling unit installation techniques	4	28	Knowledge
215	D/602/2715	Understand industrial and commercial plastic ductwork installation techniques	4	28	Knowledge
216	H/602/2716	Understand industrial and commercial fire rated ductwork installation techniques	4	28	Knowledge
217	M/602/2718	Understand industrial and commercial local exhaust ventilation installation techniques	4	28	Knowledge

To achieve the **Level 2 NVQ Diploma in Planned and Reactive Maintenance on Heating and Ventilating Equipment (6188-22),** learners must achieve 86 credits from all ten mandatory units in the table shown below.

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
Mandatory units					
201	J/602/2479	Understand and carry out safe working practices in building services engineering	10	88	Combination
202	J/602/2482	Understand how to communicate with others within BSE	3	28	Knowledge
203	D/602/2486	Understand how to apply environment protection measures within BSE	4	38	Knowledge
204	J/602/2496	Understand how to apply scientific principles within MES	7	66	Knowledge
205	A/602/2768	Understand and carry out site preparation and fabrication techniques for industrial and commercial systems	40	356	Combination
206	J/602/4927	Understand industrial and commercial hot and cold water system maintenance techniques	6	57	Knowledge

City & Guilds unit	Unit accreditation number	Unit title	Credit value	GLH	Unit type
207	L/602/4928	Understand industrial and commercial hot water heating system maintenance techniques	5	45	Knowledge
210	T/602/2493	Apply safe working practices in building services engineering working environment	2	4	Performance
221	R/602/4929	Understand industrial and commercial air system maintenance techniques	5	45	Knowledge
222	J/602/4930	Service and maintain industrial and commercial heating and ventilation systems	4	6	Performance

Total Qualification Time

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

Title and level	GLH	TQT
Level 2 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation	696	810
Level 2 NVQ Diploma in Planned and Reactive Maintenance on Heating and Ventilating systems	733	860

1.2 Opportunities for progression

On completion of this qualification candidates may progress into employment or to the following City & Guilds qualifications:

- 6188-30 Level 3 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation
- 6188-31 Level 3 NVQ Diploma in Heating & Ventilating - Ductwork Installation
- 6188-32 Level 3 NVQ Diploma in Planned and Reactive Maintenance on Heating and Ventilating Systems
- 6189-41 Level 3 NVQ Diploma in Domestic Heating
- 6189-42 Level 3 NVQ Diploma in Domestic Heating (Gas Fired Warm Air Appliances)
- 6189-43 Level 3 NVQ Diploma in Domestic Heating (Gas Fired Water and Central Heating Appliances)
- 6189-31 Level 3 NVQ Diploma in Domestic Plumbing and Heating
- 6189-32 Level 3 NVQ Diploma in Domestic Plumbing and Heating (Gas Fired Warm Air Appliances)
- 6189-33 Level 3 NVQ Diploma in Domestic Plumbing and Heating (Gas Fired Water and Central Heating Appliances)
- 4467 Level 4 Higher Level Qualification in Building Services Engineering
- ILM Level 2 Award and Certificate in Team Leading

- ILM Level 2 NVQ in Team Leading
- ILM Qualifications in Effective Team Member Skills

1.3 Qualification support materials

City & Guilds also provides the following publications and resources specifically for this qualification:

Description	How to access
Assessment pack	**www.cityandguilds.com**

2 Centre requirements

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

Centres already offering City & Guilds qualifications in this subject area

Centres that are currently approved for the following qualifications:

- 6088-02 Level 2 NVQ in Heating and Ventilating (Industrial and Commercial Installation) 100/3375/0
- 6128-02 Level 2 Certificate in Heating and Ventilating (Industrial and Commercial Systems Installation) 100/3512/6
- 6088-04 Level 2 NVQ in Heating and Ventilating (Ductwork Installation) 100/3375/0
- 6128-04 Level 2 Certificate in Heating and Ventilating (Ductwork Systems Installation) 100/3512/6

are eligible for automatic approval for the new 6188-20 Level 2 NVQ Diploma in Heating and Ventilating Industrial and Commercial Installation, and 6188-21 Level 2 NVQ Diploma in Heating and Ventilating Ductwork Installation.

Centres wishing to offer the new 6188-22 Level 2 NVQ Diploma in Planned Reactive Maintenance on Heating and Ventilating Systems 600/0143/4 must use the standard Qualification Approval Process (refer to *Centre Manual - Supporting Customer Excellence* in Appendix 2). This also applies to new centres wishing to offer any of these qualifications.

City & Guilds reserves the right to insist on full qualification approval if there have been quality issues within a centre or if there have been substantial staff changes at the centre.

New centres must use the **standard** Qualification Approval Process (refer to *Centre Manual - Supporting Customer Excellence* in Appendix 2.

2.1 Resource requirements

Physical resources and site agreements

It is acceptable for centres to use specially designated areas within a centre to teach practical skills and to assess the simulated practical assignments within the knowledge units. The equipment, systems and machinery must meet current industrial standards and be capable of being used under normal working conditions, and must fully meet the requirements set in each City & Guilds practical assignment guide.

Human resources

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

- be technically competent in the area[s] for which they are delivering training and/or have experience of providing training. This knowledge must be at least to the same level as the training being delivered
- hold appropriate qualifications as detailed in this handbook.
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

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

The following information is taken from the 'Summit Skills Consolidated Assessment Strategy for Units and Qualifications of 'Occupational Competence' in the Qualifications and Credit Framework (England, Northern Ireland and Wales) for the Building Services Engineering Sector January 2010 v2.1 (amended April 2010)', which governs the assessment of competence based qualifications in the Building Services Engineering sector.

Assessors

Assessors **must:**

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

Occupational Competence

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

- A relevant qualification (NVQs/SVQs at the appropriate level or their equivalents in the Qualifications and Credit Framework)
- Registration with the appropriate industry registration body at the relevant occupational level and grade

For particular units/qualifications the verifiable evidence may need to be above the level of the unit/qualification being assessed. Where applicable this requirement will be detailed in the 'Additional Information' pertaining to specific units/qualifications.

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

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

NOTE: Assessors and verifiers who have relevant qualifications pre-NVQ and post-NVQ which are not competence-based must provide verifiable evidence that they are occupationally competent. This evidence must demonstrate that the assessor/verifier has up-to-date knowledge of the industry/occupation (for which the assessment is taking place), its settings, legislative and regulatory requirements, codes of practice and guidance.

Assessor Continuing Professional Development

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

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

Internal Verifiers (IV)

IV Role and Responsibilities

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

Internal verifiers must:

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

IV Continuing Professional Development

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

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

Expert Witnesses

Where **'Expert Witnesses'** are used in the assessment process identified above they must be sector competent individuals who can attest to the learner's performance in the workplace.

Expert witnesses will need to demonstrate:

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

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

Evidence presented by expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency

2.2 Candidate entry requirements

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

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

As part of the assessment for this qualification, candidates must have, or have the potential to obtain access to a real work setting where they can demonstrate practical occupational competence to the requirements of the units, consistently over time.

Age restrictions

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

Other legal considerations

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

3 Course design and delivery

3.1 Initial assessment and induction

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

The initial assessment should identify any:

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

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

City & Guilds are providing optional practice tests for the online assessments within this qualification. These may aid centres and candidates in determining the learner's readiness to undertake the online assessments.

3.2 Recommended delivery strategies

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

SummitSkills expect knowledge units to be completed before performance units are undertaken by the candidate.

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

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

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

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

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

4 Assessment

4.1 Summary of assessment methods

City & Guilds provides the following assessments:

- Online on-demand testing using multiple choice questions
- Assignments (practical and written) available from the 6188 webpage (passwords for approved centres available via City & Guilds Walled Garden 6188 page).
- Short-answer questions available from the 6188 webpage (passwords for approved centres available via City & Guilds Walled Garden 6188 page.

Unit	Title	Assessment Method	Where to obtain assessment materials
201	Understand and carry out safe working practices in building services engineering	City & Guilds on-line multiple choice test (6188-201) Externally set assignment, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
202	Understand how to communicate with others within BSE	City & Guilds on-line multiple choice test (6188-202)	Go to **www.cityandguilds.com**. Password available on Walled Garden
203	Understand how to apply environment protection measures within BSE	City & Guilds on-line multiple choice test (6188-203)	Go to **www.cityandguilds.com**. Password available on Walled Garden
204	Understand how to apply scientific principles within MES	City & Guilds on-line multiple choice test (6188-204)	Go to **www.cityandguilds.com**. Password available on Walled Garden
205	Understand and carry out site preparation and fabrication techniques for industrial and commercial systems	Externally set multiple choice paper, locally marked and externally verified. Externally set assignment, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
206	Understand industrial and commercial hot and cold water system maintenance techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
207	Understand industrial and commercial hot water heating system maintenance techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
208	Understand industrial and commercial heating system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden

Unit	Title	Assessment Method	Where to obtain assessment materials
209	Understand industrial and commercial chilled water system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
210	Apply safe working practices in building services engineering working environment	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
211	Install heating and ventilation industrial and commercial ductwork	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
212	Understand industrial and commercial rectangular ductwork installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
213	Understand industrial and commercial circular and flat ductwork installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
214	Understand industrial and commercial air handling unit installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
215	Understand industrial and commercial plastic ductwork installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
216	Understand industrial and commercial fire rated ductwork installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
217	Understand industrial and commercial local exhaust ventilation installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
221	Understand industrial and commercial air system maintenance techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden

Unit	Title	Assessment Method	Where to obtain assessment materials
222	Service and maintain industrial and commercial heating and ventilation systems	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
223	Understand industrial and commercial warm air heating installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
224	Understand industrial and commercial compressed air system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
225	Install industrial and commercial fire protection systems	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
226	Install warm air heating systems	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
227	Install industrial and commercial compressed air systems	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit.	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.
228	Understand industrial and commercial cold water system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
229	Understand industrial and commercial hot water system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden
230	Install industrial and commercial heating and ventilating systems	This unit will be assessed via observation and the development of a portfolio in a work based environment and will be assessed to the assessment criteria set out in the unit	Candidates and centres may decide to use a paper-based or electronic method of recording evidence. ***Recording forms*** are available on the City & Guilds website.

Unit	Title	Assessment Method	Where to obtain assessment materials
231	Understand industrial and commercial fire protection system installation techniques	Externally set multiple choice paper, locally marked and externally verified.	Go to **www.cityandguilds.com**. Password available on Walled Garden

Time constraints

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

- Candidates must be assessed within the lifespan of the qualification.
- All assessments must take no longer than the stated time limit to complete, where maximum time limits apply. Centre staff should guide candidates to ensure excessive evidence gathering is avoided. Centres finding that assignments are taking longer, should contact the external verifier for guidance.
- All assignments must be completed and assessed within the candidate's period of registration. Centres should advise candidates of any internal timescales for the completion and marking of individual assignments.

4.2 Assignments

All assignments are available on the 6188 section of **www.cityandguilds.com** dedicated to this qualification. The password to access these materials are available to approved centres on the Walled Garden. Assessment materials **must** only be accessed by centre staff formally appointed to securely handle assessments.

4.3 Evidence requirements

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

There are three types of units within this qualification:

- Knowledge units that give the learner the opportunity to demonstrate their knowledge and understanding of identified topics and subject areas. There are some formal practical assessments within these units. In addition SummitSkills expect for some units candidates knowledge to be consolidated by the use of "Practical Support Learning" activity in simulated conditions. The 'notes for guidance' section in each unit will detail where this is expected.
- Performance units that give the learner the opportunity to demonstrate they have the practical skills that are in keeping with the relevant National Occupational Standards for identified activities.
- Combination units consist of practical activities/assignments in simulated conditions. Identified knowledge is assessed in accordance with projects/assignments, external written assessments/tests and professional discussion.

For the **performance units** the majority of evidence must be generated from a real working environment. This is an environment in which real work activities take place under real working conditions in keeping with real commercial situations

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

A simulated environment in which simulated activities take place must replicate a real working environment. The criteria for which must be to supply fit-for-purpose tools, equipment, full-size components, realistic deadlines and other commercial requirements.

Simulation **must take** place for industry identified key-safety critical aspects of the qualification as listed in and their relevant associated units. A key-safety critical aspect is defined by SummitSkills as 'any 'technical' activity with the potential to harm/damage personnel/property if carried out incorrectly'. The activities that will be undertaken demonstrating competence in these areas are contained within each industries 'Assessment of Occupational Competence' arrangement and this must **not** be undertaken before the learner has demonstrated sufficient technical expertise, knowledge, skill and maturity.

'Knowledge' units 201-204 must be undertaken in line with the City & Guilds assessment strategy for each unit as detailed in this handbook.

The environment in which the evidence and the quantity of evidence for **Performance Units** 210, 211 and 221 must be assessed, i.e. sourced from the real working environment or simulated conditions, will be detailed in the 'Additional Requirements' for each Performance Unit. This could be applicable to all the Learning Outcomes in the unit or particular Learning Outcomes.

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

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

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

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

4.4 Test specifications

The test specification for these units is available on the City & Guilds website. Please go to **www.cityandguilds.com** and navigate to the 6188 webpage.

4.5 Recording forms

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

City & Guilds endorses several EPortfolio systems. Further details are available at: **www.cityandguilds.com/eportfolios**.

Although it is expected that new centres will use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used.

4.6 Recognition of prior learning (RPL)

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

There is no automatic RPL for candidates who have completed the 6128 Level 2 Certificate in Heating and Ventilating technical certificate to enable them automatic exemption from taking the knowledge units of the 6188-20, 21 and 22 pathways of this qualification.

With regards to the performance units of this qualification there are opportunities to recognise candidate's RPL from the 6088 Level 2 NVQ in Heating and Ventilating qualifications. There are however no automatic exemption against units successfully attained in the 6088 Heating and Ventilating qualification against the new 6188 qualification. Centres will have to undertake a manual mapping exercise comparing the units to identify opportunities for recognised performance evidence gained by the candidate in the 6088 qualifications.

5 Units

Availability of units

The learning outcomes and assessment criteria are also viewable on the Register of Regulated Qualifications **www.register.ofqual.gov.uk**

Structure of units

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

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- relationship to NOS
- endorsement by the Sector Skills Council
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

Summary of units

City & Guilds unit number	Title	Unit ref number	Credits
6188-201	Understand and carry out safe working practices in building services engineering	J/602/2479	10
6188-202	Understand how to communicate with others within building services engineering	J/602/2482	3
6188-203	Understand how to apply environmental protection measures within building services engineering	D/602/2486	4
6188-204	Understand how to apply scientific principles within mechanical engineering services	J/602/2496	7
6188-205	Understand and carry out site preparation and fabrication techniques for industrial and commercial systems	A/602/2768	40
6188-206	Understand industrial and commercial hot and cold water system maintenance techniques	J/602/4927	6
6188-207	Understand industrial and commercial hot water heating system maintenance techniques	L/602/4928	5
6188-208	Understand industrial and commercial heating system installation techniques	M/602/2735	3

City & Guilds unit number	Title	Unit ref number	Credits
6188-209	Understand industrial and commercial chilled water system installation techniques	F/602/2738	3
6188-210	Apply safe working practices in building services engineering working environment	T/602/2493	2
6188-211	Install heating and ventilating industrial and commercial ductwork	M/602/2721	4
6188-212	Understand industrial and commercial rectangular ductwork installation techniques	J/602/2711	9
6188-213	Understand industrial and commercial circular and flat ductwork installation techniques	L/602/2712	9
6188-214	Understand industrial and commercial air handling unit installation techniques	R/602/2713	4
6188-215	Understand industrial and commercial plastic ductwork installation techniques	D/602/2715	4
6188-216	Understand industrial and commercial fire rated ductwork installation techniques	H/602/2716	4
6188-217	Understand industrial and commercial local exhaust ventilation installation techniques	M/602/2718	4
6188-221	Understand industrial and commercial air system maintenance techniques	R/602/4929	5
6188-222	Service and maintain industrial and commercial heating and ventilating systems	J/602/4930	4
6188-223	Understand industrial and commercial warm air heating installation techniques	K/602/2751	2
6188-224	Understand industrial and commercial compressed air system installation techniques	F/602/2755	3
6188-225	Install industrial and commercial fire protection systems	D/602/2780	2
2188-226	Install Warm Air Heating Systems	K/602/2782	2
6188-227	Install industrial and commercial compressed air systems	A/602/2785	2
6188-228	Understand industrial and commercial cold water system installation techniques	Y/602/2728	3
6188-229	Understand industrial and commercial hot water system installation techniques	H/602/2733	3
6188-230	Install industrial and commercial heating and ventilating systems	Y/602/2776	3
6188-231	Understand industrial and commercial fire protection system installation techniques	J/602/2949	2

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

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

Unit aims

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

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

Learning outcomes

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

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

Guided learning hours

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

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M1

Endorsement of the unit by a sector or other appropriate body

SummitSkills

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

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

Assessment criteria

The learner can:

1.1 state the aims of health & safety legislation in protecting the workforce and members of the public:
- general legislation
- construction specific legislation
- building services specific legislation

1.2 identify the responsibilities of members of the construction team under health & safety legislation:
- employers (including employer representatives)
- designers
- main contractors
- sub-contractors
- employees
- self-employed (labour only)
- clients (customers)

1.3 state the legal status of health and safety guidance materials:
- Acts of Parliament
- regulations
- approved codes of practice
- HSE Guidance Notes

1.4 state the role of enforcing authorities under health & safety legislation:
- Health & Safety Executive
- local authority

1.5 identify the powers of inspectors under health & safety legislation:
- improvement notice
- prohibition notice
- powers of prosecution
- role in providing advice and guidance.

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

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

Assessment criteria

The learner can:

2.1 identify the types of general site hazards that may be encountered while at work:

- site/work area cleanliness:
  - tripping hazards
  - slipping hazards
- using equipment:
  - inadequate or lack of personal protective equipment
  - defective (unsafe) equipment
- personal conduct:
  - manual handling
  - working at heights

2.2 state the potential dangers to the workforce and members of the public when work is carried out:

- on construction sites (all property types)
- in industrial commercial premises (occupied and unoccupied refurbishment)
- in dwellings (occupied and unoccupied refurbishment)

2.3 identify the methods that can be used to prevent accidents or dangerous situations occurring during work activities:

- working practices (use and understanding of):
  - method statements
  - permit to work systems
  - risk assessments
- safety notices (use and understanding of):
  - mandatory signs
  - prohibition signs
  - hazard signs
  - fire fighting signs
  - safe condition signs
  - combination signs

2.4 identify how hazardous substance legislation classifies substances and the direct precautions to be taken while working with those substances:

- toxic
- harmful
- corrosive
- irritant
- oxidising

- extremely flammable

2.5 identify the general precautions necessary for working with commonly encountered substances:

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

2.6 state the range of common building materials and services components that may contain asbestos

2.7 identify the types of asbestos that may be encountered in the workplace:

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

2.8 state the procedures that must be used to safely work with asbestos cement based materials:

- flue, soil, rainwater pipes and gutters
- tanks and cisterns
- artex
- small gaskets and seals

2.9 identify the actions to be taken when asbestos is encountered while undertaking work activities:

- protection of the workforce and members of the public
- licensing requirements for asbestos removal organisations
- safe disposal requirements.

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

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

Assessment criteria

The learner can:

3.1 state the purpose of, and application of protective equipment:

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

3.2 identify the procedures for manually handling heavy and bulky items:

- assessment of a safe load that a person can lift
- application of safe kinetic lifting technique
- use of simple mechanical lifting aids – sack trolley
- application and use of mechanical lifting aids on large construction sites.

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

Outcome 4 Be able to apply manual handling techniques

Assessment criteria

The learner can:

4.1 perform manual handling of heavy and bulky items:

- plan the lift
- safely move the load
- assist in a two-person lift

4.2 manually handle loads using mechanical lifting aids.

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

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

Assessment criteria

The learner can:

5.1 identify the requirements for first aid provision while working:
- in small occupied properties
- on construction sites (new-build and refurbishment)

5.2 identify the actions that should be taken when an accident or emergency is discovered:
- raising the alarm
- the role of the emergency services and contact methods
- typical emergency evacuation procedures

5.3 state the procedures for dealing with minor injuries that can occur while working:
- cuts
- minor burns
- objects in the eye
- exposure to fumes

5.4 state the procedures for dealing with major injuries that can occur while working:
- bone fractures
- unconscious co-workers:
  - placing the casualty in the recovery position
  - concussion
- electric shock:
  - removal from the supply
  - CPR method

5.5 state the procedures for recording accidents and near misses at work:
- statutory requirements for the reporting of accidents/serious occurrences
- the use of company accident books
- the details to be recorded on a simple accident/incident report form.

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

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

Assessment criteria

The learner can:

6.1 identify the common electrical dangers encountered on construction sites and in private dwellings:
- faulty electrical equipment
- signs of damaged or worn electrical cables – power tools and property hard wiring system
- trailing cables
- proximity of cables to services pipework
- buried/hidden cables
- inadequate over-current protection devices

6.2 identify the methods of safely using electrical tools and equipment on site:
- battery powered supplies
- 110 volt supplies
- 230 volt supplies

6.3 identify how to conduct a visual inspection of a power tool for safe condition before use:
- checking for a valid PAT test
- inspection for general condition

6.4 state the procedure that should be applied for tools and equipment that fail safety checks

6.5 state the electrical industry safe isolation procedure that should be applied to building services equipment before carrying out work on them

6.6 state the use of temporary continuity bonding when working on pipework components.

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

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

Assessment criteria

The learner can:

7.1 demonstrate the electrical industry safe isolation procedure to safely isolate an item of fixed mechanical or electrical plant or equipment

7.2 carry out a visual safety inspection of power tools before use and report on their condition

7.3 demonstrate the application of temporary continuity bonding when cutting into a fixed metallic pipework system.

Unit 201 Understand and carry out safe working practices in building services industry

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

Assessment criteria

The learner can:

8.1 identify the various types of gases used in pipe and sheet jointing processes:
- bottle colours
- properties of the gases used
- uses within the industry

8.2 identify how bottled gases and equipment should be safely transported and stored

8.3 identify the various types of heat producing equipment and how to check them for safety:
- hoses:
  - colours used
  - thread directions
  - flashback arrestors
- control valves
- gauges
- blowpipes
- direct connecting combined units (aeration in the nozzle)

8.4 identify how gas heating equipment is safely assembled and used:
- bottle location and position
- equipment assembly sequence
- leak detection procedures
- safe purging procedure
- safe lighting and extinguishing procedure
- actions in the event of leakage

8.5 identify the three elements of the fire triangle and how combustion takes place

8.6 state the dangers of working with heat producing equipment and how to prevent fires occurring

8.7 state the method for fighting small localised fires that can occur in the workplace:
- when to avoid tackling fires
- types of extinguisher
- selection of extinguisher by fire type
- method of use.

Unit 201 Understand and carry out safe working practices in building services industry

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

Assessment criteria

The learner can:

9.1 perform a safety check of gas heating equipment:

- transportation of gas bottles to the work area
- assess components and equipment for safety

9.2 perform the safe assembly of gas heating equipment for use:

- hose and blowpipe or combined unit attachment
- leak detection procedures
- purging procedures
- lighting and extinguishing procedures

9.3 demonstrate the use of a fire extinguisher in extinguishing a small solid fuel fire.

Unit 201 Understand and carry out safe working practices in building services industry

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

Assessment criteria

The learner can:

10.1 identify the situations where it may be necessary to work at height

10.2 identify the types of equipment used to permit work at heights in the building services industry:

- step ladders
- ladders
- mobile mini towers/scaffolds
- roof ladders and crawling boards
- mobile tower scaffolds
- fixed scaffolds and edge protection
- mobile elevated work platforms including scissor lifts and cherry pickers

10.3 identify how to select suitable equipment for carrying out work at heights based on the work being carried out

10.4 state the range of safety checks to be carried out on access equipment before it is used:

- step ladders
- ladders
- mobile mini towers/scaffold
- roof ladders and crawling boards
- mobile tower scaffolds
- fixed scaffolds and edge protection (appreciation only)

10.5 state the method of assembly and use of access equipment:

- step ladders
- ladders
- roof ladders
- mobile tower scaffolds.

Unit 201 Understand and carry out safe working practices in the building services industry

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

Assessment criteria

The learner can:

11.1 demonstrate the safe method of assembly and use of:

- step ladders
- ladders

11.2 demonstrate the safe method of assembly and use of mobile tower scaffolds.

Unit 201 Understand and carry out safe working practices in building services industry

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

Assessment criteria

The learner can:

12.1 identify the situations in which it may be necessary to work in excavations

12.2 state how excavations should be prepared for safe working:

- safe access into the excavation
- trench support systems

12.3 state the measures that need to be applied to prevent persons or equipment falling into excavations:

- use of warning signs
- use of barriers for pedestrians
- vehicle proximity to excavation edges

12.4 identify where work in confined spaces may be required

12.5 state the potential dangers when working in confined spaces:

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

Unit 202 Understand how to communicate with others within building services engineering

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

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

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

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

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

Details for the relationship between the unit and relevant national occupational standards
SummitSkills NOS M3

Endorsement of the unit by a sector or other appropriate body
SummitSkills

Unit 202 Understand how to communicate with others within building services engineering

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

Assessment criteria

The learner can:

1.1 identify the key roles of the site management team:

- architect
- project manager/clerk of works
- structural engineer
- surveyor
- building services engineer
- quantity surveyor
- buyer
- estimator
- contracts manager
- construction manager

1.2 identify the key roles of the individuals that report to the site management team:

- sub contractors
- site supervisor
- trade supervisor
- trades:
  - bricklayer
  - joiner
  - plasterer
  - tiler
  - electrician
  - heating and ventilation fitter
  - gas fitter
  - decorator
  - groundworkers

1.3 identify the key roles of site visitors:

- Building Control Inspector
- Water Inspector
- HSE Inspector
- Electrical Services Inspector.

Unit 202 Understand how to communicate with others within building services engineering

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

Assessment criteria

The learner can:

2.1 identify the types of statutory legislation and guidance information that applies to working in the industry:

- legislation:
  - data protection
  - equal opportunities
  - health & safety
  - employment
- regulations
- British Standards
- codes of practice
- manufacturer guidance:
  - installation instructions
  - service & maintenance instructions
  - user instructions

2.2 identify the purpose of information that is used in the workplace:

- job specifications
- plans/drawings
- work programmes
- delivery notes
- time sheets
- policy documentation – health & safety, environmental, customer service

2.3 identify the purpose of information given to customers:

- quotations
- estimates
- invoices/statements
- statutory cancellation rights
- handover information

2.4 state the importance of company policies and procedures that affect working relationships:

- company working policies/procedures:
  - behaviour
  - timekeeping
  - dress code
  - contract of employment
- limits to personal authority:
  - apprentices
  - level 2 qualified staff

    - level 3 qualified staff
- supervisor and management responsibilities.

Unit 202 Understand how to communicate with others within building services engineering

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

Assessment criteria

The learner can:

3.1 identify suitable communication methods for use in work situations:

- oral communication
- written communication:
  - e-mail
  - fax
  - letter

3.2 define methods of effective communication for people with:

- physical disabilities
- learning difficulties
- language differences
  - dialects
  - accents
  - foreign and second language issues

3.3 state the actions to take to deal with conflicts between:

- customers and operatives
- co-workers
- supervisors and operatives

3.4 state the effects that poor communication may have on an organisation:

- between operatives
- between operatives and management
- company to customer.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Unit aims

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

Learning outcomes

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

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

Guided learning hours

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

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M2

Endorsement of the unit by a sector or other appropriate body

SummitSkills

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

1.1 state the aims of energy conservation legislation:
- general legislation
- construction specific legislation
- building services specific legislation

1.2 identify the responsibilities of members of the construction team under energy conservation legislation:
- clients (customers)
- designers
- employers
- employees.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

2.1 identify the types of energy used in properties:

- high carbon:
  - natural gas / LPG
  - fuel oils
  - solid fuels (coal and peat)
  - electricity (from non-renewable sources)
- low carbon:
  - solar thermal
  - solid fuel (biomass)
  - hydrogen fuel cells
  - heat pumps
  - combined heat & power (CHP)
  - combined cooling, heat & power (CCHP)
- zero carbon:
  - electricity - wind
  - electricity - tidal
  - hydroelectric
  - solar photovoltaic

2.2 identify the basic operating principles of installations containing environmental energy sources:

- solar thermal
- solid fuel (biomass)
- heat pumps (water, air and ground source)
- combined heat & power (CHP)
- combined cooling, heat & power (CCHP)
- wind turbine
- solar photovoltaic

2.3 identify organisations which give guidance and advice on energy saving and conservation techniques

2.4 identify how to use energy rating tables and their effect on component selection

2.5 state where to find information on alternative energy sources.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

3.1 state the role of the commissioning process in conserving energy usage

3.2 state the actions to be covered during the system handover procedure to the customer that will contribute to conserving energy usage.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

4.1 identify the working practices that can be employed to conserve energy and protect the environment

4.2 state the methods used for reducing material wastage:

- planning work activities
- accurate measurement and cutting

4.3 identify the methods of conserving material usage:

- reducing material over ordering
- minimising damage to stored materials
- prevention of loss/theft.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

5.1 identify the statutory legislation for waste management on construction sites

5.2 state the methods of safely disposing of waste materials:

- licensed waste disposal
- waste carriers license
- recycling
- specialist disposal – asbestos and other forms of hazardous waste

5.3 specify the approved processes for recycling materials:

- metals
- plastics
- wood/cardboard

5.4 identify the disposal requirements of potentially hazardous materials:

- asbestos
- electrical and electronic equipment
- refrigerants (fluorinated gases)

5.5 identify what action to take if work activities endanger the environment.

Unit 203 Understand how to apply environmental protection measures within building services engineering

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

Assessment criteria

The learner can:

6.1 identify the statutory legislation for water wastage and misuse

6.2 state the criteria for water efficiency calculations for new dwellings

6.3 state the methods for reducing water wastage:

- flow reducing valves
- spray taps
- low volume flush WC

6.4 identify the methods available for capturing surface water and recycling used water

6.5 identify the uses of captured and recycled water in properties

6.6 state the basic working principles of captured and recycled water systems:

- rain water harvesting
- grey water systems.

Unit 204 Understand how to apply scientific principles within mechanical engineering services

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

Unit aims

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

Learning outcomes

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

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

Guided learning hours

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

Endorsement of the unit by a sector or other appropriate body

SummitSkills

Unit 204 Understand how to apply scientific principles within mechanical engineering services

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

Assessment criteria

The learner can:

1.1 state the application and use of internationally recognised (SI) units of measurement:

- metre (length) m
- kilogram (mass) kg
- second (time) S
- Kelvin (temperature) OK

1.2 state the application and use of SI derived units:

- area (m2)
- volume (m3):
  - litres (L)
- density (kg/m3)
- velocity (m/s).

Unit 204 Understand how to apply scientific principles with mechanical engineering services

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

Assessment criteria

The learner can:

2.1 calculate the relative densities of common materials:
- relative density to air
- relative density to water

2.2 state the principle applications of solid materials used in the mechanical services industry:
- metals:
  - pure metals
  - ferrous metals
  - alloys including solders
- plastics:
  - thermo plastics
  - thermo-setting plastics
- fireclays/ceramics

2.3 identify the detailed properties of solid materials:
- strength – tensile and compressive
- hardness
- ductility
- malleability
- conductivity – heat and electricity

2.4 state the reasons why solid materials breakdown:
- atmospheric corrosion:
  - oxidisation of metals
- UV damage to plastics
- heat damage to plastics
- electrolytic corrosion:
  - electromotive series
  - dissimilar metals in the presence of an electrolyte (water)
- erosion corrosion
- methods of preventing corrosion

2.5 state the principle applications and basic properties of liquids used in the mechanical services industry:
- water
- refrigerant
- anti-freeze/glycol mixes
- fuel oils
- lubricants/greases

2.6 identify the detailed properties of water:

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

2.7 state the principle applications of gases used in the mechanical services industry:

- air & steam
- LPG
- natural gas
- carbon dioxide
- refrigerant gases

2.8 identify the detailed properties of gases:

- pressure exerted by a gas
- volume occupied by a gas
- temperature of gases found within the industry
- gas laws:
  - Charles's Law
  - Boyle's Law
- heat pump/refrigeration cycle.

Unit 204 Understand how to apply scientific principles within mechanical engineering services

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

Assessment criteria

The learner can:

3.1 identify the relationship between the Celsius and Kelvin temperature scales:
- units of temperature measurement
- temperature measurement devices used

3.2 identify the terminology associated with a change of state:
- melting
- freezing
- boiling
- evaporating
- condensing

3.3 identify the terms latent and sensible heat as they apply to liquids and gases

3.4 identify the methods of heat transfer:
- conduction in solids
- convection in liquids and gases
- radiation between two bodies

3.5 state how units of energy and heat are related and derived:
- energy – joules (J)
- specific heat capacity (kj/kg/°C)
- power – watts (W)

3.6 state how to carry out simple heat, energy and power calculations:
- simple temperature calculations
- quantity of heat energy required to raise the temperature of a substance
- the amount of power required to heat a substance.

Unit 204 Understand how to apply scientific principles with mechanical engineering services

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

Assessment criteria

The learner can:

4.1 state how units of force and pressure are derived from SI units:

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

4.2 state the application and use of units of measurement of pressure and flow rate:

- pressure:
  - Bar/millibar
  - kPa
  - Psi
  - Metre head
- flow rate:
  - m3/s
  - l/s
  - kg/s

4.3 state how to carry out simple force and pressure calculations:

- simple force calculations
- pressure head
- simple pressure calculations:
  - static pressure
  - dynamic pressure

4.4 identify the relationship between velocity, pressure and flow rate in systems:

- effects of increasing/reducing pressure on velocity and flow rate
- effects of increasing/reducing pipe size on velocity and flow rate at constant pressure

4.5 identify the reasons why pipework restricts the flow of liquids and gases:

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

Unit 204 Understand how to apply scientific principles within mechanical engineering services

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

Assessment criteria

The learner can:

5.1 state the principles behind simple machines:

- mechanical advantage
- velocity ratio:
  - levers
  - wheel and axle
  - pulleys
  - screws

5.2 identify the principles of basic mechanics:

- theory of moments
- action & reaction
- centre of gravity
- equilibrium.

Unit 204 Understand how to apply scientific principles within mechanical engineering services

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

Assessment criteria

The learner can:

6.1 state the basic principles of electron flow theory:
- measurements of electrical flow
- material conductivity and resistance
- direct and alternating current

6.2 state the purpose and application of simple units of electrical measurement for use in the mechanical services industry:
- current (amps)
- voltage (volts)
- resistance (Ohms)
- power (watts)

6.3 state how to carry out simple electrical calculations:
- Ohm's Law
- power consumption of electrical circuits
- basic over-current protection device size
- voltage, current and resistance in series and parallel circuits

6.4 identify the requirements for earthing of electrical circuits.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Level: 2
Credit value: 40
UAN: A/602/2768

Unit aims

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

Learning outcomes

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

1. Know how to complete general site preparation work for MES systems
2. Be able to apply general site preparation techniques to install, test and decommission MES systems
3. Know how to implement general on site administration procedures required to install, test and decommission MES systems
4. Be able to apply general administration procedures required to install, test, maintain and decommission MES systems
5. Know how to prepare for fabricating, testing, maintaining and decommissioning of MES systems
6. Be able to apply preparation techniques to fabricate, test, maintain and decommission MES systems
7. Know how to fabricate MES systems
8. Be able to fabricate MES systems
9. Be able to maintain MES systems (Service and Maintenance learners only)
10. Know how to test MES systems
11. Be able to test MES systems
12. Know how to decommission MES systems
13. Be able to decommission MES systems

Guided learning hours

It is recommended **356** guided learning hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M7, M21, M25, M26

Endorsement of the unit by a sector or other appropriate body

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 1 Know how to complete general site preparation work for MES systems

Assessment criteria

The learner can:

1.1 identify and use appropriate sources of information when preparing for MES work activities, including:

- regulations and standards:
  - statutory regulations
  - codes of practice
  - industry standards
  - industry guides/good practice guides
- sources of information:
  - drawings, specifications and data
  - common types of MES drawing
  - common graphical symbols and abbreviations used on MES drawings
  - specifications and standards used to communicate information
  - coding used to identify main services within the MES sector
  - computers and Information Technology (IT) used in the MES sector
  - service and maintenance records, programmes, schedules and specifications
  - operating and maintenance manuals

1.2 define the preparatory work that is required for the work location in order to plan, install, decommission and test MES systems, to include:

- preparing work sites
- identifying and selecting materials and equipment
- installing systems and components
- maintaining and dealing with faults on systems and components
- decommissioning systems and components – temporary and permanent
- soundness testing systems and components
- commissioning systems and components

1.3 define the building construction/local site features which may impact upon the work required to install, decommission and test MES systems, including:

- building construction methods and materials used in the MES sector
- simple industrial/commercial building details
- main functions of the components that make up a simple building
- principal services required for a simple industrial/commercial building

1.4 state how to check for any pre-existing damage to customer/client property, such as:

- building wall/floor fabric
- appliances and components
- building décor and floor finishes

1.5 define the measures required to protect the building fabric/customer property, before and throughout completion of work on MES installations, including:

- use of dust sheets
- protection from flame damage
- protection of customer/client
- protection of appliances and components before and during work activities.

1.6 state the actions that should be taken to liaise with other persons during soundness testing, including:

- customers
- other site workers.

1.7 state the implications that suspension of an MES system can have on appropriate persons, including:

- customers
- other site workers.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 2 Be able to apply general site preparation techniques to install, test and decommission MES systems

Assessment criteria

The learner can:

2.1 check the safety of the work location in order for the work to safely proceed:

- safe access and exit
- immediate work location eg tripping hazards
- appropriate risk assessments/ method statements are available and worked to.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 3 Know how to implement general on site administration procedures required to install, test and decommission MES systems

Assessment criteria

The learner can:

3.1 state the procedures for reporting problems that could delay progress of the work

3.2 state the procedures for the ordering, requisitioning and checking of MES materials

3.3 state the procedures for the safe and secure storage of MES materials, tools and equipment in the workplace

3.4 state the methods used to ensure that customers are fully briefed on all aspects of the work programme.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 4 Be able to apply general administration procedures required to install, test, maintain and decommission MES systems

Assessment criteria

The learner can:

4.1 implement the procedures for the ordering, requisitioning and checking of MES materials

4.2 implement the procedures for the safe and secure storage of MES materials tools and equipment in the workplace.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 5 Know how to prepare for fabricating, testing, maintaining and decommissioning of MES systems

Assessment criteria

The learner can:

5.1 identify the drawings and specifications required to prepare for the fabrication of MES systems

5.2 identify the materials and fittings required to complete work and check them for damage, including materials for MES systems:

- pipe:
  - low carbon steel
  - stainless steel
  - galvanised steel
  - copper
  - ABS plastic
  - PEX plastic
  - polypropylene
  - polyethylene
  - insulation
- fittings:
  - capillary soldered fittings
  - compression fittings
  - threaded fittings
  - push fit fittings
  - fusion welded fittings
  - weld-on fittings
  - mechanical controls (eg valves)
  - crimped fittings

5.3 identify the hand and power tools required to complete work, including:

- general hand and power tools
- specialist tools used in the MES sector and their maintenance requirements:
  - power threading machines
  - hand power threading tools
  - crimping power tools
  - grinders
  - welding equipment
  - electric drills (110v and cordless)
  - pipe bending machines
  - pipe wrenches
  - pipe cutters
  - reamers

- chain wrenches
- general hand tools
- levels (including laser)
- core drills
- joint forming tools (mechanical groove)
- testing equipment

5.4 state the requirements for the safe use of general hand and power tools and specialist tools

5.5 state the requirements for tool maintenance including:

- cleaning
- servicing
- PAT testing
- sharpening
- calibration (gas welding regulators)

5.6 identify personal protective equipment relevant to the work activity.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 6 Be able to apply preparation techniques to fabricate, test, maintain and decommission MES systems

Assessment criteria

The learner can:

6.1 use drawings and specifications to prepare for the fabrication of MES systems

6.2 select the materials and fittings required to complete work and check them for damage, including materials for MES systems identified in:

- pipe:
  - low carbon steel
  - stainless steel
  - galvanised steel
  - copper
  - ABS plastic
  - PEX plastic
  - polypropylene
  - polyethylene
  - insulation
- fittings:
  - capillary soldered fittings
  - compression fittings
  - threaded fittings
  - push fit fittings
  - fusion welded fittings
  - weld-on fittings
  - mechanical controls (eg valves)
  - crimped fittings

6.3 select the hand and power tools required to complete work, including:

- general hand and power tools
- specialist tools used in the MES sector and their maintenance requirements:
  - power threading machines
  - hand power threading tools
  - crimping power tools
  - grinders
  - welding equipment
  - electric drills (110v and cordless)
  - pipe bending machines
  - pipe wrenches
  - pipe cutters
  - reamers

- chain wrenches
- general hand tools
- levels (including laser)
- core drills
- joint forming tools (mechanical groove)
- testing equipment

6.4 check that tools are safe to use

6.5 check that the tools have been correctly maintained including:

- cleaning
- servicing
- PAT testing
- sharpening
- calibration (gas welding regulators)

6.6 select Personal Protective Equipment relevant to the work activity.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 7 Know how to fabricate MES systems

Assessment criteria

The learner can:

7.1 state the industry requirements for:

- safe use of tools:
  - marking out
  - cutting
  - bending
  - jointing (mechanical, solvent & heating)
- tool maintenance:
  - cleaning
  - servicing
  - PAT testing
  - sharpening
  - calibration (gas welding regulators)

7.2 the methods and techniques for fabricating mess systems to industry standards and specifications including:

- measuring and marking out
- cutting
- bending, hydraulic and machine:
  - 90˚
  - off-set
  - passover

in copper and LCS:

- drilling and fixing

7.3 state the material jointing techniques on pipework using:

- mechanical methods:
  - bolting
  - compression pipe joints
  - crimped pipe joints
  - threaded pipe joints
- heat methods:
  - soft soldering
  - hard soldering
- solvent methods:
  - adhesives
  - anaerobic
  - solvent
- specialist jointing techniques:
  - push fit

- press fit
- crimping
- fusion welding

7.4 state the methods and techniques for using hand tools, power tools, drills and fixing devices for fixing to:

- materials:
  - wood
  - masonry
  - metal
- fixing devices:
  - nails
  - screws
  - heavy duty fixing devices

7.5 state the methods and techniques for fixing pipework using clips and brackets for the following materials identified in 5.2:

- low carbon steel
- stainless steel
- galvanised steel
- copper
- ABS plastic
- PEX plastic
- polypropylene
- polyethylene
- insulation

7.6 determine appropriate bracket spacing intervals in accordance with pipe diameter requirements for:

- horizontally mounted pipework in:
  - copper
  - plastic
  - stainless steel
  - LCS
- vertically mounted pipework in:
  - copper
  - plastic
  - stainless steel
  - LCS.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 8 Be able to fabricate MES systems

Assessment criteria

The learner can:

8.1 apply the industry requirements for:

- safe use of tools for :
  - marking out
  - cutting
  - bending
  - jointing (mechanical, solvent & heating)
- tool maintenance:
  - cleaning
  - servicing
  - PAT testing
  - sharpening
  - calibration (gas welding regulators)

8.2 fabricate MES systems to industry standards and specifications to include:

- measuring and marking out of items
- cutting
- bending, hydraulic and machine:
  - 90˚
  - off-set
  - passover

in copper and LCS:

- drilling and fixing

8.3 conduct material jointing techniques on pipework using:

- mechanical methods of items:
  - bolting
  - compression pipe joints
  - crimped pipe joints
  - threaded pipe joints
- heat methods:
  - soft soldering
  - hard soldering
- solvent methods:
  - adhesives
  - anaerobic
  - solvent
- specialist jointing techniques:
  - push fit

- press fit
- crimping
- fusion welding

8.4 select and use hand tools, power tools, drills and fixing devices for fixing to:

- wood
- masonry
- metal

8.5 fabricate a pipework section from one of the following MES systems:

- industrial and commercial including:
  - cold water
  - hot water
  - heating

8.6 apply fixings to vertically and horizontally mounted pipework in accordance with appropriate industry standards.

Unit 205 Understand and carry our site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 9 Be able to maintain MES systems (service and maintenance learners only)

Assessment criteria

The learner can:

9.1 implement routine maintenance procedures including, cleaning, greasing, washing, component replacement and testing on all of the following:

- float operated valves
- servicing valves
- terminal fittings
- pumps
- heat emitters
- heating controls.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 10 Know how to test MES systems

Assessment criteria

The learner can:

10.1 identify appropriate equipment for applying soundness tests to rigid and plastic pipework

10.2 state the procedure for completing a soundness test on rigid or plastic pipework systems in accordance with appropriate industry standards and record the soundness test procedure

10.3 explain the action that must be taken when inspection and testing reveals defects in MES systems, including:

- remedial work associated with leakage from systems.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 11 Be able to test MES systems

Assessment criteria

The learner can:

11.1 use appropriate equipment for applying a soundness test to rigid or plastic pipework systems

11.2 apply a soundness test to rigid or plastic pipework systems in accordance with appropriate industry standards and record the soundness test procedure

11.3 take appropriate action when inspection and testing reveals defects in MES systems, including:

- remedial work associated with leakage from systems.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 12 Know how to decommission MES systems

Assessment criteria

The learner can:

12.1 state the procedures for confirming that a pre-fabricated MES system will permit safe decommissioning for one of the following:

- industrial commercial, including:
  - cold water
  - hot water
  - heating

12.2 specify the procedures for conducting the decommissioning of MES systems for one of the following:

- industrial commercial, including:
  - cold water
  - hot water
  - heating.

Unit 205 Understand and carry out site preparation and pipework fabrication techniques for industrial and commercial systems

Outcome 13 Be able to decommission MES systems

Assessment criteria

The learner can:

13.1 check and confirm that the MES system will permit safe decommissioning, from one of the following:

- cold water
- hot water
- heating

13.2 conduct the decommissioning of pre-fabricated MES systems from one of the following:

- cold water
- hot water
- heating.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Level: 2
Credit value: 6
UAN: J/602/4927

Unit aims
This knowledge unit provides learning in the maintenance of industrial and commercial systems and covers the requirements of hot and cold water systems and their components.

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

1. Understand the working principles and layouts of industrial and commercial hot and cold water systems
2. Understand the legislative and organisational procedures for maintaining industrial and commercial hot and cold water systems, equipment and components
3. Understand the servicing requirements for industrial and commercial hot and cold water systems, equipment and components
4. Understand the maintenance requirements for industrial and commercial hot and cold water systems, equipment and components
5. Understand the procedures for carrying out tests on industrial and commercial hot and cold water systems, equipment and components
6. Understand the decommissioning procedures for industrial and commercial water systems, equipment and components

Guided learning hours
It is recommended **57** guided learning hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details for the relationship between the unit and relevant national occupational standards
SummitSkills NOS M7, M22, M23, M25, M26

Endorsement of the unit by a sector or other appropriate body
SummitSkills

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial hot and cold water systems

Assessment criteria

The learner can:

1.1 state the installation requirements of hot and cold water systems including:

- cold water:
  - storage (indirect)
  - non-storage (direct)
- hot water:
  - open vented
  - indirect
  - storage
  - unvented
  - secondary circulation
  - instantaneous

and including (relevant to hot or cold water applications):

- connections from mains to premises
- pipe sizes for all installation pipework
- cold water storage cistern capacities
- connection to cold water services
- hot water storage vessel capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting the following appliance types to hot and cold water systems, including:

- sanitary appliances:
  - sinks
  - wash basins
  - baths
  - WCs
  - showers
- industrial and commercial appliances:
  - hospital sanitary appliances
  - appliances for the disabled
- appliances specific to industrial and commercial premises (relevant to hot or cold water applications):
  - heating systems
  - chilled water
  - steam

- hot water heating boilers
- hot water storage vessels
- instantaneous hot water heaters

1.3 define the working principles of the following components contained within hot and cold water systems, including:

- storage cisterns
- F and E cisterns
- hot water storage vessels including high to low temperature calorifiers
- electric and gas water heaters
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- pressure reducing valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- circulating pumps (bronze)
- booster pumps
- line strainer
- temperature and pressure relief valve
- expansion vessels

1.4 confirm hot and cold water system layout requirements including the following components:

- storage cisterns
- F and E cisterns
- hot water storage vessels including high to low temperature calorifiers
- electric and gas water heaters
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- pressure reducing valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- circulating pumps (bronze)
- booster pumps
- line strainer
- temperature and pressure relief valve
- expansion vessels

including compliance with industry specifications and regulations.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 2 Understand the legislative and organisational procedures for maintaining industrial and commercial hot and cold water systems, equipment and components

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when maintaining water systems

2.2 state the documentation appropriate to the routine maintenance of hot and cold water systems:

- statutory regulations
- codes of practice
- industry specifications
- manufacturer's instruction
- organisational procedures

2.3 state appropriate persons whom it may be necessary to advise before a hot and cold water system is isolated in order to undertake maintenance work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 3 Understand the servicing requirements for industrial and commercial hot and cold water systems, equipment and components

Assessment criteria

The learner can:

3.1 state the routine maintenance procedures, which comply with industry requirements, for the following:

systems:

- cold water:
  - storage (indirect)
  - non –storage (direct)
- hot water:
  - open vented
  - indirect
  - storage
  - unvented
  - secondary circulation
  - instantaneous

components:

- storage cisterns
- F and E cisterns
- hot water storage vessels including high to low temperature calorifiers
- electric and gas water heaters
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- pressure reducing valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- circulating pumps (bronze)
- booster pumps
- line strainer
- temperature and pressure relief valve
- expansion vessels

3.2 list the range of materials required to carry out the routine maintenance of hot and cold water systems

3.3 list the range of tools and equipment required to carry out the routine maintenance of hot and cold water systems

3.4 state the records or reports that are required for routine maintenance activities

3.5 state the action to take when a system or component does not meet the performance specification.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 4 Understand the maintenance requirements for industrial and commercial hot and cold water systems, equipment and components

Assessment criteria

The learner can:

4.1 state the routine maintenance procedures required to restore or maintain system performance in accordance with industry specifications, for the following systems:

- cold water:
  - storage (indirect)
  - non –storage (direct)
- hot water:
  - open vented
  - indirect
  - storage
  - unvented
  - secondary circulation
  - instantaneous

4.2 define the specific tests required to complete the routine maintenance of systems including:

- hydrostatic pressure
- dynamic tests
- heat input

4.3 define the relative operating principles of gas, oil and solid fuel boilers

4.4 state the purpose and function of the following components in relation to hot and cold water systems:

- storage cisterns
- F and E cisterns
- hot water storage vessels including high to low temperature calorifiers
- electric and gas water heaters
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- pressure reducing valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- circulating pumps (bronze)
- booster pumps

- line strainer
- temperature and pressure relief valve
- expansion vessels

4.5 state the requirements for hot and cold water systems in terms of:

- safe operating pressures and temperatures
- lubricants and cleansing agents
- causes of corrosion, erosion and acidity
- methods of locating defects caused by corrosion, erosion and acidity
- colour coding for identification of pipework

4.6 state the requirements for completing records or reports for system maintenance activities

4.7 state the actions to take should a system or component fail to operate to specification.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 5 Understand the procedures for carrying out tests on industrial and commercial hot and cold water systems, equipment and components

Assessment criteria

The learner can:

5.1 identify the requirements of hot and cold water systems to confirm that they are ready to receive soundness tests to cover:

- pipework
- appliances
- components

5.2 define procedures for flushing and charging a hot and cold water system

5.3 state the procedures and equipment for establishing that input services adequately meet the water system requirements

5.4 state the actions that must be taken when inspection and testing reveals defects in hot and cold water systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 206 Understand industrial and commercial hot and cold water system maintenance techniques

Outcome 6 Understand the decommissioning procedures for industrial and commercial water systems, equipment and components

Assessment criteria

The learner can:

6.1 state the implications that the suspension of a water system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

6.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

6.3 identify work sequences for decommissioning a hot and water system following organisational procedures

6.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

6.5 state the action to take when normal emptying or shut off mechanisms for hot and cold water systems do not operate.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Level: 2
Credit value: 5
UAN: L/602/4928

Unit aims

This knowledge unit provides learning in the maintenance of industrial and commercial systems and covers the requirements of hot water heating systems and their components.

Learning outcomes

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

1. Understand the working principles and layouts of industrial and commercial heating systems.
2. Understand the legislative and organisational procedures for maintaining industrial and commercial heating systems, equipment and components
3. Understand the servicing requirements for industrial and commercial heating systems, equipment and components
4. Understand the maintenance requirements for industrial and commercial heating systems, equipment and components
5. Understand the procedures for carrying out tests on industrial and commercial heating systems, equipment and components
6. Understand the decommissioning procedures for industrial and commercial heating systems, equipment and components

Guided learning hours

It is recommended **45** guided learning hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M7, M21, M22, M23, M25, M26

Endorsement of the unit by a sector or other appropriate body

SummitSkills

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial heating systems

Assessment criteria

The learner can:

1.1 state the installation requirements of hot water heating systems including:

- low temperature hot water
- medium temperature hot water

and including where appropriate to the specific systems:

- pipe sizes for all installation pipework
- feed and expansion cistern capacities
- connection to cold water services
- hot water storage vessel capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting the following boiler types to heating systems, including:

- high efficiency
- modular
- steel shell
- biomass

1.3 define the working principles of all low and medium temperature hot water heating system components, including:

- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems
- energy management systems
- storage calorifiers
- non-storage calorifiers
- feed and expansion cisterns
- pressurisation units
- mechanical controls
- dosing pots
- drain taps
- motorised valves
- pumps/accelerators
- temperature and pressure relief valves
- expansion vessels

- industry specifications and regulations

1.4 confirm the system layout requirements for low and medium temperature hot water heating systems including:

- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems
- energy management systems
- storage calorifiers
- non-storage calorifiers
- feed and expansion cisterns
- pressurisation units
- mechanical controls
- dosing pots
- drain taps
- motorised valves
- pumps/accelerators
- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 2 Understand the legislative and organisational procedures for maintaining industrial and commercial heating systems, equipment and components

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when maintaining water systems

2.2 state the documentation appropriate to the routine maintenance of heating systems:

- statutory regulations
- codes of practice
- industry specifications
- manufacturer's instruction
- organisational procedures

2.3 state appropriate persons whom it may be necessary to advise before a heating system is isolated in order to undertake maintenance work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 3 Understand the servicing requirements for industrial and commercial heating systems, equipment and components

Assessment criteria

The learner can:

3.1 state the routine maintenance procedures, which comply with industry requirements, for the following:

- systems:
  - low temperature hot water
  - medium temperature hot water
- components:
  - hot water storage vessels
  - radiators
  - convector heaters, natural and assisted
  - panel heaters
  - ceiling coils
  - thermostatic control of heating systems
  - time control of heating systems
  - energy management systems
  - storage calorifiers
  - non-storage calorifiers
  - feed and expansion cisterns
  - pressurisation units
  - mechanical controls
  - dosing pots
  - drain taps
  - motorised valves
  - pumps/accelerators
  - temperature and pressure relief valves
  - expansion vessels
  - industry specifications and regulations

3.2 list the range of materials required to carry out the routine maintenance of heating systems

3.3 list the range of tools and equipment required to carry out the routine maintenance of heating systems

3.4 state the records or reports that are required for routine maintenance activities

3.5 propose what action to take when a system or component does not meet the performance specification.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 4 Understand the maintenance requirements for industrial and commercial heating systems, equipment and components

Assessment criteria

The learner can:

4.1 state the routine maintenance procedures required to restore or maintain system performance in accordance with industry specifications, for the following systems:
- low temperature hot water
- medium temperature hot water

4.2 define the relative operating principles of gas, oil and solid fuel boilers

4.3 state the purpose and function of the following components in relation to heating systems:
- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems
- energy management systems
- storage calorifiers
- non-storage calorifiers
- feed and expansion cisterns
- pressurisation units
- mechanical controls
- dosing pots
- drain taps
- motorised valves
- pumps/accelerators
- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations

4.4 state the requirements for heating systems in terms of:
- safe operating pressures and temperatures
- lubricants and cleansing agents
- causes of corrosion, erosion and acidity
- methods of locating defects caused by corrosion, erosion and acidity
- colour coding for identification of pipework

4.5 state the requirements for completing records or reports for system maintenance activities

4.6 state the actions to take should a system or component fail to operate to specification.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 5 Understand the procedures for carrying out tests on industrial and commercial heating systems, equipment and components

Assessment criteria

The learner can:

5.1 identify the requirements of heating systems to confirm that they are ready to receive soundness tests to cover:

- pipework
- appliances
- components

5.2 define procedures for flushing and charging a heating system

5.3 state the procedures and equipment for establishing that input services adequately meet the heating system requirements

5.4 state the actions that must be taken when inspection and testing reveals defects in heating systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 207 Understand industrial and commercial hot water heating system maintenance techniques

Outcome 6 Understand the decommissioning procedures for industrial and commercial heating systems, equipment and components

Assessment criteria

The learner can:

6.1 state the implications that the suspension of a heating system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

6.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

6.3 identify work sequences for decommissioning a heating system following organisational procedures

6.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

6.5 state the action to take when normal emptying or shut off mechanisms for heating systems do not operate.

Unit 208 Understand industrial and commercial heating system installation

Level: 2
Credit value: 3
UAN: M/602/2735

Unit aims

This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial heating systems and covers low temperature hot water, medium temperature and sealed heating systems.

Learning outcomes

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

1. Understand the working principles and layouts of industrial and commercial heating water systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial heating water systems
3. Understand the installation procedures for industrial and commercial heating systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial heating systems
5. Understand the decommissioning procedures for industrial and commercial hot water heating systems

Guided learning hours

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

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M7, M21, M25 and M26

Endorsement of the unit by a sector or other appropriate body

SummitSkills

Unit 208 Understand industrial and commercial heating system installation

Outcome 1 Understand the working principles and layouts of industrial and commercial heating water systems

Assessment criteria

The learner can:

1.1 state installation requirements for low and medium temperature hot water heating systems, including:

- pipe sizes for all installation pipework
- connections to cold water services
- cold water storage cistern capacities
- hot water storage vessel capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting all the following boiler types to hot water heating systems, including:

- high efficiency
- modular
- steel shell

1.3 define the working principles of all low and medium temperature hot water heating system components, including:

- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems
- energy management systems
- motorised valves
- pumps/accelerators
- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations

1.4 confirm the system layout requirements for low and medium temperature hot water heating systems including:

- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems
- energy management systems
- motorised valves
- pumps/accelerators

- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations.

Unit 208 Understand industrial and commercial heating system installation

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial heating water systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning hot water heating systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of hot water heating systems

2.3 state appropriate persons whom it may be necessary to advise before a hot water heating system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 208 Understand industrial and commercial heating system installation

Outcome 3 Understand the installation procedures for industrial and commercial heating systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

- systems:
  - low temperature hot water heating systems
  - medium temperature hot water heating systems
- components:
  - hot water storage vessels
  - radiators
  - convector heaters, natural and assisted
  - panel heaters
  - ceiling coils
  - thermostatic control of heating systems
  - time control of heating systems
  - energy management systems
  - motorised valves
  - pumps/accelerators
  - temperature and pressure relief valves
  - expansion vessels
  - industry specifications and regulations
- appliances:
  - high efficiency
  - modular
  - steel shell

3.2 define suitable methods for making pipework connections to:

- cold and hot water service pipework
- existing systems
- boilers
- hot water storage vessels
- system controls.

Unit 208 Understand industrial and commercial heating system installation

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial heating systems

Assessment criteria

The learner can:

4.1 identify the requirements of low and medium temperature hot water heating systems to confirm that they are ready to receive soundness tests to cover:

- pipework
- appliances
- components

4.2 define procedures for flushing and charging a hot water heating system

4.3 state the procedures and equipment for establishing that input services adequately meet low and medium temperature heating system requirements

4.4 state the actions that must be taken when inspection and testing reveals defects in low and medium temperature heating systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 208 Understand industrial and commercial heating system installation

Outcome 5 Understand the decommissioning procedures for industrial and commercial hot water heating systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a hot water heating system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning a hot water heating system following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for hot water heating systems do not operate.

Unit 209 Understand industrial and commercial chilled water system installation

Level: 2
Credit value: 3
UAN: F/602/2738

Unit aims

This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial chilled water systems and covers air conditioning systems, fan coil units, chilled beams, air handling units and heat rejection systems.

Learning outcomes

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

1. Understand the working principles and layouts of industrial and commercial chilled water systems.
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial chilled water systems
3. Understand the installation procedures for industrial and commercial chilled water systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial chilled water systems
5. Understand the decommissioning procedures for industrial and commercial chilled water systems

Guided learning hours

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

Details for the relationship between the unit and relevant national occupational standards

SummitSkills NOS M7, M21, M25 and M26

Endorsement of the unit by a sector or other appropriate body

SummitSkills

Unit 209 Understand industrial and commercial chilled water system installation

Outcome 1 Understand the working principles and layouts of industrial and commercial chilled water systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all the following chilled water systems:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems

including:

- pipe sizes for all installation pipework
- connections to cold water services
- cold water storage cistern capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting all the following appliance types to chilled water systems:

- refrigeration plant
- fan coil units
- air conditioning plant
- heat rejection units
- air handling units
- heat exchangers
- chilled beams

1.3 define the working principles of all the following chilled water:

- systems:
  - air conditioning systems
  - chilled beams
  - fan coil units
  - air handling units
  - heat rejection systems
- components/controls:
  - isolation valves
  - three & four port valves
  - temperature & humidity stats
  - calorifiers
  - actuators
  - RPZ valves
  - pumps

- industry specifications and regulations

1.4 confirm the system layout requirements for all of the following chilled water:

- systems:
  - air conditioning systems
  - chilled beams
  - fan coil units
  - air handling units
  - heat rejection systems
- components/controls:
  - isolation valves
  - three & four port valves
  - temperature & humidity stats
  - calorifiers
  - actuators
  - RPZ valves
  - pumps
  - industry specifications and regulations.

Unit 209 Understand industrial and commercial chilled water system installation

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial heating water systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning chilled water systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of chilled water systems

2.3 state appropriate persons whom it may be necessary to advise before a chilled water system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 209 Understand industrial and commercial chilled water system installation

Outcome 3 Understand the installation procedures for industrial and commercial chilled water systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

- systems:
  - air conditioning systems
  - chilled beams
  - fan coil units
  - air handling units
  - heat rejection systems
- components/controls:
  - isolation valves
  - three & four port valves
  - temperature & humidity stats
  - calorifiers
  - actuators
  - RPZ valves
  - pumps
  - industry specifications and regulations

3.2 define suitable methods for making pipework connections to:

- primary cooling
- existing pipework
- appliances
- water main.

Unit 209 Understand industrial and commercial chilled water system installation

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial chilled water systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following chilled water systems to confirm that they are ready to receive soundness tests to cover pipework, appliances and components:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems

4.2 define procedures for flushing and charging any one of the following chilled water systems:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems

4.3 state the procedures and equipment for establishing that input services adequately meet the chilled water system requirements

4.4 state the procedure for applying a soundness test to a chilled water system in accordance with appropriate industry standards and record the soundness test procedure

4.5 state the actions that must be taken when inspection and testing reveals defects in all chilled water systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 209 Understand industrial and commercial chilled water system installation

Outcome 5 Understand the decommissioning procedures for industrial and commercial chilled water systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a chilled water system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning a chilled water system following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for chilled water systems do not operate.

Unit 210 Apply safe working practices in building services engineering working environment

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

Unit aims
This performance unit provides job competence in a basic range of level 2 health and safety requirements through formal assessment in the workplace.

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

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

Guided learning hours
It is recommended **4** guided learning hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details for the relationship between the unit and relevant national occupational standards
SummitSkills NOS M1

Endorsement of the unit by a sector or other appropriate body
SummitSkills

Unit 210 Apply safe working practices in building services engineering working environment

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

Assessment criteria

the learner can:

1.1 demonstrate that appropriate personal protective equipment is used throughout work activities

1.2 ensure that health & safety precautions are in place:

- first aid kit provision
- fire extinguisher provision

1.3 demonstrate safe manual lifting techniques.

Unit 210 Apply safe working practices in building services engineering working environment

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

Assessment criteria

The learner can:

2.1 use risk assessments to identify safe methods of working at height

2.2 check access equipment for safe condition prior to use

2.3 perform the safe erection of access equipment

2.4 demonstrate the safe use of access equipment.

Unit 210 Apply safe working practices in building services engineering working environment

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

Assessment criteria

The learner can:

3.1 carry out a check of the work location for health and safety hazards

3.2 verify that access and exit routes to and from the immediate work location are safe and free from obstructions

3.3 demonstrate safe working practices when working with heat producing equipment.

Unit 210 Apply safe working practices in building services engineering working environment

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

Assessment criteria

The learner can:

4.1 demonstrate methods of recording accidents in the accident book in accordance with company procedures

4.2 demonstrate methods of reporting hazards and accidents in accordance with company procedures.

Unit 211 Install industrial and commercial heating and ventilation ductwork

Level: 2
Credit value: 4
UAN: M/602/2721

Unit aims
This performance unit confirms job competence at Level 2 in the installation and testing of industrial and commercial ductwork systems, including the requirements for supply, extract, kitchen extraction and low/medium/high pressure/velocity air systems and their components.

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

1. Be able to complete preparation work for rectangular, circular or flat oval ductwork systems
2. Be able to install industrial and commercial rectangular, circular or flat oval ductwork systems
3. Be able to complete soundness tests on industrial and commercial rectangular, circular or flat oval ductwork systems

Guided learning hours
It is recommended **4** guided learning hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details for the relationship between the unit and relevant national occupational standards
SummitSkills NOS M7, M21, M25

Endorsement of the unit by a sector or other appropriate body
SummitSkills

Assessment
In accordance with the above assessment strategy, this *performance unit* will assess performance based learning outcomes by utilising practical activities in a real working environment, for at least 3 ductwork systems (must include rectangular and circular/flat oval ductwork systems) at a minimum of two separate work locations and on a minimum of two occasions as determined by the Awarding Organisations.

Unit 211 Install industrial and commercial heating and ventilation ductwork

Outcome 1 Be able to complete preparation work for rectangular, circular or flat oval ductwork systems

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for the installation of one of the following rectangular, circular or flat oval ductwork systems:

- supply
- extract
- kitchen extract
- low, medium and high pressure/velocity air systems

job information and documentation including:

- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

1.3 use job information and documentation to ensure that the following are fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- customers/clients
- other site workers
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work, from at least one of the following:

- customers/clients
- other site workers
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features, should it exist, and report to job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the materials needed to complete the job are free from damage and report any defects to a supervisor or line manager. From materials for rectangular, circular and flat oval ductwork which include and any one from:

- stainless steel
- galvanised steel
- aluminium

1.10 complete preparatory work for the installation of rectangular, circular or flat ductwork systems to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for installation activities
- confirmation of secure site storage for tools, equipment, materials and components
- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 211 Install industrial and commercial heating and ventilation ductwork

Outcome 2 Be able to install industrial and commercial rectangular, circular or flat oval ductwork systems

Assessment criteria

The learner can:

2.1 confirm job information appropriate to the installation process is available

2.2 demonstrate that materials, tools and equipment necessary for the installation of rectangular, circular or flat oval ductwork systems are:

- available as required
- safely and securely stored
- meet industry requirements
- fit for intended purpose

2.3 install rectangular and circular or flat oval ductwork in one of the following materials:

- stainless steel
- galvanised steel
- aluminium

for the following systems:

- supply
- extract

2.4 complete jointing for rectangular, circular or flat oval ductwork including:

- flanges
- slip joints
- methods of sealing joints

to industry specifications

2.5 position and fix a minimum of one small air handling unit, one fan, and at least four of the following components:

- attenuator
- heater / filter / cooler batteries
- fan coil units
- variable air volume units
- regulating/ motorised dampers
- fire dampers
- kitchen hoods and grease filters
- access doors
- terminal unit/grilles/diffusers

to industry specifications

2.6 position and fix appropriate hangers or supports for rectangular, circular or flat oval ductwork systems installations for:

- horizontally mounted ductwork
- vertically mounted ductwork

2.7 perform connections for rectangular, circular or flat oval ductwork to:

- small air handling units or fans

- building openings

2.8 demonstrate that all aspects of the installation process conforms with industry requirements, including:

- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

2.9 apply methods of working to ensure that any damage to customer/client property and building features is avoided during work activities

2.10 report problems which may affect the progress of the installation to the immediate job supervisor or line manager.

Unit 211 Install industrial and commercial heating and ventilation ductwork

Outcome 3 Be able to complete soundness tests on industrial and commercial rectangular, circular or flat oval ductwork systems

Assessment criteria

The learner can:

3.1 conduct visual inspections of rectangular, circular or flat oval supply systems and confirm
3.2 compliance with industry requirements:
3.3 confirm that the ductwork system is ready to receive soundness tests
3.4 apply a soundness test to a rectangular, circular or flat oval supply system in accordance with industry standards, guides and good practice guide
3.5 complete test sheet documentation in accordance with appropriate industry specifications/guides
3.6 conduct checks to confirm:

- system cleanliness
- un-commissioned systems and components cannot be activated.

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Level: 2
Credit value: 9
UAN: J/602/2711

Unit aim
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial rectangular ductwork and covers the requirements for supply, extract, kitchen extraction and low/medium/high pressure/velocity air systems and their components.

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

1. Understand the working principles and layouts of industrial and commercial rectangular ductwork systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial rectangular ductwork systems
3. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial rectangular ductwork systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial rectangular ductwork systems
5. Understand the decommissioning procedures for industrial and commercial rectangular ductwork systems

Guided learning hours
It is recommended that **75** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial rectangular ductwork systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all of the following rectangular ductwork systems:

- supply
- extract
- kitchen extract
- low, medium and high pressure/velocity air

including:

- identifying ductwork sizes from drawings
- factors to determine system selection
- relevant specifications and guidelines

1.2 state the purpose of all the following components within a rectangular ductwork system:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- heater / filter / cooler batteries
- fan coil units
- variable air volume units
- regulating/ motorised dampers
- fire dampers
- kitchen hoods and grease filters
- plenum boxes
- access doors
- terminal units/grilles/diffusers

1.3 state the requirements for connecting small air handling units and fans to rectangular ductwork systems.

1.4 confirm the system layout requirements from drawings and specifications for all of the following rectangular ductwork:

- systems:
  - supply
  - extract
  - kitchen extract
  - low, medium and high pressure/velocity air
- components:
  - flexible ducts
  - air handling units
  - fans, axial and centrifugal
  - attenuator
  - heater / filter / cooler batteries
  - fan coil units
  - variable air volume units
  - regulating/ motorised dampers
  - fire dampers
  - kitchen hoods and grease filters
  - plenum boxes
  - access doors
  - terminal units/grills/diffusers.

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial rectangular ductwork systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning rectangular ductwork systems

2.2 identify the appropriate codes of practice and industry recommendations relevant to the installation, testing and decommissioning of rectangular ductwork systems

2.3 state appropriate persons whom it may be necessary to advise before a rectangular ductwork system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons during:

- installation
- testing
- decommissioning of rectangular ductwork system.

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial rectangular ductwork systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following rectangular ductwork:

- systems:
  - supply
  - extract
  - kitchen extract
  - low, medium and high pressure/velocity air
- components:
  - flexible ducts
  - air handling units
  - fans, axial and centrifugal
  - attenuator
  - heater / filter / cooler batteries
  - fan coil units
  - variable air volume units
  - regulating/ motorised dampers
  - fire dampers
  - kitchen hoods and grease filters
  - plenum boxes
  - access doors
  - terminal units/grills/diffusers

3.2 identify from drawings and specifications the appropriate materials and components required to complete the work activities

3.3 identify from industry specifications the methods used for jointing rectangular ductwork systems including:

- expansion joints
- flanges
- slip joints
- methods of sealing joints

3.4 state one specific method for making ductwork connections to:

- small air handling units and fans
- building openings

3.5 identify a minimum of two types of hangers or supports for rectangular ductwork manufactured in galvanised steel

3.6 state the recommended support intervals for:

- horizontally mounted rectangular ductwork
- vertically mounted rectangular ductwork.

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial rectangular ductwork systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following rectangular ductwork systems to confirm that they are ready to receive soundness tests:

- supply
- low, medium and high pressure/velocity air

4.2 state the procedure for carrying out a soundness test on a rectangular ductwork system

4.3 state the actions that must be taken when testing reveals leakage in rectangular ductwork systems

4.4 state the information that would be required to complete test sheet documentation.

Unit 212 Understand industrial and commercial rectangular ductwork installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial rectangular

Assessment criteria

The learner can:

5.1 state the implications that shutting down a rectangular ductwork system can have on other person(s), including:

- customers/clients
- other site workers

5.2 identify the safe procedures and equipment for handling and removal of rectangular ductwork system materials including mechanical and manual handling requirements

5.3 state the procedures required to prevent the inadvertent operation of the installed system

5.4 state the action to take when normal shut off mechanisms for rectangular ductwork systems do not operate.

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Level: 2
Credit value: 9
UAN: L/602/2712

Unit aims

This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial circular or flat oval ductwork and covers the requirements for supply, extract, kitchen extraction and low/medium/high pressure/velocity air systems and their components.

Learning outcomes

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

1. Understand the working principles and layouts of industrial and commercial circular or flat oval ductwork systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial circular or flat oval ductwork systems
3. Understand the installation procedures for industrial and commercial circular or flat oval ductwork systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial circular or flat oval ductwork systems
5. Understand the decommissioning procedures for industrial and commercial circular or flat oval ductwork systems

Guided learning hours

It is recommended that **75** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body

SummitSkills

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial circular or flat oval ductwork systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all of the following circular or flat oval ductwork systems:

- supply
- extract
- kitchen extract
- low, medium and high pressure/velocity air

including:

- identifying ductwork sizes from drawings
- factors to determine system selection
- relevant specifications and guidelines

1.2 state the purpose of all the following components within a circular or flat oval ductwork system:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- heater / filter / cooler batteries
- fan coil units
- variable air volume units
- regulating/ motorised dampers
- fire dampers
- kitchen hoods and grease filters
- plenum boxes
- access doors
- terminal units/grilles/diffusers

1.3 state the requirements for connecting small air handling units and fans to circular or flat oval ductwork systems

1.4 confirm the system layout requirements from drawings and specifications for all of the following circular or flat oval ductwork:

- systems:
  - supply
  - extract
  - kitchen extract
  - low, medium and high pressure/velocity air
- components:
  - flexible ducts
  - air handling units
  - fans, axial and centrifugal
  - attenuator
  - heater / filter / cooler batteries
  - fan coil units
  - variable air volume units
  - regulating/ motorised dampers
  - fire dampers
  - kitchen hoods and grease filters
  - plenum boxes
  - access doors
  - terminal units/grilles/diffusers.

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial circular or flat oval ductwork systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning circular or flat oval ductwork systems

2.2 identify the appropriate codes of practice and industry recommendations relevant to the installation, testing and decommissioning of circular or flat oval ductwork systems

2.3 state appropriate persons whom it may be necessary to advise before a circular or flat oval ductwork system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons during:

- installation
- testing
- decommissioning of circular or flat oval ductwork systems.

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial circular or flat oval ductwork systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following circular or flat oval ductwork:

- systems:
  - supply
  - extract
  - kitchen extract
  - low, medium and high pressure/velocity air
- components:
  - flexible ducts
  - air handling units
  - fans, axial and centrifugal
  - attenuator
  - heater / filter / cooler batteries
  - fan coil units
  - variable air volume units
  - regulating/ motorised dampers
  - fire dampers
  - kitchen hoods and grease filters
  - plenum boxes
  - access doors
  - terminal units/grilles/diffusers

all to industry specifications

3.2 identify from drawings and specifications the appropriate materials and components required to complete the work activities

3.3 identify from industry specifications the methods used for jointing circular or flat oval ductwork systems including:

- expansion joints
- flanges
- slip joints
- methods of sealing joints

3.4 state one specific method for making ductwork connections to:

- small air handling units and fans
- building openings

3.5 identify a minimum of two types of hangers or supports for circular or flat oval ductwork manufactured in galvanised steel

3.6 state the recommended support intervals for:

- horizontally mounted circular or flat oval ductwork

- vertically mounted circular or flat oval ductwork.

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial circular or flat oval ductwork systems

Assessment criteria

The learner can:

4.1 identify the requirements for the following circular or flat oval ductwork systems to confirm that they are ready to receive soundness tests:

- supply
- low, medium and high pressure/velocity air

4.2 state the procedure for carrying out a soundness test on a circular or flat oval ductwork system

4.3 state the actions that must be taken when testing reveals leakage in circular or flat oval ductwork systems

4.4 state the information that would be required to complete test sheet documentation.

Unit 213 Understand industrial and commercial circular and flat oval ductwork installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial circular or flat oval ductwork systems

Assessment criteria

The learner can:

5.1 state the implications that shutting down a circular or flat oval ductwork system can have on other person(s), including:

- customers/clients
- other site workers

5.2 identify the safe procedures and equipment for handling and removal of circular or flat oval ductwork system materials including mechanical and manual handling requirements

5.3 state the procedures required to prevent the inadvertent operation of the installed system

5.4 state the action to take when normal shut off mechanisms for circular or flat oval systems do not operate.

Unit 214 Understand industrial and commercial air handling unit installation techniques

Level: 2
Credit value: 4
UAN: R/602/2713

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial air handling units.

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

1. Understand the working principles and layouts of industrial and commercial air handling units
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial air handling units
3. Understand the installation procedures for industrial and commercial air handling units
4. Understand the procedures for carrying out a soundness test on industrial and commercial air handling units
5. Understand the decommissioning procedures for industrial and commercial air handling units

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 214 Understand industrial and commercial air handling unit installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial air handling units

Assessment criteria

The learner can:

1.1 state the installation requirements for the following air handling units:

- high and low velocity systems
- constant and variable volume systems:
  - primary (fresh air) air plant for fan-coil, induction and room heat pump systems
  - supply and extract air plant for single-duct, dual-duct and multi-zone systems
  - special filtration for operating theatres, museums or clean rooms
  - energy/heat recovery for industrial application, and for very quiet applications such as concert halls
- units which may be accommodated in plant rooms or external to the building served, typically a roof location

including:

- sizes for all installation ductwork
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting appliances to air handling units including manufacturers units

1.3 define the working principles of the following air handling components and controls

- mechanical, moving non-moving parts
- electrical
- motors
- pumps
- humidifiers
- filters

1.4 confirm the system layout requirements for air handling unit:

systems:

- high and low velocity systems
- constant and variable volume systems:
  - primary (fresh air) air plant for fan-coil, induction and room heat pump systems
  - supply and extract air plant for single-duct, dual-duct and multi-zone systems
  - special filtration for operating theatres, museums or clean rooms
  - energy/heat recovery for industrial application, and for very quiet applications such as concert halls
- units which may be accommodated in plant rooms or external to the building served, typically a roof location

components:

- mechanical, moving non-moving parts
- electrical
- motors
- pumps
- humidifiers

- filters.

Unit 214 Understand industrial and commercial air handling unit installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial air handling units

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning air handling units

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of air handling units

2.3 state appropriate persons whom it may be necessary to advise before an air handling system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 214 Understand industrial and commercial air handling unit installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial air handling units

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for fixing all the following air handling unit:

systems:

- high and low velocity systems
- constant and variable volume systems:
  - primary (fresh air) air plant for fan-coil, induction and room heat pump systems
  - supply and extract air plant for single-duct, dual-duct and multi-zone systems
  - special filtration for operating theatres, museums or clean rooms
  - energy/heat recovery for industrial application, and for very quiet applications such as concert halls
- units which may be accommodated in plant rooms or external to the building served, typically a roof location

components:

- mechanical, moving non-moving parts
- electrical
- motors
- pumps
- humidifiers
- filters

all to industry specification and regulations

3.2 state the techniques used for joining to air handling units using:

- specific joints for circular or flat oval ductwork eg taped, sleeved or push-fit (self fit)
- sealing methods
- flexible connections
- expansion joints

3.3 define suitable methods for connecting air handling units to:

- pipework
- ductwork

3.4 state the recommended fixing methods for air handling units.

Unit 214 Understand industrial and commercial air handling unit installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on individual and commercial air handling units

Assessment criteria

The learner can:

4.1 identify the requirements of all the following air handling unit systems to confirm that they are ready to receive soundness tests:

- high and low velocity systems
- constant and variable volume systems:
  - primary (fresh air) air plant for fan-coil, induction and room heat pump systems
  - supply and extract air plant for single-duct, dual-duct and multi-zone systems
  - special filtration for operating theatres, museums or clean rooms
  - energy/heat recovery for industrial application, and for very quiet applications such as concert halls
- units which may be accommodated in plant rooms or external to the building served, typically a roof location

4.2 define procedures for cleaning an air handling unit

4.3 state the procedure for carrying out a soundness test on an air handling unit

4.4 state the actions that must be taken when inspection and testing reveals defects in an air handling unit installation systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective components
- remedial work associated with leakage from air handling units.

Unit 214 Understand industrial and commercial air handling unit installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial air handling units

Assessment criteria

The learner can:

5.1 state the implications that the suspension of an air handling unit system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning an air handling unit following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal shut off mechanisms for circular or flat oval systems do not operate.

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Level: 2
Credit value: 4
UAN: D/602/2715

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial plastic ductwork and covers the requirements for supply, extract and low/medium/high pressure/velocity air systems and their components.

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

1. Understand the working principles and layouts of industrial and commercial plastic ductwork systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial plastic ductwork systems
3. Understand the installation procedures for industrial and commercial plastic ductwork systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial plastic ductwork systems
5. Understand the decommissioning procedures for industrial and commercial plastic ductwork systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial plastic ductwork systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all of the following plastic ductwork systems:

- supply
- extract
- low, medium and high pressure/velocity air

including:

- identifying ductwork sizes from drawings
- factors to determine system selection
- relevant specifications and guidelines

1.2 state the purpose of all the following components within a plastic ductwork system:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- heater / filter / cooler batteries
- regulating/ motorised dampers
- fire dampers
- plenum boxes
- access doors
- terminal units/grills/diffusers

1.3 state the requirements for connecting small air handling units and fans to plastic ductwork systems

1.4 confirm the system layout requirements from drawings and specifications for supply and extract plastic ductwork systems and the following components:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- heater / filter / cooler batteries
- regulating/ motorised dampers
- fire dampers
- plenum boxes
- access door.

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial plastic ductwork systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning plastic ductwork systems

2.2 identify the appropriate codes of practice and industry recommendations relevant to the installation, testing and decommissioning of plastic ductwork systems

2.3 state appropriate persons whom it may be necessary to advise before a plastic ductwork system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons during:

- installation
- testing
- decommissioning of plastic ductwork systems.

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial plastic ductwork systems

Assessment criteria

The Learner can:

3.1 state the installation and fixing procedures for supply and extract plastic ductwork systems and the following components:

- flexible ducts
- small air handling units
- fans, axial and centrifugal
- attenuator
- heater / filter / cooler batteries
- regulating/ motorised dampers
- fire dampers
- plenum boxes
- access doors
- terminal units/grills/diffusers

to industry specifications

3.2 identify from drawings and specifications the appropriate materials and components required to complete the work activities

3.3 identify from industry specifications the methods used for jointing plastic ductwork systems including:

- flanged
- socket and spigot
- sealants and gaskets
- hot air welding
- expansion joints

3.4 state one specific method for making ductwork connections to:

- small air handling units
- building openings

3.5 identify a minimum of two types of hangers or supports for plastic ductwork

3.6 state the recommended support intervals for:

- horizontally mounted plastic ductwork
- vertically mounted plastic ductwork.

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial plastic ductwork systems

Assessment criteria

The learner can:

4.1 identify the requirements of plastic ductwork supply systems to confirm that they are ready to receive soundness tests to cover ductwork, appliances and components

4.2 state the procedure for carrying out a soundness test on a plastic ductwork system

4.3 state the actions that must be taken when testing reveals leakage in plastic ductwork systems

4.4 state the information that would be required to complete test sheet documentation.

Unit 215 Understand industrial and commercial plastic ductwork installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial plastic ductwork systems

Assessment criteria

The learner can:

5.1 state the implications that shutting down a plastic system can have on other person(s), including:

- customers/clients
- other site workers

5.2 identify the safe procedures and equipment for handling and removal of plastic ductwork system materials including mechanical and manual handling requirements

5.3 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.4 state the action to take when normal shut off mechanisms for plastic ductwork systems do not operate.

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Level: 2
Credit value: 4
UAN: H/602/2716

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial fire rated ductwork and covers the requirements for supply and extract air systems and their components.

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

1. Understand the working principles and layouts of industrial and commercial fire rated ductwork systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial fire rated ductwork systems
3. Understand the installation procedures for industrial and commercial fire rated ductwork systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial fire rated ductwork systems
5. Understand the decommissioning procedures for industrial and commercial fire rated ductwork systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial fire rated ductwork systems

Assessment criteria

The learner can:

1.1 state the installation requirements for supply and extract fire rated ductwork systems in:

- car parks
- stair wells
- other fire protected areas

including:

- identifying ductwork sizes from drawings
- factors to determine system selection
- relevant specifications and guidelines

1.2 state the requirements for connecting small air handling units and fans to fire rated ductwork systems

1.3 state the purpose of all the following components within a fire rated ductwork system:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- regulating/ motorised dampers
- fire dampers
- access doors
- grilles/louvres

1.4 confirm the system layout requirements from drawings and specifications for supply and extract fire rated ductwork systems in:

- car parks
- stair wells
- other fire protected areas

1.5 confirm the system layout requirements from drawings and specifications for all the following fire rated ductwork components:

- flexible ducts
- air handling units
- fans, axial and centrifugal
- attenuator
- regulating/ motorised dampers
- fire dampers
- access doors
- grilles/louvres.

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial fire rated ductwork systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning fire rated ductwork systems

2.2 identify the appropriate codes of practice and industry recommendations relevant to the installation, testing and decommissioning of fire rated ductwork systems

2.3 state appropriate persons whom it may be necessary to advise before a fire rated ductwork system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons during:

- installation
- testing
- decommissioning of fire rated ductwork systems.

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial fire rated ductwork systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for supply and extract fire rated ductwork systems and the following components:

- flexible ducts
- small air handling units
- fans, axial and centrifugal
- attenuator
- regulating/ motorised dampers
- fire dampers
- access doors
- grilles/louvres

to industry specifications

3.2 identify from drawings and specifications the appropriate materials and fittings required to complete the work activities

3.3 identify from industry and manufacturer's specifications the methods to be used for jointing fire rated ductwork systems

3.4 state one specific method for making ductwork connections to:

- small air handling units and fans
- building openings

in accordance with manufacturer's instructions

3.5 identify a minimum of two types of hangers or supports for fire rated ductwork manufactured in galvanised steel

3.6 state the recommended support intervals for:

- horizontally mounted fire rated ductwork
- vertically mounted fire rated ductwork.

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial fire rated ductwork systems

Assessment criteria

The learner can:

4.1 identify the requirements of fire rated ductwork systems to confirm that they are ready to receive soundness tests

4.2 state the procedure for carrying out a soundness test on a fire rated ductwork system

4.3 state the actions that must be taken when testing reveals leakage in fire rated ductwork systems

4.4 state the information that would be required to complete test sheet documentation.

Unit 216 Understand industrial and commercial fire rated ductwork installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial fire rated ductwork systems

Assessment criteria

The learner can:

5.1 state the implications that shutting down a fire rated system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures and equipment for handling and removal of fire rated ductwork system materials including mechanical and manual handling requirements

5.3 state the procedures required to prevent the inadvertent operation of the installed system

5.4 state the action to take when normal shut off mechanisms for fire rated systems do not operate.

Unit 217 Understand industrial and commercial local exhaust ventilation system installation techniques

Level: 2
Credit value: 4
UAN: M/602/2718

Unit aims

This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial local exhaust ventilation systems and covers the requirements for ducted systems serving fume and dust extraction systems and their components.

Learning outcomes

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

1. Understand the working principles and layouts of industrial and commercial local exhaust ventilation systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial local exhaust ventilation systems
3. Understand the installation procedures for industrial and commercial local exhaust ventilation systems
4. Understand the decommissioning procedures for industrial and commercial local exhaust ventilation systems

Guided learning hours

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

Details of the relationship between the unit and relevant national standards

SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body

SummitSkills

Unit 217 Understand industrial and commercial local exhaust ventilation system installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial local exhaust ventilation systems

Assessment criteria

The learner can:

1.1 state the installation requirements for the following local exhaust ventilation types:
- ducted systems serving fume and dust extraction applications including:
  - identifying ductwork sizes from drawings
  - factors to determine system selection
  - relevant specifications and guidelines

1.2 state the requirements for connecting the following components to local exhaust ventilation systems:
- rectangular and circular ductwork components including flexible ducts
- manufacturer's units
- laboratory fume cupboards
- ventilated hoods, enclosures and work stations
- storage cabinets

1.3 state the purpose of all of the following local exhaust ventilation components:
- filters
- fume and dust extraction ductwork
- fume and dust extraction fans

1.4 confirm the system layout requirements from drawings and specifications for all of the following local exhaust ventilation:
- systems:
  - ducted systems serving fume and dust extraction applications
- components:
  - filters
  - fume and dust extraction ductwork
  - fume and dust extraction fans.

Unit 217 Understand industrial and commercial local exhaust ventilation system installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial local exhaust ventilation systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning local exhaust ventilation systems

2.2 identify the appropriate codes of practice and industry recommendations relevant to the installation, testing and decommissioning of local exhaust ventilation systems

2.3 state appropriate persons whom it may be necessary to advise before a local exhaust ventilation system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons during:

- installation
- testing
- decommissioning of local exhaust ventilation systems.

Unit 217 Understand industrial and commercial local exhaust ventilation system installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial local exhaust ventilation systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for the following local exhaust ventilation:

- systems:
  - ducted systems serving fume and dust extraction applications
- components:
  - filters
  - fume and dust extraction ductwork
  - fume and dust extraction fans

to industry specifications

3.2 identify from drawings and specifications the appropriate materials and fittings required to complete the work activities

3.3 identify from job specifications the methods for connecting ductwork to local exhaust ventilation system components.

Unit 217 Understand industrial and commercial local exhaust ventilation system installation techniques

Outcome 4 Understand the decommissioning procedures for industrial and commercial local exhaust ventilation systems

Assessment criteria

The learner can:

4.1 state the implications that shutting down a local exhaust ventilation system can have on other person(s), including:

- customers/clients
- other site workers

4.2 identify the safe procedures and equipment for handling and removal including contaminated local exhaust ventilation system ductwork materials including mechanical and manual handling requirements

4.3 state the decommissioning procedures required to prevent the inadvertent operation of the local exhaust ventilation system

4.4 state the action to take when normal shut off mechanisms for local exhaust ventilation systems do not operate.

Unit 221 Understand industrial and commercial air system maintenance techniques

Level: 2
Credit value: 5
UAN: R/602/4929

Unit aims
This knowledge unit provides learning in the maintenance of industrial and commercial systems and covers the requirements of air systems and their components including; air conditioning systems, chilled beams, fan coil units, air handling units, heat rejection and recovery systems.

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

1. Understand the working principles and layouts of industrial and commercial air systems
2. Understand the legislative and organisational procedures for maintaining industrial and commercial air systems, equipment and components
3. Understand the servicing requirements for industrial and commercial air systems, equipment and components
4. Understand the maintenance requirements for industrial and commercial air systems, equipment and components
5. Understand the procedures for carrying out tests on industrial and commercial air systems, equipment and components
6. Understand the decommissioning procedures for industrial and commercial air systems, equipment and components

Guided learning hours
It is recommended that **45** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21,M22, M25, M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial air systems

Assessment criteria

The learner can:

1.1 state the installation requirements of air systems including:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems
- heat recovery systems

and including where appropriate to the specific systems:

- pipe sizes for all installation pipework
- duct sizes for all installations
- connection to cold water services
- fans
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting the following appliance types to air systems, including:

- refrigeration plant
- fan coil units
- air conditioning plant
- constant volume unit
- induction unit
- heat rejection units
- air handling units
- heat exchangers
- chilled beams

1.3 define the working principles of all air system components, including:

- isolation valves
- three & four port valves
- temperature & humidity stats
- registers and grilles
- actuators
- RPZ valves
- pumps
- fans
- filters
- air washer
- humidifier
- attenuators
- dampers

- heat exchangers
- condensers
- industry specifications and regulations

1.4 confirm the system layout requirements for air systems including:

- isolation valves
- three & four port valves
- temperature & humidity stats
- registers and grilles
- actuators
- RPZ valves
- pumps
- fans
- filters
- air washer
- humidifier
- attenuators
- dampers
- heat exchangers
- condensers
- industry specifications and regulations.

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 2 Understand the legislative and organisational procedures for maintaining industrial and commercial air systems, equipment and components

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when maintaining air systems

2.2 state the documentation appropriate to the routine maintenance of air systems:

- statutory regulations
- codes of practice
- industry specifications
- manufacturer's instruction
- organisational procedures

2.3 state appropriate persons whom it may be necessary to advise before an air system is isolated in order to undertake maintenance work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 3 Understand the servicing requirements for industrial and commercial air systems, equipment and components

Assessment criteria

The learner can:

3.1 state the routine maintenance procedures, which comply with industry requirements for the following:

systems:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems
- heat recovery systems

components:

- isolation valves
- three & four port valves
- temperature & humidity stats
- registers and grilles
- actuators
- RPZ valves
- pumps
- fans
- filters
- air washer
- humidifier
- attenuators
- dampers
- heat exchangers
- condensers
- industry specifications and regulations

3.2 list the range of materials required to carry out the routine maintenance of air system

3.3 list the range of tools and equipment required to carry out the routine maintenance of air system

3.4 state the records or reports that are required for routine maintenance activities

3.5 propose what action to take when a system or component does not meet the performance specification.

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 4 Understand the maintenance requirements for industrial and commercial air systems, equipment and components

Assessment criteria

The learner can:

4.1 state the routine maintenance procedures required to restore or maintain system performance in accordance with industry specifications, for the following systems:

- air conditioning systems
- chilled beams
- fan coil units
- air handling units
- heat rejection systems
- heat recovery systems

4.2 define the relative operating principles of chiller units, air handling units and air conditioning units

4.3 state the purpose and function of the following components in relation to air systems:

- isolation valves
- three & four port valves
- temperature & humidity stats
- registers and grilles
- actuators
- RPZ valves
- pumps
- fans
- filters
- air washer
- humidifier
- attenuators
- dampers
- heat exchangers
- condensers
- industry specifications and regulations

4.4 state the requirements for air systems in terms of:

- safe operating pressures and temperatures
- lubricants and cleansing agents
- causes of corrosion, erosion and acidity
- methods of locating defects caused by corrosion, erosion and acidity
- colour coding for identification of pipework

4.5 state the requirements for completing records or reports for system maintenance activities

4.6 state the actions to take should a system or component fail to operate to specification.

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 5 Understand the procedures for carrying out tests on industrial and commercial air systems, equipment and components

Assessment criteria

The learner can:

5.1 identify the requirements of air systems to confirm that they are ready to receive soundness tests to cover:
- pipework
- appliances
- components

5.2 define procedures for flushing and charging an air system

5.3 state the procedures and equipment for establishing that input services adequately meet the air system requirements

5.4 state the actions that must be taken when inspection and testing reveals defects in air systems such as:
- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 221 Understand industrial and commercial air system maintenance techniques

Outcome 6 Understand the decommissioning procedures for industrial and commercial air systems, equipment and components

Assessment criteria

The learner can:

6.1 state the implications that the suspension of an air system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

6.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

6.3 identify work sequences for decommissioning an air system following organisational procedures

6.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

6.5 state the action to take when normal emptying or shut off mechanisms for air systems do not operate.

Unit 222 Service and maintain industrial and commercial heating and ventilation systems

Level: 2
Credit value: 4
UAN: J/602/4930

Unit aims
This performance unit confirms job competence at Level 2 in the maintenance of industrial and commercial systems and covers the requirements of hot and cold water, low and medium heating and air systems and their components.

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

1. Be able to complete preparation work for industrial and commercial heating and ventilation systems service and maintenance activities
2. Be able to service industrial and commercial heating and ventilation systems, equipment and components
3. Be able to complete soundness tests on industrial and commercial heating and ventilation systems
4. Be able to decommission industrial and commercial heating and ventilation systems

Guided learning hours
It is recommended that **6** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M22, M23, M25, M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 222 Service and maintain industrial and commercial heating and ventilation systems

Outcome 1 Be able to complete preparation work for industrial and commercial heating and ventilation systems service and maintenance activities

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for heating and ventilation system service and maintenance requirements including:

systems:

- cold water: one of the following:
  - storage (indirect)
  - non storage (direct)
- hot water: one of the following:
  - open vented
  - storage (indirect)
  - unvented
  - secondary circulation
  - instantaneous (plate heat exchanger)
- heating: one of the following:
  - low temperature hot water
  - medium temperature hot water
- air: one of the following:
  - air conditioning systems
  - heat rejection systems
  - tempered air ventilation systems
- job information and documentation:
  - statutory regulations
  - codes of practice
  - industry standards
  - industry guides/good practice guides
  - verbal instructions

1.3 use job information and documentation to ensure that the following is fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- other site workers
- site visitors
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work, from one of the following:

- other site workers
- site visitors
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features, should it exist, and report it to the job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the resources needed to complete the job are free from damage and take appropriate action should any defects be found

1.10 complete preparatory work for the service and maintenance of heating and ventilation systems, to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for service and maintenance activities
- confirmation of secure site storage for tools, equipment, materials and components
- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 222 Service and maintain industrial and commercial heating and ventilation systems

Outcome 2 Be able to service industrial and commercial heating and ventilation systems, equipment and components

Assessment criteria

The learner can:

2.1 check that the relevant information is available in order to carry out maintenance work

2.2 check that materials, tools and equipment are available for the specified maintenance activity

2.3 demonstrate that liaison has taken place with the supervisor or line manager at the key points within the routine maintenance activities to minimise disruption to work routines

2.4 perform work activities for routine maintenance that complies with industry specifications and manufacturer's instructions, for hot and cold water system and components including:

all of the following:

- cold water storage cistern
- pressure booster sets
- hot water storage vessels
- appliance control valve or tap, terminal fittings

and a minimum of any two from the following:

- electric and gas water heaters
- stop valves
- shower mixing valves
- blending valves
- mixing valves
- circulating pumps (bronze)
- expansion vessels
- RPZ valves

2.5 perform work activities for routine maintenance that ensure the continued effective operation of the hot and cold water systems and components

2.6 perform work activities for routine maintenance that complies with industry specifications and manufacturer's instructions, for hot water heating systems and components including:

one from the following:

- low temperature hot water
- medium temperature hot water

and a minimum of six from the following:

- hot water storage vessels
- radiators
- convector heaters, natural and assisted
- panel heaters
- ceiling coils
- thermostatic control of heating systems
- time control of heating systems

- energy management systems
- storage calorifiers
- non-storage calorifiers
- feed and expansion cisterns
- pressurisation units
- mechanical controls
- dosing pots
- drain taps
- motorised valves
- pumps/accelerators
- temperature and pressure relief valves
- expansion vessels

2.7 perform work activities for routine maintenance that ensure the continued effective operation of the hot water heating systems and components

2.8 perform work activities for routine maintenance that complies with industry specifications and manufacturer's instructions for air systems and components, including:

one from the following:

- air conditioning systems
- tempered air ventilation systems

and a minimum of six from the following:

- isolation valves
- three & four port valves
- temperature & humidity stats
- registers and grilles
- actuators
- RPZ valves
- pumps
- fans
- filters
- air washer
- humidifier
- attenuators
- dampers
- heat exchangers
- condensers
- industry specifications and regulations

2.9 perform work activities for routine maintenance that ensure the continued effective operation of the air systems and components

2.10 confirm that maintenance records have been completed accurately and checked by the supervisor or line manager.

Unit 222 Service and maintain industrial and commercial heating and ventilation systems

Outcome 3 Be able to complete soundness tests on industrial and commercial heating and ventilation systems

Assessment criteria

The learner can:

3.1 conduct visual inspections of the following heating and ventilation systems and confirm compliance with industry requirements:

- cold water (one of the following):
  - storage (indirect)
  - non storage (direct)
- hot water (one of the following):
  - open vented
  - storage (indirect)
  - unvented
  - secondary circulation
  - instantaneous (plate heat exchanger)
- heating (one of the following):
  - low temperature hot water
  - medium temperature hot water
- air (one of the following):
  - air conditioning systems
  - tempered air ventilation systems

3.2 confirm that systems are ready to receive soundness tests to cover:

- pipework
- ductwork
- appliances
- components

3.3 perform procedures for:

- cleaning
- flushing
- charging

systems in accordance with industry requirements

3.4 conduct procedures for establishing that input services to the system components are suited to the intended purpose for two of the following:

- water company mains
- mains fed, direct, or indirect
- air supplies
- gas
- oil

3.5 apply a soundness test to the following systems in accordance with appropriate industry standards, guides and good practice guides:

- cold water
- hot water
- heating (one of the following):
  - low temperature hot water heating
  - medium temperature hot water heating
- air (one of the following):
  - air conditioning
  - tempered air ventilation

3.6 conduct pre-commissioning tests and checks in accordance with appropriate industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

3.7 conduct checks to confirm:

- system cleanliness
- system is charged
- un-commissioned systems and components cannot be activated.

Unit 222 Service and maintain industrial and commercial heating and ventilation systems

Outcome 4 Be able to decommission industrial and commercial heating and ventilation systems

Assessment criteria

The learner can:

4.1 verify that decommissioning processes minimise disturbance to work routines

4.2 verify that systems or components are safe for decommissioning for at least two from the following systems:

- cold water
- hot water
- low temperature heating
- medium temperature heating
- air conditioning
- tempered air ventilation

4.3 conduct decommissioning of systems or components which comply with industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

4.4 verify that the decommissioning procedures carried out prevent the inadvertent operation of the installed system through:

- temporary capping of pipework or ductwork sections
- use of safety and warning notices

4.5 verify that decommissioned systems and components are left safe, in line with industry requirements.

Unit 223 Understand industrial and commercial warm air heating installation techniques

Level: 2
Credit value: 2
UAN: K/602/2751

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial warm air systems and covers the requirements of tempered air supply ventilation, fan coil units, direct fired warm air heaters and ducted distribution systems.

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

1. Understand the working principles and layouts of industrial and commercial warm air heating systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial warm air heating systems
3. Understand the installation procedures for industrial and commercial warm air heating systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial warm air heating systems
5. Understand the decommissioning procedures for industrial and commercial warm air heating systems

Guided learning hours
It is recommended that **18** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 223 Understand industrial and commercial warm air heating installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial warm air heating systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all the following warm air heating systems:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems:
  - main distribution duct
  - branch duct
  - re-circulation duct

including:

- duct sizes
- factors to determine system selection
- key regulations relevant to the installation
- connections to heating source

1.2 state the requirements for connecting all the following appliance types to warm air heating systems:

- ducted warm air heater unit
- heating source:
  - gas
  - oil

1.3 define the working principles of all the following warm air heating system components/controls:

- ducted sections, rectangular and circular, angles and elbows
- diffusers
- mechanical and thermostatic controls

1.4 confirm the system layout requirements for the following warm air heating:

systems:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems
  - main distribution duct
  - branch duct
  - re-circulation duct

components:

- ducted sections, rectangular and circular, angles and elbows
- diffusers
- mechanical and thermostatic controls.

Unit 223 Understand industrial and commercial warm air heating installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial warm air heating systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning warm air heating systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of warm air heating systems

2.3 state appropriate persons whom it may be necessary to advise before a warm air heating system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 223 Understand industrial and commercial warm air heating installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial warm air heating systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

systems:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems:
  - main distribution duct
  - branch duct
  - re-circulation duct

components:

- ducted sections, rectangular and circular, angles and elbows
- diffusers
- mechanical and thermostatic controls

3.2 define suitable methods for making pipework connections to:

- indirect hot water supplies
- gas supply
- oil supply.

Unit 223 Understand industrial and commercial warm air heating installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial warm air heating systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following warm air systems to confirm that they are ready to receive soundness tests to cover ductwork, appliances and components:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems:
  - main distribution duct
  - branch duct
  - re-circulation duct

4.2 define procedures for cleaning and charging a warm air heating system

4.3 state the procedures and equipment for establishing that input services adequately meet the warm air heating system requirements

4.4 state the procedure for applying a soundness test to a warm air heating system in accordance with appropriate industry standards

4.5 state the documentation and procedures for recording soundness test results

4.6 state the actions that must be taken when inspection and testing reveals defects in warm air heating systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective ductwork bracketing
- remedial work associated with leakage from ductwork systems.

Unit 223 Understand industrial and commercial warm air heating installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial warm air heating systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a warm air heating system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning a warm air heating system following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for warm air heating systems do not operate.

Unit 224 Understand industrial and commercial compressed air system installation techniques

Level: 2
Credit value: 3
UAN: F/602/2755

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial compressed air systems and covers the requirements of; compressed air controls, tools, equipment and process systems.

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

1. Understand the working principles and layouts of industrial and commercial compressed air systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial compressed air systems
3. Understand the installation procedures for industrial and commercial compressed air systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial compressed air systems
5. Understand the decommissioning procedures for industrial and commercial compressed air systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 224 Understand industrial and commercial compressed air system installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial compressed air systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all the following compressed air systems:

- compressed air controls
- compressed air tools & equipment
- process systems

including:

- pipe sizes for all installation pipework
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting all the following appliance types to compressed air systems, including:

- compressors
- machines
- control systems
- receivers
- hand tools
- systems

1.3 define the working principles of all the following compressed air:

systems:

- compressed air controls
- compressed air tools & equipment
- process systems

and components:

- compressors
- receivers
- separators
- filters
- regulators
- lubricators
- flow meters
- drain traps
- air & gas traps
- isolating valves
- air dryers
- heat recovery

1.4 confirm the system layout requirements for the following compressed air:

systems:

- compressed air controls
- compressed air tools & equipment
- process systems

components:

- compressors
- receivers
- separators
- filters
- regulators
- lubricators
- flow meters
- drain traps
- air & gas traps
- isolating valves
- air dryers
- heat recovery.

Unit 224 Understand industrial and commercial compressed air system installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial compressed air systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning compressed air systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of compressed air systems

2.3 state appropriate persons whom it may be necessary to advise before a compressed air system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 224 Understand industrial and commercial compressed air system installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial compressed air systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

systems:

- compressed air controls
- compressed air tools & equipment
- process systems

components:

- compressors
- receivers
- separators
- filters
- regulators
- lubricators
- flow meters
- drain traps
- air & gas traps
- isolating valves
- air dryers
- heat recovery
- industry specifications and regulations

3.2 define suitable methods for making pipework connections to:

- compressors
- machinery
- receivers
- hand tools
- systems.

Unit 224 Understand industrial and commercial compressed air system installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial compressed air systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following compressed air systems to confirm that they are ready to receive soundness tests to cover ductwork, appliances and components:

- compressed air controls
- compressed air tools & equipment
- process systems

4.2 state the procedures and equipment for establishing that input services adequately meet the compressed air system requirements

4.3 state the procedure for applying a soundness test to a compressed air system in accordance with appropriate industry standards

4.4 state the documentation and procedures for recording soundness test results

4.5 state the actions that must be taken when inspection and testing reveals defects in all compressed air systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 224 Understand industrial and commercial compressed air system installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial compressed air systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a compressed air system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning a compressed air system following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for compressed air systems do not operate.

Unit 225 Install industrial and commercial fire protection systems

Level: 2
Credit value: 2
UAN: D/602/2780

Unit aims
This performance unit confirms job competence at Level 2 in the installation, testing and decommissioning of the following fire protection systems:

- sprinklers
- hose reels
- dry risers.

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

1. Be able to complete preparation work for fire protection installation activities
2. Be able to install industrial and commercial fire protection systems
3. Be able to complete soundness tests on industrial and commercial fire protection systems
4. Be able to decommission industrial and commercial fire protection systems.

Guided learning hours
It is recommended that **4** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25, M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 225 Install industrial and commercial fire protection systems

Outcome 1 Be able to complete preparation work for fire protection installation activities

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for the following system installation including two of the following:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- hose reel
  - wet riser
- dry riser
- foam installations
- gas extinguishers
- carbon dioxide

1.3 use job information and documentation to ensure that the following is fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- other site workers
- site visitors
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work, from at least one from the following:

- other site workers
- site visitors
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features should it exist, and report to job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the materials needed to complete the job are free from damage and report any defects to a supervisor or line manager, including copper pipe and low carbon steel

1.10 complete preparatory work for the installation of fire protection systems, to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for installation activities

- confirmation of secure site storage for tools, equipment, materials and components
- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 225 Install industrial and commercial fire protection systems

Outcome 2 Be able to install industrial and commercial fire protection systems

Assessment criteria

The learner can:

2.1 confirm job information appropriate to the installation process is available

2.2 demonstrate that materials, tools and equipment necessary for the installation of fire protection systems are:

- available as required
- safely and securely stored
- meet industry requirements
- fit for intended purpose

2.3 fabricate and install pipework materials including all of the following:

- copper pipe
- low carbon steel

for two of the following systems:

- sprinklers
- hose reel
- dry riser

2.4 complete jointing of system pipework using:

- compression
- threaded
- grooved
- flanges
- soft soldering

2.5 position and fix:

all of the following appliances:

- hose reels
- breeching valves
- landing valves

three of the following components:

- storage cisterns
- appliance control valve or tap, terminal fittings
- automatic air valves
- stop valves
- float operated valves
- single and double check valves
- gate valves
- service valves
- drain taps
- sprinkler heads

- pumps
- pressure vessels

2.6 position and fix appropriate brackets for systems installations pipework for:

- horizontally mounted pipework
- vertically mounted pipework

in pipework materials which include all of the following:

- copper pipe
- low carbon steel

2.7 perform pipework connections to two of the following:

- mains
- risers
- fire fighting equipment, including hose reels
- fire alarm systems

2.8 demonstrate that all aspects of the installation process conform to industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

2.9 apply methods of working to ensure that any damage to customer/client property and building features is avoided during work activities

2.10 report problems which may affect the progress of the installation, to the immediate job supervisor, line manager or customer.

Unit 225 Install industrial and commercial fire protection systems

Outcome 3 Be able to complete soundness tests on industrial and commercial fire protection systems

Assessment criteria

The learner can:

3.1 conduct visual inspections of the following fire protection systems and confirm compliance with industry requirements:
- sprinklers
- hose reel
- dry riser

3.2 confirm that the fire protection system is ready to receive soundness tests to cover:
- pipework
- appliances
- components

3.3 perform procedures for:
- cleaning
- flushing
- charging systems in accordance with industry requirements

3.4 conduct procedures for establishing that input services to the system components are suited to the intended purpose for two of the following systems:
- sprinklers
  - wet
  - dry
  - alternate wet and dry
- hose reel
  - wet riser
- dry riser
- foam installations

3.5 apply a soundness test to one of the following in accordance with appropriate industry standards, guides and good practice guides:
- sprinklers
- hose reel
- dry riser

3.6 conduct pre-commissioning tests and checks in accordance with appropriate industry requirements, including:
- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

3.7 conduct checks to confirm:

- system cleanliness
- system is charged
- un-commissioned systems and components cannot be activated.

Unit 225 Install industrial and commercial fire protection systems

Outcome 4 Be able to decommission industrial and commercial fire protection systems

Assessment criteria

The learner can:

4.1 verify that decommissioning processes minimise disturbance to work routines

4.2 conduct decommissioning of systems and components which comply with industry requirements, one of the following:

- sprinklers
- hose reel
- dry riser

4.3 conduct decommissioning of systems or components which comply with industry requirements including one from the following:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

4.4 verify that the decommissioning procedures carried out prevent the inadvertent operation of the installed system through:

- temporary capping of pipework sections
- use of safety and warning notices

4.5 verify that decommissioned systems and components are left safe, in line with industry requirements.

Unit 226 Install warm air heating systems

Level: 2
Credit value: 2
UAN: K/602/2782

Unit aims

This performance unit confirms job competence at Level 2 in the installation, testing and decommissioning of the following warm air heating systems:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems.

Learning outcomes

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

1. Be able to complete preparation work for warm air heating installation activities
2. Be able to install industrial and commercial warm air heating systems
3. Be able to soundness test industrial and commercial warm air heating systems
4. Be able to decommission industrial and commercial warm air heating systems

Guided learning hours

It is recommended that **4** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

SummitSkills NOS M7, M21, M25, M26

Support of the unit by a sector or other appropriate body

SummitSkills

Unit 226 Install warm air heating systems

Outcome 1 Be able to complete preparation work for warm air heating installation activities

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for the following system installation including two of the following:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems

1.3 use job information and documentation to ensure that the following is fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- other site workers
- site visitors
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work from at least one from the following:

- other site workers
- site visitors
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features, should it exist, and report to job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the materials / components needed to complete the job are of the correct quantity and are free from damage and report any defects to a supervisor or line manager

1.10 from materials/components used for warm air system installation activities including all of the following:

- diffusers
- mechanical and thermostatic controls

1.11 complete preparatory work for the installation of warm air heating systems, to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for installation activities

- confirmation of secure site storage for tools, equipment , materials and components
- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 226 Install warm air heating systems

Outcome 2 Be able to install industrial and commercial warm air heating systems

Assessment criteria

The learner can:

2.1 confirm job information appropriate to the installation process is available

2.2 demonstrate that materials, tools and equipment necessary for the installation of warm air heating systems are:

- available as required
- safely and securely stored
- meet industry requirements
- fit for intended purpose

2.3 fabricate and install pipework materials including all of the following:

- copper
- stainless steel
- low carbon steel
- mechanical controls

from two of the following systems:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems

2.4 complete jointing of system pipework using:

- compression
- threaded
- grooved
- flanges
- soft soldering

2.5 position and fix one of the following appliances:

- ducted warm air heater unit
- direct fired warm air heaters
- heating source:
  - gas
  - low temperature hot water

one of the following components:

- ductwork sections, rectangular and circular, angles and elbows
- diffusers
- mechanical and electrical time and thermostatic controls

2.6 position and fix appropriate brackets for systems installations for:

- horizontally mounted pipework
- vertically mounted pipework

in materials, which include all of the following:

- low carbon steel
- stainless steel
- copper

2.7 perform connections to:

- low temperature hot water
- gas supply

2.8 demonstrate that all aspects of the installation process conform with industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

2.9 apply methods of working to ensure that any damage to customer/client property and building features is avoided during work activities

2.10 report problems which may affect the progress of the installation, to the immediate job supervisor, line manager or customer.

Unit 226 Install warm air heating systems

Outcome 3 Be able to soundness test industrial and commercial warm air heating systems

Assessment criteria

The learner can:

3.1 conduct visual inspections for all of the following warm air heating systems and confirm compliance with industry requirements:
- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems

3.2 confirm that the warm air heating system is ready to receive soundness tests to cover:
- pipework
- appliances
- components

3.3 perform procedures for:
- cleaning
- charging systems in accordance with industry requirements

3.4 conduct procedures for establishing that input services to the system components are suited to the intended purpose, for the following:
- gas
- low temperature hot water

3.5 apply a soundness test to one of the following systems in accordance with appropriate industry standards
- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems

3.6 conduct pre-commissioning tests and checks in accordance with appropriate industry requirements including:
- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

3.7 conduct checks to confirm:
- system cleanliness
- un-commissioned systems and components cannot be activated.

Unit 226 Install warm air heating systems

Outcome 4 Be able to decommission industrial and commercial warm air heating systems

Assessment criteria

The learner can:

4.1 verify that decommissioning processes minimise disturbance to work routines

4.2 verify that systems or components are safe for decommissioning

4.3 conduct decommissioning of systems which comply with industry requirements including two from the following:

- tempered air supply ventilation
- fan coil units
- direct fired warm air heaters
- ducted distribution systems

4.4 verify that the decommissioning procedures carried out prevent the inadvertent operation of the installed system through:

- temporary sealing of ductwork sections
- use of safety and warning notices

4.5 verify that decommissioned systems and components are left safe, in line with industry requirements.

Unit 227 Install industrial and commercial compressed air systems

Level: 2
Credit value: 2
UAN: A/602/2785

Unit aims
This performance unit confirms job competence at Level 2 in the installation, testing and decommissioning of the following compressed air systems:

- compressed air controls
- compressed air tools and equipment
- process systems.

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

1. Be able to complete preparation work for compressed air installation activities
2. Be able to install industrial and commercial compressed air systems
3. Be able to soundness test industrial and commercial compressed air systems
4. Be able to decommission industrial and commercial compressed air systems

Guided learning hours
It is recommended that **4** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25, M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 227 Install industrial and commercial compressed air systems

Outcome 1 Be able to complete preparation work for compressed air installation activities

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for the following system installation including one of the following:

- compressed air controls
- compressed air tools & equipment
- process systems

1.3 use job information and documentation to ensure that the following is fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- other site workers
- site visitors
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work from at least one from the following:

- other site workers
- site visitors
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features, should it exist, and report to job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the materials needed to complete the job are of the correct quantity and are free from damage and report any defects to a supervisor or line manager

1.10 from materials used for compressed air installation activities including two of the following:

- galvanised LCS pipe
- ABS Plastic
- PVC-U Plastic

1.11 complete preparatory work for the installation of warm air heating systems, to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for installation activities
- confirmation of secure site storage for tools, equipment ,materials and components

- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 227 Install industrial and commercial compressed air systems

Outcome 2 Be able to install industrial and commercial compressed air systems

Assessment criteria

The learner can:

2.1 confirm job information appropriate to the installation process is available

2.2 demonstrate that materials, tools and equipment necessary for the installation of compressed air systems are:

- available as required
- safely and securely stored
- meet industry requirements
- fit for intended purpose

2.3 fabricate and install pipework materials including all of the following:

- galvanised LCS pipe
- ABS Plastic
- PVC-U Plastic

from two of the following: systems

- compressed air controls
- compressed air tools & equipment
- process systems

2.4 complete jointing of system pipework using all of the following techniques:

- compression
- threaded
- grooved
- flanges
- solvent welded

2.5 position and fix:

one of the following appliances:

- hand tools
- machines
- control systems

three of the following components:

- compressors
- receivers
- separators
- filters
- regulators
- lubricators
- flow meters
- drain traps
- air & gas traps
- isolating valves
- air dryers

- heat recovery
- after-coolers
- pressure gauges

2.6 position and fix appropriate brackets for systems pipework installations for:
- horizontally mounted pipework
- vertically mounted pipework

in materials which include all of the following:
- galvanised LCS pipe
- ABS Plastic
- PVC-U Plastic

2.7 perform connections to two of the following:
- compressors
- machinery
- receivers
- hand tools
- systems

2.8 demonstrate that all aspects of the installation process conforms with industry requirements, including:
- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

2.9 apply methods of working to ensure that any damage to customer/client property and building features is avoided during work activities

2.10 report problems which may affect the progress of the installation, to the immediate job supervisor, line manager or customer.

Unit 227 Install industrial and commercial compressed air systems

Outcome 3 Be able to soundness test industrial and commercial compressed air systems

Assessment criteria

The learner can:

3.1 conduct visual inspections from one of the following compressed air systems and confirm compliance with industry requirements:
- compressed air controls
- compressed air tools & equipment
- process systems

3.2 confirm that the compressed air system is ready to receive soundness tests to cover:
- pipework
- appliances
- components

3.3 perform procedures for:
- cleaning
- charging systems in accordance with industry requirements

3.4 conduct procedures for establishing that the following input services to the system components are suited to the intended purpose:
- air intake
- compressor

3.5 apply a soundness test to one of the following in accordance with appropriate industry standards, guides and good practice guides:
- hand tools
- machines
- control systems

3.6 conduct pre-commissioning tests and checks in accordance with appropriate industry requirements including:
- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

3.7 conduct checks to confirm:
- system cleanliness
- system is charged
- un-commissioned systems and components cannot be activated.

Unit 227 Install industrial and commercial compressed air systems

Outcome 4 Be able to decommission industrial and commercial compressed air systems

Assessment criteria

The learner can:

4.1 verify that decommissioning processes minimise disturbance to work routines

4.2 conduct decommissioning of systems and components which comply with industry requirements, from one of the following:

- hand tools
- machines
- control systems

4.3 conduct decommissioning of systems or components which comply with industry requirements including one from the following:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

4.4 verify that the decommissioning procedures carried out prevent the inadvertent operation of the installed system through:

- temporary capping of pipework sections
- use of safety and warning notices

4.5 verify that decommissioned systems and components are left safe, in line with industry requirements.

Unit 228 Understand industrial and commercial cold water system installation techniques

Level: 2
Credit value: 3
UAN: Y/602/2728

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial cold water systems and covers the requirements of storage and non storage systems and their components.

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

1. Understand the working principles and layouts of industrial and commercial cold water systems
2. Understand the principles of water supply to industrial and commercial buildings
3. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial cold water systems
4. Understand the installation procedures for industrial and commercial cold water systems
5. Understand the procedures for carrying out a soundness test on industrial and commercial cold water systems
6. Understand the decommissioning procedures for industrial and commercial cold water systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial cold water systems

Assessment criteria

The learner can:

1.1 state the installation requirements of storage and non-storage cold water systems including:

- connections from mains to premises
- pipe sizes for all installation pipework
- cold water storage cistern capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting the following appliance types to cold water systems, including:

- sanitary appliances:
  - sinks
  - wash basins
  - baths
  - WCs
  - showers
- industrial and commercial appliances:
  - hospital sanitary appliances
  - appliances for the disabled
- appliances specific to industrial and commercial premises:
  - heating systems
  - chilled water
  - steam

1.3 define the working principles of all cold water system components contained within storage and non-storage systems, including:

- storage cisterns
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves

1.4 confirm the cold water system layout requirements for storage and non-storage systems including:

- storage cisterns
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- industry specifications and regulations.

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 2 Understand the principles of water supply to industrial and commercial buildings

Assessment criteria

The learner can:

2.1 state the key stages in the rainwater cycle

2.2 identify the various water supply sources including:

- surface sources
- underground sources

2.3 state the requirements of water supply to industrial and commercial buildings, including:

- supply from a water undertaker's main
- supply from a private source

2.4 describe the mains water treatment process and the typical features of mains water distribution systems from treatment works to industrial and commercial buildings

2.5 state the uses of cold water supplied to industrial and commercial buildings, including:

- wholesome water for drinking, washing, food production
- water for sanitary applications (showers, baths, WCs)
- water for heating and cooling systems
- water for industrial processes

2.6 state what is meant by recycled water and identify how recycled water can be used in industrial and commercial situations, including:

- WC flushing
- water for outdoor use
- water for industrial processes.

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 3 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial cold water systems

Assessment criteria

The learner can:

3.1 state the appropriate sources of health and safety information when installing, testing and decommissioning cold water systems

3.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of cold water systems

3.3 state appropriate persons whom it may be necessary to advise before a cold water system is isolated in order to undertake work

3.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 4 Understand the installation procedures for industrial and commercial cold water systems

Assessment criteria

The learner can:

4.1 state the installation and fixing procedures for storage and non-storage systems including:

- storage cisterns
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- gate valves
- RPZ valves
- servicing valves
- drain taps
- shower mixer valves
- blending valves
- industry specifications and regulations

4.2 define suitable methods for making pipework connections to:

- water company mains
- existing systems.

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 5 Understand the procedures for carrying out a soundness test on industrial and commercial cold water systems

Assessment criteria

The learner can:

5.1 identify the requirements of cold water storage and non storage systems to confirm that they are ready to receive soundness tests to cover:

- pipework
- appliances
- components

5.2 define procedures for flushing and charging a cold water storage system

5.3 state the procedures and equipment for establishing that input services adequately meet the cold water system requirements

5.4 state the actions that must be taken when inspection and testing reveals defects in storage and non-storage cold water systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 228 Understand industrial and commercial cold water system installation techniques

Outcome 6 Understand the decommissioning procedures for industrial and commercial cold water systems

Assessment criteria

The learner can:

6.1 state the implications that the suspension of a cold water system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

6.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

6.3 identify work sequences for decommissioning a cold water system following organisational procedures

6.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

6.5 state the action to take when normal emptying or shut off mechanisms for cold water systems do not operate.

Unit 229 Understand industrial and commercial hot water system installation techniques

Level: 2
Credit value: 3
UAN: H/602/2733

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial hot water systems.

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

1. Understand the working principles and layouts of industrial and commercial hot water systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial hot water systems
3. Understand the installation procedures for industrial and commercial hot water systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial hot water systems
5. Understand the decommissioning procedures for industrial and commercial hot water systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 229 Understand industrial and commercial hot water system installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial hot water systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all of the following hot water systems:

- open vented
- indirect (storage)
- unvented
- secondary circulation
- instantaneous (plate heat exchanger)

including:

- pipe sizes for all installation pipework
- connections to cold water services
- cold water storage cistern capacities
- hot water storage vessel capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting all the following appliance types to hot water systems, including:

- sanitary appliances:
  - sinks
  - wash basins
  - baths
  - WCs
  - showers
- industrial and commercial appliances
  - hospital sanitary appliances
  - appliances for the disabled
- appliances specific to industrial and commercial premises
  - hot water heating boilers
  - hot water storage vessels
  - instantaneous hot water heaters

1.3 define the working principles for all the following hot water:

- systems:
  - open vented
  - indirect (storage)
  - unvented
  - secondary circulation
  - instantaneous (plate heat exchanger)
- components:

- cold water storage cistern (secondary system)
- feed and expansion cistern (primary system)
- hot water storage vessels, including high temperature to low temperature calorifiers
- electric and gas water heaters
- appliance control valve or tap, terminal fittings
- stop valves
- float operated valves
- single and double check valves
- gate valves
- servicing valves
- drain taps
- pressure reducing valves
- shower mixing valves
- blending valves
- mixing valves
- circulating pumps (bronze)
- booster pumps
- line strainers
- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations

1.4 confirm the system layout requirements for all of the following hot water:

- systems:
  - open vented systems
  - indirect (storage) systems
  - unvented systems
  - secondary circulation systems
  - instantaneous (plate heat exchanger) systems
- components:
  - cold water storage cistern (secondary system)
  - feed and expansion cistern (primary system)
  - hot water storage vessels, including high temperature to low temperature calorifiers
  - electric and gas water heaters
  - appliance control valve or tap, terminal fittings
  - stop valves
  - float operated valves
  - single and double check valves
  - gate valves
  - servicing valves
  - drain taps
  - pressure reducing valves
  - shower mixing valves
  - blending valves
  - mixing valves
  - circulating pumps (bronze)
  - booster pumps
  - line strainers

- temperature and pressure relief valves
- expansion vessels
- industry specifications and regulations.

Unit 229 Understand industrial and commercial hot water system installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial hot water systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning hot water systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of hot water systems

2.3 state appropriate persons whom it may be necessary to advise before a hot water system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 229 Understand industrial and commercial hot water system installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial hot water systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

- systems:
  - open vented systems
  - indirect (storage) systems
  - unvented systems
  - secondary circulation systems
  - instantaneous (plate heat exchanger) systems
- components:
  - cold water storage cistern (secondary system)
  - feed and expansion cistern (primary system)
  - hot water storage vessels, including high temperature to low temperature calorifiers
  - electric and gas water heaters
  - appliance control valve or tap, terminal fittings
  - stop valves
  - float operated valves
  - single and double check valves
  - gate valves
  - servicing valves
  - drain taps
  - pressure reducing valves
  - shower mixing valves
  - blending valves
  - mixing valves
  - circulating pumps (bronze)
  - booster pumps
  - line strainers
  - temperature and pressure relief valves
  - expansion vessels
  - industry specifications and regulations

3.2 define suitable methods for making pipework connections to:

- existing systems
- cold water service pipework
- heating systems
- industrial/commercial solar hot water applications
- industrial/commercial ground source heating applications.

Unit 229 Understand industrial and commercial hot water system installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial hot water systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following hot water systems to confirm that they are ready to receive soundness tests to cover pipework, appliances and components:

- open vented systems
- indirect (storage) systems
- unvented systems
- secondary circulation systems
- instantaneous (plate heat exchanger) systems

4.2 define procedures for flushing and charging a hot water storage system

4.3 state the procedures and equipment for establishing that input services adequately meet the hot water system requirements

4.4 state the actions that must be taken when inspection and testing reveals defects in all hot water systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 229 Understand industrial and commercial hot water system installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial hot water systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a hot water system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning a hot water system following organisational procedures

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for hot water systems do not operate.

Unit 230 Install industrial and commercial heating and ventilating systems

Level: 2
Credit value: 3
UAN: Y/602/2776

Unit aims
This performance unit confirms job competence at Level 2 in the installation, testing and decommissioning of a range of industrial and commercial heating and ventilating systems and components in industrial and commercial situations.

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

1. Be able to complete preparation work for cold water, hot water, heating and chilled water systems installation activities
2. Be able to install industrial and commercial cold water, hot water, heating and chilled water systems
3. Be able to complete soundness tests on industrial and commercial cold water, hot water, heating and chilled water systems
4. Be able to decommission industrial and commercial cold water, hot water, heating and chilled water systems

Guided learning hours
It is recommended that **4** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25, M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 230 Install industrial and commercial heating and ventilating systems

Outcome 1 Be able to complete preparation work for cold water, hot water, heating and chilled water systems installation activities

Assessment criteria

The learner can:

1.1 check the work location and report factors that will impact on the work to the supervisor or line manager

1.2 source appropriate job information and documentation for heating and ventilation system service and maintenance requirements including:

systems:

- cold water: one of the following:
- storage (indirect)
- non storage (direct)

hot water (one of the following):

- open vented
- storage (indirect)
- unvented
- secondary circulation
- instantaneous (plate heat exchanger)

heating (one of the following):

- low temperature hot water
- medium temperature hot water

air (one of the following):

- air conditioning systems
- heat rejection systems
- tempered air ventilation systems

job information and documentation:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

1.3 use job information and documentation to ensure that the following is fit for purpose:

- equipment
- tools

1.4 identify the points in the work process where liaison with other persons may be necessary:

- other site workers
- site visitors
- supervisor or line manager

1.5 demonstrate that job information on key aspects of the work has been issued to relevant people including user instructions or manufacturer's instructions

1.6 demonstrate that authorisation has been obtained from the relevant person(s) prior to commencement of the work, from one of the following:

- other site workers
- site visitors
- supervisor or line manager

1.7 note any pre work damage or defects to existing equipment or building features should it exist, and report the job supervisor or line manager

1.8 demonstrate that suitable personal protective equipment has been worn throughout the duration of work preparation activities

1.9 check that the resources needed to complete the job are free from damage and take appropriate action should any defects be found

1.10 complete preparatory work for the service and maintenance of heating and ventilation systems, to include:

- use of material and equipment requisites where appropriate
- confirmation that the selection of material, equipment and components are compatible to the installation
- confirmation that the work location is ready for service and maintenance activities
- confirmation of secure site storage for tools, equipment, materials and components
- confirmation of suitable access equipment
- confirmation of suitable lifting equipment where required.

Unit 230 Install industrial and commercial heating and ventilating systems

Outcome 2 Be able to install industrial and commercial cold water, hot water, heating and chilled water systems

Assessment criteria

The learner can:

2.1 confirm job information appropriate to the installation process is available

2.2 demonstrate that materials, tools and equipment necessary for the installation of cold water, hot water, heating and chilled water systems are:

- available as required
- safely and securely stored
- meet industry requirements
- fit for intended purpose

2.3 fabricate and install pipework materials including all of the following:

- copper pipe
- plastic
- stainless steel
- low carbon steel

for each of the following systems:

- cold water
- hot water
- heating
- chilled water

2.4 complete jointing of system pipework for all of the following methods:

- compression
- threaded
- grooved
- flanges
- soft soldering
- adhesives

2.5 position and fix:

hot and cold water pipework to terminations in preparation for the installation of:

- sanitary appliances, one from the following:
  - sinks
  - wash basins
  - baths
  - WCs
  - showers
  - hospital sanitary appliances
  - appliances for the disabled
- hot and cold water system components including all of the following:
  - cold water storage cistern
  - pressure booster sets

- hot water storage vessels, including high temperature to low temperature calorifiers
- appliance control valve or tap, terminal fittings

and a minimum of any two from the following:

- electric and gas water heaters
- stop valves
- shower mixing valves
- blending valves
- mixing valves
- circulating pumps (bronze)
- expansion vessels
- RPZ valves
- feed and expansion cistern (primary system)

heating system:

- appliances:
  - low temperature hot water heating boiler, one from:
    - modular
    - sectional
    - biomass
- components (all of the following):
  - hot water storage vessels
  - radiators
  - convector heaters, natural and assisted
  - panel heaters
  - ceiling coils
  - thermostatic control of heating systems
  - time control of heating systems
  - energy management systems
  - motorised valves
  - pumps/accelerators
  - temperature and pressure relief valves
  - expansion vessels

chilled water system:

- appliances (two from the following)
  - refrigeration plant
  - FCU
  - A/C plant
  - cooling towers
  - air handling units
  - heat exchangers
  - chilled beams
- components (two from the following)
  - isolation valves
  - three & four port valves
  - temperature & humidity stats
  - calorifiers
  - actuators
  - RPZ valves

2.6 position and fix appropriate brackets for systems installation pipework for:

- horizontally mounted pipework
- vertically mounted pipework

in pipework materials which include:

- copper pipe
- plastic:
  - ABS
  - PVC-U
- stainless steel
- steel flues
- low carbon steel

2.7 perform pipework connections to all of following:

- water company mains
- existing systems
- heating systems
- sanitary appliances
- industrial/commercial solar hot water applications
- industrial/commercial ground source heating applications
- boilers
- hot water storage vessels
- systems controls (including management systems)
- primary cooling system
- existing pipework
- appliances

2.8 demonstrate that all aspects of the installation process conforms with industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

2.9 apply methods of working to ensure that any damage to customer/client property and building features is avoided during work activities

2.10 report problems which may affect the progress of the installation, to the immediate job supervisor, line manager or customer.

Unit 230 Install industrial and commercial heating and ventilating systems

Outcome 3 Be able to complete soundness tests on industrial and commercial cold water, hot water, heating and chilled water systems

Assessment criteria

The learner can:

3.1 conduct visual inspections of the following cold water, hot water, heating and chilled water systems and confirm compliance with industry requirements:

- cold water (one of the following):
  - storage (indirect)
  - non storage (direct)
- hot water (one of the following):
  - open vented
  - storage (indirect)
  - unvented
  - secondary circulation
  - instantaneous (plate heat exchanger)
- heating (two of the following):
  - low temperature hot water heating
  - sealed heating systems
  - medium temperature hot water heating
- chilled water (two of the following):
  - air conditioning systems
  - heat rejection systems
  - chilled beams
  - fan coil units and air handling units

3.2 confirm that cold water, hot water, heating and chilled water system is ready to receive soundness tests to cover:

- pipework
- appliances
- components

3.3 perform procedures for:

- cleaning
- flushing
- charging

systems in accordance with industry requirements

3.4 conduct procedures for establishing that input services to the system components are suited to the intended purpose for two of the following:

- water company mains
- mains fed, direct, or indirect
- gas

- oil

3.5 apply a soundness test to one of the following systems in accordance with appropriate industry standards, guides and good practice guides:

- cold water
- hot water
- heating
- chilled water

3.6 conduct pre-commissioning tests and checks in accordance with appropriate industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

3.7 conduct checks to confirm:

- system cleanliness
- use of additives where appropriate
- system is charged
- un-commissioned systems and components cannot be activated.

Unit 230 Install industrial and commercial heating and ventilating systems

Outcome 4 Be able to decommission industrial and commercial cold water, hot water, heating and chilled water systems

Assessment criteria

The learner can:

4.1 verify that decommissioning processes minimise disturbance to work routines

4.2 verify that systems or components are safe for decommissioning including at least one from the following systems:

- cold water
- hot water
- heating
- chilled water

4.3 conduct decommissioning of systems or components which comply with industry requirements, including:

- statutory regulations
- codes of practice
- industry standards
- industry guides/good practice guides
- verbal instructions

4.4 verify that the decommissioning procedures carried out prevent the inadvertent operation of the installed system through:

- temporary capping of pipework sections
- use of safety and warning notices

4.5 verify that de-commissioned systems and components are left safe, in line with industry requirements.

Unit 231 Understand industrial and commercial fire protection system installation techniques

Level: 2
Credit value: 2
UAN: J/602/2949

Unit aims
This knowledge unit provides learning in the installation, testing and decommissioning of industrial and commercial fire protection systems and covers the requirements of sprinklers, drenchers, hose reels, hydrants, foam installations and gas extinguishers.

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

1. Understand the working principles and layouts of industrial and commercial fire protection systems
2. Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial fire protection systems
3. Understand the installation procedures for industrial and commercial fire protection systems
4. Understand the procedures for carrying out a soundness test on industrial and commercial fire protection systems
5. Understand the decommissioning procedures for industrial and commercial fire protection systems

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

Details of the relationship between the unit and relevant national standards
SummitSkills NOS M7, M21, M25 and M26

Support of the unit by a sector or other appropriate body
SummitSkills

Unit 231 Understand industrial and commercial fire protection system installation techniques

Outcome 1 Understand the working principles and layouts of industrial and commercial fire protection systems

Assessment criteria

The learner can:

1.1 state the installation requirements for all of the following fire protection systems:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide

including:

- pipe sizes for all installation pipework
- connections to cold water services
- cold water storage cistern capacities
- factors to determine system selection
- key regulations relevant to the installation

1.2 state the requirements for connecting all the following appliance types to fire protection systems, including:

- storage cisterns
- automatic air valves
- stop valves
- landing valves
- breeching valves
- differential pressure valve
- float operated valves
- pressure vessels
- pumps
- sprinkler heads
- gate valves
- drain taps
- single and double check valves
- industry specifications and regulations

1.3 define the working principles for all the following fire protection:

systems:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide

components:

- storage cisterns
- automatic air valves
- stop valves
- landing valves
- breeching valves
- differential pressure valves
- float operated valves
- pressure vessels
- pumps
- sprinkler heads
- gate valves
- drain taps
- single and double check valves
- industry specifications and regulations

1.4 confirm the fire protection system layout requirements for components from the following systems:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide.

Unit 231 Understand industrial and commercial fire protection system installation techniques

Outcome 2 Understand the legislative and organisational procedures for the installation, testing and decommissioning of industrial and commercial fire protection systems

Assessment criteria

The learner can:

2.1 state the appropriate sources of health and safety information when installing, testing and decommissioning fire protection systems

2.2 state the regulations, codes of practice, and industry recommendations appropriate to the installation, testing and decommissioning of fire protection systems

2.3 state appropriate persons whom it may be necessary to advise before a fire protection system is isolated in order to undertake work

2.4 state the actions that should be taken to liaise with other persons upon completion of work procedures with regard to:

- safe system shutdown
- labelling of components.

Unit 231 Understand industrial and commercial fire protection system installation techniques

Outcome 3 Understand the installation procedures for industrial and commercial fire protection systems

Assessment criteria

The learner can:

3.1 state the installation and fixing procedures for all the following:

systems:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide

components:

- storage cisterns
- automatic air valves
- stop valves
- landing valves
- breeching valves
- differential pressure valves
- float operated valves
- pressure vessels
- pumps
- sprinkler heads
- gate valves
- drain taps
- single and double check valves
- industry specifications and regulations

3.2 define suitable methods for making pipework connections to:

- mains
- risers
- fire fighting equipment.

Unit 231 Understand industrial and commercial fire protection system installation techniques

Outcome 4 Understand the procedures for carrying out a soundness test on industrial and commercial fire protection systems

Assessment criteria

The learner can:

4.1 identify the requirements of all the following hot water systems to confirm that they are ready to receive soundness tests to cover pipework, appliances and components:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide

4.2 define the procedure for flushing and charging one of the following fire protection systems:

- sprinklers
  - wet
  - dry
  - alternate wet and dry
- drenchers
- hose reel
  - wet riser
- hydrants
- foam installations
- gas extinguishers
  - carbon dioxide

4.3 state the procedures and equipment for establishing that input services adequately meet the fire protection system requirements

4.4 state the procedure for applying a soundness test to a fire protection system in accordance with appropriate industry standards

4.5 state the documentation and procedures for recording soundness test results

4.6 state the actions that must be taken when inspection and testing reveals defects in all fire protection systems such as:

- dealing with systems that do not meet correct installation requirements
- remedial work associated with defective pipework bracketing
- remedial work associated with leakage from pipework systems.

Unit 231 Understand industrial and commercial fire protection system installation techniques

Outcome 5 Understand the decommissioning procedures for industrial and commercial fire protection systems

Assessment criteria

The learner can:

5.1 state the implications that the suspension of a fire protection system can have on other person(s), including:

- customers/clients
- other site workers
- site visitors

5.2 identify the safe procedures for handling potentially hazardous system materials including mechanical and manual handling requirements

5.3 identify work sequences for decommissioning one of the following fire protection systems, following organisational procedures:

- alternate wet and dry sprinkler system
- foam installation
- gas extinguishers

5.4 state the decommissioning procedures required to prevent the inadvertent operation of the installed system

5.5 state the action to take when normal emptying or shut off mechanisms for fire protection systems do not operate.

Appendix 1 Relationship to other qualifications

Links to other qualifications and frameworks

This qualification will be contained within the SummitSkills Apprenticeship framework. Please visit SummitSkills website **www.summitskills.org.uk** for more details.

Literacy, language, numeracy and ICT skills development

This qualification includes opportunities to develop and practise many of the skills and techniques required for success in the following qualifications:

- Functional Skills (England) – see **www.cityandguilds.com/functionalskills**
- Essential Skills (Northern Ireland) – see **www.cityandguilds.com/essentialskillsni**
- Essential Skills Wales - see **www.cityandguilds.com/esw**

There might also be opportunities to develop skills and/or portfolio evidence if candidates are completing any Key Skills alongside this qualification.
Any Key Skills evidence will need to be separately assessed and must meet the relevant standard.

Appendix 2 Sources of general information

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

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

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

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

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

Useful contacts

UK learners **General qualification information**	**T: +44 (0)844 543 0033** **E: learnersupport@cityandguilds.com**
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: **intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: **singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: **business@cityandguilds.com**
Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

If you have a complaint, or any suggestions for improvement about any of the services that City & Guilds provides, email: feedbackandcomplaints@cityandguilds.com

Published by City & Guilds
1 Giltspur Street
London
EC1A 9DD
T +44 (0)844 543 0000
F +44 (0)20 7294 2413
www.cityandguilds.com

City & Guilds is a registered charity established to promote education and training

WW-01-6188