City & Guilds Level 2 Award in F-Gas and ODS Regulations (2079)

Qualification handbook

Level 2 Award in F-Gas and ODS Regulations: Category I (2079-11) Accreditation Qualification number: 500/5730/3

Level 2 Award in F-Gas and ODS Regulations: Category II (2079-12) Accreditation Qualification number: 500/5731/5

Level 2 Award in F-Gas and ODS Regulations: Category III (2079-13) Accreditation Qualification number: 500/5732/7

Level 2 Award in F-Gas and ODS Regulations: Category IV (2079-14) Accreditation Qualification number: 500/5729/7

www.cityandguilds.com
March 2024
Version 2.3

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Version and date	Change detail	Section
Version 1.5 December 2012	Updated test specifications for Unit 101	**8 Test specifications**
Version 1.6 August 2013	Updated test specifications for Unit 401	**8 Test specifications**
Version 1.7 December 2013	Updated test specifications for Units 201 and 301	**8 Test specifications**
Version 1.8 March 2014	Updated test specifications for Unit 101	**8 Test specifications**
Version 1.9 August 2017	Added TQT details	**Qualification at a glance, Structure**
	Deleted QCF	**Throughout**
Version 2.0 March 2022	GLH and TQT clarified and highlighted	**About the qualifications**
Version 2.1 October 2022	References to GOLA removed. Assessment modules clarified.	**2.4 Rules of combination** **7 Assessment, 9 Units**
Version 2.2 December 2023	Image removed Reference to QCA removed Note added to confirm that 2079-12 is no longer awarded	**Front cover** **Throughout** **Throughout**
Version 2.3 March 2024	Update of Quality Assurance Statement	**Centre Requirements**

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Contents

1 About this document

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

Level 2 Award in F-Gas and ODS Regulations (2079)

Qualification title	City & Guilds qualification number	Regulatory number(s)	Guided Learning Hours	Total Qualification Time	Total credit value
Level 2 Award in F-Gas and ODS Regulations: Category I	2079-11	500/5730/3	30	30	3
Level 2 Award in F-Gas and ODS Regulations: Category II **(no longer awarded)**	2079-12	500/5731/5	30	30	3
Level 2 Award in F-Gas and ODS Regulations: Category III	2079-13	500/5732/7	20	20	2
Level 2 Award in F-Gas and ODS Regulations: Category IV	2079-14	500/5729/7	20	20	2

This document includes details and guidance on:

- centre resource requirements
- candidate entry requirements
- information about links with, and progression to, other qualifications
- qualification standards and specifications
- assessment requirements.

2 About the qualifications

2.2 Aims of the qualifications

The aim of these qualifications is to provide the learner with the knowledge and skills to work on the installation, service, maintenance, recovery and leak checking of stationary refrigeration, air conditioning and heat pump equipment that contains refrigerants classified as either fluorinated (F) gases or ozone depleting substances (ODS).

The introduction of the *Fluorinated Greenhouse Gases Regulations 2009* means it is an offence for an individual to work with fluorinated greenhouse gases without holding one of the qualifications listed within the regulations. These City & Guilds qualifications are recognised stationary refrigeration, air conditioning and heat pump equipment qualifications within the Regulations which become law in England, Scotland and Wales in 2009.

The Ozone-Depleting Substances (Qualifications) Regulations 2009 means it is an offence for an individual to work with ozone-depleting substances without holding one of the qualifications listed within the regulations. This regulation also lists certain 2079 qualifications as acceptable minimum requirements.

There are specific regulations to Northern Ireland; *The Fluorinated Greenhouse Gases Regulations (Northern Ireland) 2009*, which also name the achievement of these qualifications as acceptable minimum requirements.

The current draft of the revised *Ozone-Depleting Substances (Northern Ireland)* includes some of these qualifications as acceptable minimum requirements. However, until this legislation is introduced, individuals wishing to meet the current qualification requirements for ozone-depleting substances legislation in Northern Ireland (The Ozone Depleting Substances (Qualifications) Regulations (Northern Ireland) 2006), would need to undertake the 2078-01 City and Guilds Certificate in Handling Refrigerant qualification.

Other EU nations may also decree that these qualifications are suitable stationary refrigeration, air conditioning and heat pump equipment qualifications to meet their legislative requirements. Candidates should always determine the legal appropriateness of the use of these qualifications outside of the United Kingdom.

It is important to note that in both the F-Gas and ODS regulations, not all of the qualifications allow individuals to undertake all activities with all different systems. As such it is extremely important that centres and candidates ensure that candidates undertake the qualification that enables all of their relevant legal responsibilities to be met in relation to qualification achievement to be met upon certification. If there is uncertainty over what qualification should be undertaken, or what additional legal requirements need to be met in addition to qualification achievement, advice should be sought from F-Gas support.

City & Guilds have developed these qualifications from the Air Conditioning and Refrigeration Industry Board (ACRIB) specification. The qualifications are endorsed by the Sector Skills Council (SSC) for Building Services Engineering, SummitSkills, and are approved by OfQual.

2 About the qualifications

2.2 Aims of the qualifications

The aims of these qualifications are to:

- meet the legal qualification requirements of candidates who work or want to work with fluorinated gases and ozone depleted substances, as engineers in the refrigeration, air conditioning and heat pump sector
- allow candidates to learn, develop and practise the skills required for employment to work with fluorinated greenhouse gases
- reduce direct greenhouse gas emissions by limiting the release of fluorinated and other greenhouse gases
- reduce indirect greenhouse gas emissions by improving the energy efficiency of stationary refrigeration, air conditioning and heat pump equipment
- supersede the City & Guilds Level 2 Certificate in Handling Refrigerants (2078-01).

Philosophy and principles

The qualifications have been designed to meet the EU requirement of candidates being assessed in relation to their subject area on both practical skills and theoretical knowledge.

2 About the qualifications

2.3 Value statement

These qualifications meet the competence and training requirements of and EC Reg 303/2008.

All of the 2079 qualifications are named as meeting the minimum qualification requirements for certain activities in the following legislation:

- The Fluorinated Greenhouse Gases Regulations 2009
- The Fluorinated Greenhouse Gases Regulations (Northern Ireland) 2009.

Some of the 2079 qualifications are named as meeting the minimum qualification requirements for certain activities in the following legislation:

- The Ozone-Depleting Substances (Qualifications) Regulations 2009.

Some of the 2079 qualifications are named in the following draft legislation:

- *Ozone-Depleting Substances (Northern Ireland).*

The qualifications are aimed at any individual that does, or will, work with stationary refrigeration, air conditioning and heat pump equipment.

2 About the qualifications

2.4 Rules of combination

Rules of combination are used to define the structure of qualifications. The rules of combination specify the credits which must be achieved through a particular combination of units to gain a full qualification.

This section provides information about the full qualifications which may be awarded to candidates successfully completing the required combinations of units and/or credits as shown in the table below:

Accreditation unit reference	City & Guilds unit reference	Unit title	Mandatory/ optional for full qualification	Credit value	Excluded combination of units (if any)	Assessment modules (both must be achieved)
D/502/0629	Unit 2079-100	Handling category I fluorinated gases and ozone-depleting substances	Mandatory for 2079-11	3	None	101 and 102
D/502/1988	Unit 2079-200 (no longer awarded)	Handling category II fluorinated gases and ozone-depleting substances	Mandatory for 2079-12	3	None	201 and 202 (no longer awarded)
K/502/1993	Unit 2079-300	Handling category III fluorinated gases and ozone-depleting substances	Mandatory for 2079-13	2	None	301 and 302
A/502/2002	Unit 2079-400	Handling category IV fluorinated gases and ozone-depleting substances	Mandatory for 2079-14	2	None	401 and 402

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 Award in F-Gas and ODS Regulations: Category I	30	30
Level 2 Award in F-Gas and ODS Regulations: Category II (no longer awarded)	30	30
Level 2 Award in F-Gas and ODS Regulations: Category III	20	20
Level 2 Award in F-Gas and ODS Regulations: Category IV	20	20

2 About the qualifications

2.5 Sources of information and assistance

Related publications

City & Guilds also provides the following documents specifically for these qualifications:

Publication	Available from
Assessment Pack *Sample Assessment* *Test Specifications* *Assignment guides*	www.cityandguilds.com
SmartScreen	www.smartscreen.com

Other essential City & Guilds documents

There are other City & Guilds documents which contain general information on City & Guilds qualifications:

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

- ***Ensuring quality***
  contains updates on City & Guilds assessment and policy issues.

- ***Centre toolkit***
  contains additional information on *Providing City & Guilds qualifications*, in a CD-ROM, which links to the internet for access to the latest documents, reference materials and templates. The *Centre Toolkit* is sent to centres when they receive approved centre status. It is also available from to order at an additional cost.

- ***Online catalogue/shop***
  contains details of general regulations, registration and certification procedures and fees.

For the latest updates on our publications and details of how to obtain them and other City & Guilds resources, please refer to the City & Guilds website.

City & Guilds websites

Website	Address	Purpose and content
City & Guilds main website	**www.cityandguilds.com**	This is the main website for finding out about the City & Guilds group, accessing qualification information and publications.
Walled Garden	**www.walled-garden.com**	The Walled Garden is a qualification administration portal for approved centres, enabling them to register candidates and claim certification online.

Contacting City & Guilds by e-mail

The following e-mail addresses give direct access to our Customer Relations team.

e-mail	Query types
learnersupport@cityandguilds.com	all learner enquiries, including • requesting a replacement certificate • information about our qualification • finding a centre.
centresupport@cityandguilds.com	all centre enquiries
walledgarden@cityandguilds.com	all enquiries relating to the Walled Garden, including • setting up an account • resetting passwords.

2 Candidate entry and progression

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.

This is a qualification designed for experienced workers, it is not entry level qualification. It is desirable that candidates would have gained an existing qualification or possess significant equivalent experience in the sector.

Without evidence of formal qualifications, candidates must be able to demonstrate adequate prior knowledge and experience to ensure they have the potential to successfully gain the qualification[s].

Age restrictions

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

Verification of candidate identity

As all personnel and engineers working on equipment containing F gases and ODS need to have prescribed minimum qualifications, such as the 2079, it is extremely important that verification of candidate identification is undertaken.

Please refer to City & Guilds and JCQ guidance for identification requirements.

Other legal considerations

The following legal considerations apply to these qualifications.

- These qualifications are based upon the meeting the current legal requirements in accordance with the Fluorinated Greenhouse Gases and Ozone-Depleting Substances regulations. City & Guilds cannot be held responsible for any alterations made in the future which alter the qualifications requirements.
- Successful achievement of any of these qualifications is not the sole requirement for practising in accordance with the Fluorinated Greenhouse Gases and Ozone-Depleting Substances regulations. Candidates should ensure they are fully aware of the requirements according to the regulations **before** working with fluorinated gases or ozone-depleting substances.

Progression

The qualifications provide knowledge and practical skills related to the NVQ Level 2 in Refrigeration and Air Conditioning.

On completion of this qualification candidates will legally be able to work with fluorinated gases and may be able to progress onto the following City & Guilds qualifications:

- City & Guilds Level 2 Diploma in Refrigeration, Air-Conditioning and Heat Pump Systems (6390-20)
- City & Guilds Level 3 Diploma in Refrigeration, Air-Conditioning and Heat Pump Systems (6390-30)

3 Centre requirements

3.1 Centre, qualification and fast track approval

Centres not yet approved by City & Guilds

To offer these qualifications, new centres will need to gain both **centre and qualification approval**. Please refer to 0 for further information.

Existing City & Guilds centres

To offer this qualification, centres already approved to deliver City & Guilds qualifications will need to gain **qualification approval**. Please refer to 0 for further information.

Centres already offering City & Guilds qualifications in this subject area

There is **no** fast track approval provision for this qualification because of the need to have a technical test rig inspected by an external verifier in order to conduct the practical assessment requirements for each category.

Existing centres wishing to offer this qualification must use the **standard** Qualification Approval Process.

Centres must provide a clear photograph of the built technical test rig, with the photograph also proving that the rig relates to the centre (such as a member of staff holding letter head), to accompany the submission of the qualification approval form. Certification rights are not granted until after the first successful EV visit of this qualification.

4 Centre requirements

4.2 Resource requirements

Physical resources

It is acceptable for centres to use specially designated areas within a centre to assess, for example, the installation of a technical rig to meet the practical assessment requirements for each category. The equipment, systems and machinery must meet the practical assessments requirements as detailed within the *Assessment guide for centres* (stock code EN-00-2079) and be capable of being used under normal working conditions.

Health & Safety relating to rig

The rig must be built in accordance with the relevant Acts and Regulations in respect of health and safety. Centres must meet all insurance requirements to deliver this qualification, including ensuring those that relate to Brazing.

Safety equipment and codes of practice associated with the equipment and working practices must be understood and implemented by the all staff involved with building of the rig, the delivery and the assessment at all times. Failure to work safely will result in the immediate halting and failure of the assessment.

Where a mobile rig is built, centres must ensure that any location where the practical assessment is delivered meets the full health & safety requirements for delivery (including brazing) and has sufficient insurance to undertake all of the practical assessment activities.

Human resources

To meet the quality assurance criteria for these qualifications, the centre must ensure that the following internal roles are undertaken:

- quality assurance co-ordinator
- trainer/tutor
- assessor
- internal verifier

Staff delivering the qualifications

All new teachers delivering publicly funded qualifications in the learning and skills sector (all post 16 education – including FE, adult and community learning, work-based learning, offender education) in England are now required to take qualifications which form part of the Qualified Teacher – Learning and Skills (QTLS) framework. City & Guilds offers a range of qualifications within the QTLS framework. Details are available on the QTLS pages of **www.cityandguilds.com**.

Staff delivering these qualifications must also be able to demonstrate that they are technically competent in the area 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.

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

Every centre must have a minimum of one assessor and one internal verifier.

Trainer/tutors

- Trainers/tutors must be occupationally knowledgeable and familiar with the occupational standards for refrigeration and air conditioning, in addition to having a full understanding of the related regulations for which they are delivering training. This knowledge must be at least to the same level as the training being delivered.

- Trainers/tutors must have credible and verifiable experience of providing training.

Assessors and internal verifiers

- Assessors and internal verifiers must hold, or be working towards, the relevant Assessor/Verifier (A/V or D) (or equivalent) units (or City & Guilds recognised alternatives when the qualification is delivered outside of the UK) for their role(s) in delivering, assessing and verifying these qualifications.
- Assessors and internal verifiers must hold as a minimum one of the following qualifications:
    - City & Guilds NVQ in refrigeration and air conditioning (6007, 6017 or 6087)
    - City & Guilds 207/3
    - City & Guilds 257 part 1
    - City & Guilds 257 part 2
    - City & Guilds Certificate in refrigeration and air conditioning (6127)
    - A related HND or degree coupled with practical experience as agreed with a City & Guilds External Verifier
    - SQA SVQ in refrigeration and air conditioning.

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge of the occupational area and of best practice in delivery, mentoring, training, assessment and verification remains current, and takes account of any national or legislative developments.

In addition, centre staff are expected to demonstrate their CPD achievement by ensuring trainers/tutors, assessors and verifiers involved in the development are fully aware of the regulatory requirements and achieve the Level 2 Award in F-Gas and ODS Regulations: Category I (2079-11) preferably before, but if not, as soon as possible after commencing delivery.

4 Centre requirements

4.3 Administration, registration and certification

City & Guilds' administration

Full details of City & Guilds' administrative procedures for these qualifications are provided in the *Online Catalogue*. This information includes details on:

- registration procedures
- enrolment numbers
- fees
- entry for examinations
- claiming certification.

Centres should be aware of time constraints regarding the registration and certification periods for the qualifications, as specified in the City & Guilds *Online Catalogue*.

Centres should follow all administrative guidance carefully, particularly noting that fees, registration and certification end dates for the qualifications are subject to change. The latest News is available on the website (**www.cityandguilds.com**).

Regulations for the conduct of examinations

Regulations for the conduct of examinations for online and written examinations are given in *Providing City & Guilds qualifications - a guide to centre and qualification approval* and in the *Online Catalogue*. Centres should ensure they are familiar with all requirements prior to offering assessments.

Retaining assessment records

Centres must retain copies of candidate paper-based assessment records for at least three years after certification.

Notification of results

After completion of assessment, candidates will receive, via their centre, a 'notification of candidate results', giving details of how they performed. It is not a certificate of achievement.

Full certificates

Full certificates are only issued to candidates who have met the full requirements of the qualification[s], as described in section 2.4 Rules of Combination.

4 Centre requirements

4.4 Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City and Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

This information is a summary of quality assurance requirements.

Providing City & Guilds qualifications and in the *Centre toolkit* provide full details and guidance on:

- internal quality assurance
- external quality assurance
- roles and responsibilities of quality assurance staff.

Internal quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications.

Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance, and City & Guilds is responsible for external quality assurance.

External quality assurance

External quality assurance for the qualification[s] will be provided by City & Guilds external quality assurance process.

External Quality Assurers (EQAs) are appointed by City & Guilds to approve centres, and to monitor the assessment and internal quality assurance carried out by centres. External quality assurance is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres.

To carry out their quality assurance role, EQAs must have appropriate occupational and verifying knowledge and expertise. City & Guilds' EQAs attend training and development designed to keep them up-to-date, facilitate standardisation between EQAs and share good practice.

City & Guilds EQAs use electronic report forms designed to provide an objective risk analysis of individual centre assessment and verification practice.

External Quality Assurers (EQAs):

The role of the EQA is to:

- provide advice and support to centre staff
- ensure the quality and consistency of assessments within and between centres by the use of systematic sampling
- regularly visit centres to ensure they continue to meet the centre and qualification approval criteria

- provide feedback to centres and to City & Guilds.

4 Centre requirements

4.3 Administration, registration and certification

5 Course design and delivery

5.1 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 qualifications. This is sometimes referred to as diagnostic testing.

City & Guilds recommends that centres provide an induction programme to ensure the candidate fully understands the requirements of the qualifications 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.

Further guidance about initial assessment and induction, as well as a learning contract that centres may use, are available in the *Centre toolkit.*

5 Course design and delivery

5.2 Recommended delivery strategies

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

Centres may design course programmes of study in any way that

- best meets the needs and capabilities of their candidates
- which satisfies the requirements of the qualification[s].

In particular, staff should consider the skills and knowledge related to the national occupational standards.

City & Guilds recommends that centres address the wider curriculum, where appropriate, when designing and delivering the course. Centres should also consider links to the National Occupational Standards, Key/Core Skills and other related qualifications. Relationship tables are provided section 6 Relationships to other qualifications to assist centres with the design and delivery of the qualification.

Centres may wish to include topics as part of the course programme which will not be assessed through the qualification[s].

For further information to assist with the planning and development of the programme, please refer to the delivery strategies/suggested topics included in each unit.

5 Course design and delivery

5.3 Data protection, confidentiality and legal requirements

Data protection and confidentiality

Data protection and confidentiality must not be overlooked when planning the delivery of this qualification.

Centres offering these qualifications will need to provide City & Guilds with personal data for staff and candidates. Guidance on data protection and the obligations of City & Guilds and centres are explained in *Providing City & Guilds qualifications*.

As a condition of approval, centre enrolment forms must include a candidate signed statement, as shown below, before candidates are registered on any of the Level 2 Awards in F-Gas and ODS regulations (2079). If this cannot be included on the normal enrolment form, a separate enrolment form including the statement below must be produced, administered and retained by the centre:

'I _____the candidate consent to my City & Guilds 2079 registration information being disclosed to City & Guilds.

I understand that under currently proposed UK government legislation City & Guilds may be obliged to, and can, disclose information to interested parties about my achievement, or otherwise, of this qualification'.

Legal requirements

- These qualifications have been designed to meet the EU and UK regulatory training requirements in relation to working with fluorinated gases and ozone-depleting substances (according to the Fluorinated Greenhouse Gases Regulations 2009, The Ozone-Depleting Substances (Qualifications) Regulations 2009, The Fluorinated Greenhouse Gases Regulations (Northern Ireland) 2009 and EC Reg 303/2008).

There are additional ongoing requirements that relate to these regulations and each individual working with these substances must ensure they adhere to all of the regulatory requirements on an ongoing basis.

5 Course design and delivery

5.4 Learning and support resources

The qualification specification includes suggested resources for each unit.

Unit	Resource	How to access
All	Regulations: • The Fluorinated Greenhouse Gases Regulations 2009 (for England, Scotland and Wales) • The Ozone-Depleting Substances (Qualifications) Regulations 2009 (for England, Scotland and Wales) • The Fluorinated Greenhouse Gases Regulations 2009 (for Northern Ireland) • EC 842/2006 • EC 303/2008	**www.defra.gov.uk** **www.doeni.gov.uk**
All	SmartScreen. Tutor and learner materials: • Handouts • Interactive slides • Tutor forum • Career support	**www.SmartScreen.co.uk**

6 Relationships to other qualifications

6.1 Links to National Occupational Standards/other qualifications

Coverage of this subject will be provided within the new National Occupational Standards, currently due for approval in 2010.

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications. For example, units within a qualification may be similar in content to units in the NQF qualification which the candidate may have already undertaken and this may present opportunities for APL.

Contacting the Sector Skills Council/Standards Setting Body

These units were developed by City & Guilds from the F-Gas assessment standard set by the Air Conditioning and Refrigeration Industry Board (ACRIB) and relate to the occupational standards that had been set by SummitSkills (formerly the SSC).

Name of SSB	**Air Conditioning and Refrigeration Industry Board (ACRIB)**
Address	Kelvin House, 76 Mill Lane, Carshalton, Surrey SM5 2JR
Telephone	020 8254 7842
Fax	020 8773 0165
e-mail	N/A
URL	www.acrib.org.uk

6 Relationships to other qualifications

6.2 Key/Essential/Functional skills (England, Wales and Northern Ireland)

These qualifications include opportunities to develop and practise many of the underlying skills and techniques described in Part A of the standard for each key skills qualification. Where candidates are working towards any key skills alongside these qualifications they will need to be registered with City & Guilds for the key skills qualifications.

It should not be assumed that candidates will necessarily be competent in, or able to produce evidence for, the key skills at the same level as these qualifications.

The 'signposts' below identify the **potential** for key/essential/functional skills portfolio evidence gathering that can be naturally incorporated into the completion of each unit. Any key skills evidence needs to be separately assessed and must meet the relevant standard defined in the QCA document '*Key skills qualifications standards and guidance*'.

If these qualifications are being delivered alongside an Essential Skills Communication and/or Application of Number programme in **Northern Ireland**, it is good practice to emphasise the relevance of these skills to candidates when completing their Action-Based Activities.

Unit number	**Problem Solving**	**Application of Number**
100	PS2	N2
200	PS2	N2
300	PS2	N2
400	PS2	N2

6 Relationships to other qualifications

6.3 Personal, Learning and Thinking Skills (PLTS)

Candidates taking these qualifications will demonstrate PLTS in the following areas:

Unit number	**Personal, Learning and Thinking Skills Areas**					
	Independent enquirers	Creative thinkers	Reflective learners	Team workers	Self-managers	Effective participators
100	✓				✓	
200	✓				✓	
300	✓				✓	
400	✓				✓	

7 Assessment

7.1 Summary of assessment requirements

For each qualification, candidates will be required to successfully complete both of the following assessments:

- **one** practical assessment
- **one** theoretical assessment

City & Guilds provides the following assessments:

- Online, on-demand testing using multiple choice questions
- Practical assessments.

Unit Ref.	Title	Assessment Method	Where to obtain assessment materials
100	Handling fluorinated gases and ozone-depleting substances (category I personnel.)	City & Guilds e-volve online multiple choice test **2079-101** The assessment covers all of the knowledge outcomes.	Examinations provided on E-VOLVE
		Assessment **2079-102** The assessment covers the practical activities for all outcomes and will also sample underpinning knowledge to verify coverage of the unit.	*City & Guilds website*
200	Handling fluorinated gases and ozone-depleting substances (category II personnel.)	City & Guilds e-volve online multiple choice test **2079-201** The assessment covers all of the knowledge outcomes.	Examinations provided on E-VOLVE
		Assessment **2079-202** The assessment covers the practical activities for all outcomes and will also sample underpinning knowledge to verify coverage of the unit. **This unit is no longer awarded.**	*City & Guilds website*

Unit Ref.	Title	Assessment Method	Where to obtain assessment materials
300	Handling fluorinated gases and ozone-depleting substances (category III personnel.)	City & Guilds e-volve online multiple choice test **2079-301** The assessment covers all of the knowledge outcomes.	Examinations provided on E-VOLVE
		Assessment **2079-302** The assessment covers the practical activities for all outcomes and will also sample underpinning knowledge to verify coverage of the unit.	*City & Guilds website*
400	Handling fluorinated gases and ozone-depleting substances (category IV personnel.)	City & Guilds e-volve online multiple choice test **2079-401** The assessment covers all of the knowledge outcomes.	Examinations provided on E-VOLVE
		Assessment **2079-402** The assessment covers the practical activities for all outcomes and will also sample underpinning knowledge to verify coverage of the unit.	*City & Guilds website*

Grading and marking

Grading of assessments for these units and qualifications is pass or fail. The theoretical, multiple choice assessment is externally marked by e-volve.

The practical assessment is internally marked and externally verified. Detailed performance criteria for the practical assessment are provided in the *Assessment guide for centres*.

Assessment guidance

General guidance

This *Assessment guide for centres* provides assessors with the necessary information to prepare, conduct and mark the practical assessments for the Award.

The *Assessment guide for centres* contains information for the assessor on set up of the rig, performance criteria for each assessment and recording forms.

No candidate assessments should be conducted until the external verifier has approved the test rig, as part of the qualification approval process.

Assessors should ensure that candidates understand the assessment and the performance criteria **prior** to starting the assessment.

Safe working

Adequate supervision must be provided in accordance with the relevant Acts and Regulations in respect of health and safety.

Safety equipment and codes of practice associated with the equipment and working practices must be understood and implemented by the candidate at all times. Failure to work safely will result in the immediate halting and failure of the assessment.

Performance criteria

All performance criteria within each assessment must be completed satisfactorily for a candidate to be credited with a pass.

Performance criteria for each assessment are provided for each assessment.

Candidates must complete the assessment without assistance. Each candidate must have access to their own testing station which they solely work upon. No joint working is permitted.

Important Note: The ratio between assessors and candidates should not exceed 3: 1 during the assessment.

All practical tasks must be successfully completed for the candidate to be awarded a pass. If the candidate does not pass all assessments then the candidate is deemed not yet competent. Candidates that are not yet competent can re-take the practical assessments but must complete the assessment in its entirety. Candidates retaking the assessment cannot undertake only those aspects of assessments where they were previously unsuccessful.

All referral records must be held with the candidate records for inspection by the External Verifier.

Candidates must observe the correct health and safety procedures when carrying out any of the practical assessments. This must be clearly demonstrated to the assessor. Failure to observe the correct health and safety procedures must result in the assessment being immediately halted by the assessor.

Sample assessments

In addition to the recording requirements stated above City & Guilds provides sample assessment materials which are available to download from the City & Guilds website.

Accreditation of prior learning and experience (APEL)

Accreditation of Prior Learning (APL) and Accreditation of Prior Experience and Learning (APEL) recognise the contribution a person's previous experience could contribute to a qualification and exempt candidates from aspects of the learning input. The assessments must be fully undertaken and achieved in order for any candidate to achieve certification of the Award.

Simulation

Simulation is not permitted for the assessment of these qualifications.

7 Assessment

7.2 Evidence requirements

Evidence requirements

Evidence of candidate performance in the practical assessment will be derived from assessor observation of the candidate carrying out activities on the test rig in the City & Guilds set practical assessment.

Evidence of candidate knowledge in the theory assessment will be derived from the City & Guilds set and marked theory assessment.

Detailed additional guidance is provided on a unit basis for the use of these performance assessment methods.

7 Assessment

7.3 Recording forms

City & Guilds has developed a set of *Recording forms* for the practical assessment.

Recording forms are available on the City & Guilds website in the *Assessment guide for centres*.

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

8 Test specifications

The test specifications for the units and qualifications are below.

Test: 101 (closed book)
Duration: 1 hour and 20 minutes (80 minutes)
Grading: Pass/fail only

Test Section	Area		No. of questions	% of overall grade
01	01.01	Identify standard units of temperature, pressure, mass, density, and enthalpy	13	32.5
	01.02	Describe basic theory of basic vapour compressions cycle, including key terms, and use of basic pH diagram		
	01.02	Describe the function of the four major components/processes (compressor, condenser, expansion device, evaporator)		
	01.02	Identify condition/state of refrigerant (ie superheated vapour/2 phase mix/subcooled liquid) by use of refrigerant comparator or service gauge		
	01.02	Determine reasonable operating conditions (sat. temperatures) for a condenser and evaporator, for a range of applications		
	01.02	Describe features of zeotropic blends		
	04.01	Understand the function of and role/importance of monitoring system performance for indications that leakage has occurred from: a. valves – service, pressure relief b. thermostats/pressure controls c. liquid line, receiver sight glasses and indicators d. defrost controls e. overloads f. service gauge manifold and thermometer g. oil control and separator systems h. high pressure receivers i. low pressure accumulators		
02	02.01	Describe climate change and the Kyoto Protocol	6	15
	02.02			
	02.03	Understand direct and indirect Global Warming Potential (GWP) of the common HFC and HC refrigerants		
	02.04	Understand importance of energy efficiency on greenhouse gas emissions to the atmosphere		

02.05	Describe the basic requirements of Regulation (EC) No. 842/2006 and other relevant regulations

Test Section	Area		No. of questions	% of overall grade
03	02.06	Describe the equipment records/commissioning data requirements to be recorded in such records	2	5
04	04.01 04.02 04.06	Identify potential leakage points of refrigeration/air conditioning and heat pump equipment	2	5
05	04.03	State requirements and procedures for handling, storage, transportation and disposal of contaminated refrigerant and oil	2	5
06	04.04 04.06	Describe the function of a compressor and the risks of refrigerant leakage or release associated with it	2	5
	04.05	Identify the state/condition of a compressor that could lead to refrigerant release		
07	04.04 04.06	Describe the function of a condenser and the risks of refrigerant leakage or release associated with it	2	5
	04.05	Identify the state/condition of a condenser that could lead to refrigerant release		
08	04.04 04.06	Describe the function of an evaporator and the risks of refrigerant leakage or release associated with it	2	5
	04.05	Identify the state/condition of a evaporator that could lead to refrigerant release		
09	04.04 04.06	Describe the function of a thermostatic expansion valve and a capillary tube restrictor, and the risk of refrigerant release associated with them	2	5
	04.05	Identify the state/condition of a thermostatic expansion valve and capillary tube restrictor that could lead to refrigerant release		
10	03.01 03.02	Demonstrate knowledge of the potential of HCFC refrigerants to deplete ozone, and the effect of chlorine on ozone depletion. Identify the ODP of various HCFC refrigerants in use	2	5
	03.03 03.04	Describe the basic requirements of Regulation (EC) 2037/2000 and the impact of the Montreal Protocol		
11	05.02	Describe the hazards associated with refrigerant release, including a cold burns b asphyxiation c thermal decomposition d CNS effect e cardiac sensitisation	5	12.5
	05.03	Describe the hazards associated with flame brazing		
	05.01	Describe the hazards associated with pressure testing with nitrogen		
		Total	**40**	**100**

Test 201: Handling Fluorinated Gases and Ozone-Depleting Substances (Category II Personnel) (closed book)

Duration: 1 hour and 10 minutes (70 minutes)

Grading: Pass/fail only

Test Section	Area		No. of questions	% of overall grade
01	01.01	Identify the standard units relating to Category II systems	11	32
	01.02.01	Identify the terms and principles of basic theory/thermodynamics that relate to Category II systems (basic vapour compressions cycle, key terms and P-h diagrams)		
	01.02.02	Identify the terms and principles of basic theory/thermodynamics that relate to Category II systems (function of compressor, condenser, expansion device and evaporator)		
	01.02.03	Identify the terms and principles of basic theory/thermodynamics that relate to Category II systems (condition/state of refrigerant by use of a refrigerant comparator or service gauge)		
	01.02.04	Identify the terms and principles of basic theory/thermodynamics that relate to Category II systems (reasonable operating conditions for a condenser and evaporator for a range of applications)		
	01.02.05	Identify the terms and principles of basic theory/thermodynamics that relate to Category II systems (features of zeotropic blends)		
02	02.01	identify the stated causes of climate change	8	23.5
	02.02	identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions		
	02.03	Identify direct and indirect Global Warming Potential (GWP) of the common Hydrofluorocarbon (HFC) and Hydrocarbon (HC) refrigerants		
	02.04	Identify the importance of energy efficiency on greenhouse gas emissions to atmosphere		
	02.05	Identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations		
	02.06	Identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards		
03	03.01	Identify Ozone Depletion Potential (ODP) of Hydrochlorofluorocarbon (HCFC) refrigerants	2	6
	03.02	Identify the effect of chlorine on ozone depletion		
	03.03	Identify the basic requirements of Regulation (EC) 2037/2000		

03.04	Identify the aims and impact of the Montreal Protocol

Test Section	Area		No. of questions	% of overall grade
04	04.02	Identify potential leakage points of refrigeration/air conditioning and heat pump equipment	8	23.5
	04.03	Identify the requirements and procedures for handling, storage, transportation and disposal of contaminated refrigerant and oil		
	04.04	Identify how the state/condition of equipment (major components) can lead to refrigerant release		
	04.05	Identify the risks of refrigerant release associated with equipment (major, control and line components)		
05	05.01	Identify the hazards and safe working practices associated with flame brazing	5	15
	05.02	Identify the hazards and safe working practices associated with nitrogen pressure testing		
	05.03	Identify the hazards and safe working practices associated with refrigerant release		
		Total	**34**	**100**

Test 301: Handling Fluorinated Gases and Ozone-Depleting Substances (Category III Personnel) (closed book)

Duration: 25 minutes

Grading: Pass/fail only

Test Section	Area		No. of questions	% of overall grade
01	01.01	Identify the stated causes of climate change	6	50
	01.02	Identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions		
	01.03	Identify direct and indirect global warming potential (GWP) of the common Hydrofluorocarbon (HFC) and Hydrocarbon (HC) refrigerants		
	01.04	Identify the importance of energy efficiency on greenhouse gas emissions to atmosphere		
	01.05	Identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations		
	01.06	Identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards		
02	02.01	Identify Ozone Depletion Potential (ODP) of Hydrochlorofluorocarbon (HCFC) refrigerants	2	16.5
	02.02	Identify the effect of chlorine on ozone depletion		
	02.03	Identify the basic requirements of Regulation (EC) 2037/2000		
	02.04	Identify the aims and impact of the Montreal Protocol		
03	03.01	Identify the hazards and safe working practices associated with refrigerant release	4	33.5
	03.02	Identify the safe working practices associated with the recovery, storage and transportation of recovered refrigerant		
		Total	**12**	**100**

Test: 401 (closed book)
Duration: 35 minutes
Grading: Pass/fail only

Test Section	Area	No. of questions	% of overall grade
01	Identify basic standard units	2	12.5
02	Identify the causes and effects of global warming and climate change	8	50
03	Identify causes and effects of ozone depletion	2	12.5
04	Identify stationary refrigerant, air conditioning and heat-pump system leakage risk	2	12.5
05	Identify the hazards and safe working practices for the leak checking of stationary refrigerant, air conditioning and heat-pump systems	2	12.5
	Total	**16**	**100**

9 Units

9.1 About the units

Availability of units

The units for these qualifications follow.

Structure of units

The units in these qualifications are written in a standard format and comprise the following:

- City & Guilds reference number
- title
- level
- credit value
- unit aim
- relationship to NOS/other qualifications
- endorsement by a sector or other appropriate body
- key skills/PLTS mapping
- statement of guided learning hours
- assessment and grading
- learning outcomes which are comprised of a number of practical and/or knowledge based assessment criteria
- guidance notes.

9.2 Glossary of terms used in the units

The following key words and terms are used in the units.

Term	Definition
F gas[es]	Fluorinated gas[es]
ODS	Ozone depleting substances
CNS	Central nervous system
HC	Hydrocarbon
HFC	Hydrofluorocarbon
HCFC	Hydrochlorofluorocarbon

9.3 The units

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel).

Assessed by external e-volve test 101 and practical assessment 102.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel.)

Assessed by external e-volve test 201 and practical assessment 202. **(no longer awarded)**

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel.)

Assessed by external e-volve test 301 and practical assessment 302.

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel.)

Assessed by external e-volve test 401 and practical assessment 402.

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Level: 2

Credit value: 3

Unit aim(s)

The aim of this unit is to provide the learner with the knowledge and practical skills required to undertake leak checking, recovery, installation, service and maintenance of stationary refrigeration, air conditioning and heat-pump equipment that contains refrigerants which are classified as either fluorinated (F) gases or ozone depleting substances (ODS) to meet Category I theoretical and practical requirements. The learner will also become aware of the national and European regulations which legislate in the areas of refrigerant and other greenhouse gas emissions to atmosphere.

Successful candidates will demonstrate an understanding of how to work to legal requirements, work safely, work with due regard to the local and global environment, reduce greenhouse gas emissions and reduce energy usage in order to meet the theoretical requirements of Category I regulations. Successful candidates will demonstrate the application of practical skills to successfully fabricate and examine pipework, undertake pressure testing, evacuation and record completion, refrigerant charging, leak checking and record keeping, and recover refrigerants and oil and preparation for disposal.

Successful candidates will be qualified to undertake leak checking, recovery, installation, service and maintenance of equipment.

Learning outcomes

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

1 identify basic systems, terms, principles, units and how these relate to theory and thermodynamics of vapour compression cycles and refrigerants

2 identify the causes and effects of global warming and climate change

3 identify causes and effects of ozone depletion

4 identify stationary refrigerant, air conditioning and heat-pump system components, functions and leakage risk

5 identify the hazards and safe working practices for the installation, commissioning and handling of refrigerants

6 fabricate and examine pipework

7 undertake pressure testing, evacuation and record completion

8 undertake refrigerant charging, leak checking and record keeping

9 undertake recovery of refrigerant and oil and prepare for disposal.

Guided learning hours

It is recommended that 30 hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the SummitSkills Refrigeration and Air Conditioning National Occupational Standards.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by the Air Conditioning and Refrigeration Industry Board (ACRIB) and by SummitSkills.

Key Skills

This unit contributes towards the Key Skills in the following areas:

- Communication
- Working with Others
- Problem Solving

Assessment and grading

This unit will be assessed by an externally set and marked on-line examination (E-VOLVE) (unit 101) and practical assessment (unit 102).

Practical guidance

Please refer to the *Assessment guide for centres* in combination with learning outcomes 6-9 for detailed guidance on the practical assessment.

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 1 Identify basic systems, terms, principles, units and how these relate to theory and thermodynamics of vapour compression cycles and refrigerants

Assessment Criteria

The learner can:

1 identify the **standard units** relating to category I systems

2 identify the terms and principles of **basic theory/thermodynamics** that relate to category I systems.

Range/Scope/Unit content

Standard units

- temperature
- pressure
- mass
- density
- enthalpy

Basic theory/thermodynamics

- basic vapour compression cycle – key terms – four major components/processes, plots and uses basic pH diagram, function of each of the four major components (compressor, condenser, expansion device, evaporator)
- condition/state of refrigerant (eg superheated vapour/saturated two phase mix/subcooled liquid), by use of refrigerant comparator or service gauge
- reasonable operating conditions (sat. temps) for condenser and evaporator, for a range of applications (chill/frozen display/ storage, air conditioning/heat-pumping)
- features of zeotropic blends

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 2 Identify the causes and effects of global warming and climate change

Assessment Criteria

The learner can:

1 identify the stated causes of climate change

2 identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions

3 identify direct and indirect global warming potential (GWP) of the common hydrofluorocarbon (HFC) and hydrocarbon (HC) refrigerants

4 identify the importance of energy efficiency on greenhouse gas emissions to atmosphere

5 identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations

6 identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards.

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 3 Identify causes and effects of ozone depletion

Assessment Criteria

The learner can:

1 identify ozone depletion potential (ODP) of hydrochlorofluorocarbon (HCFC) refrigerants
2 identify the effect of chlorine on ozone depletion
3 identify the basic requirements of Regulation (EC) 2037/2000
4 identify the aims and impact of the Montreal Protocol

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 4 Identify stationary refrigerant, air conditioning and heat-pump system components, functions and leakage risk

Assessment Criteria

The learner can:

1 identify the function of and the role/importance of monitoring system performance for indications that leakage has occurred from **equipment (control and line components)** relating to category I systems

2 identify potential leakage points of refrigeration/air conditioning and heat pump equipment

3 identify the requirements and procedures for handling, storage, transportation and disposal of contaminated refrigerant and oil

4 identify the function of stationary refrigeration, air conditioning and heat-pump system **equipment (major components)**

5 identify how the state/condition of **equipment (major components)** can lead to refrigerant release

6 identify the risks of refrigerant release associated with **equipment (major, control and line components).**

Range/Scope/Unit content

Equipment (control and line components)

- valves – service, pressure relief
- thermostats/pressure controls
- liquid line, receiver sight glasses and indicators
- defrost controls
- overloads
- service gauge manifold and thermometer
- oil control and separator systems
- high pressure receivers
- low pressure accumulators

Equipment (major components)

- compressor
- condenser
- evaporator
- thermostatic expansion valves
- capillary tube restrictor

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 5 Identify the hazards and safe working practices for the installation, commissioning and handling of refrigerants

Assessment Criteria

The learner can:

1 identify the **hazards** and **safe working practices** associated with **flame brazing**

2 identify the **hazards** and **safe working practices** associated with **nitrogen pressure testing**

3 identify the **hazards** and **safe working practices** associated with **refrigerant release.**

Range/Scope/Unit content

Flame brazing hazards

- hot burns
- combustion
- fire
- explosion

Flame brazing safe working practices

- correct selection and use of personal protective equipment (PPE)
- storage of flammable gas in line with manufacturers instructions and current regulations
- transportation of flammable gas in line with manufacturers instructions and current regulations
- safe working practices for flame brazing in accordance with current Health & Safety at Work Act

Nitrogen hazards

- explosion
- physical injury due to incorrect handling and lifting techniques
- asphyxiation

Nitrogen safe working practices

- selection and use of appropriate personal protective equipment (PPE)
- safe handling and lifting techniques
- pneumatic testing in line with recognised safe industry practices
- storage of nitrogen cylinders in line with manufacturers instructions and current regulations
- transportation of nitrogen cylinders in line with manufacturers instructions and current regulations
- gauge and regulator selection
- safe working practices for nitrogen in accordance with the Health & Safety at Work Act

Refrigerant release hazards

- cold burns
- asphyxiation
- thermal decomposition
- central nervous system (CNS) effect
- cardiac sensitization

Refrigeration release safe working practices

- correct selection and use of personal protective equipment (PPE)
- safe working practices for refrigerant handling in accordance with current Health & Safety at Work Act

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 6 Fabricate and examine pipework

Assessment Criteria

The learner can:

1 fabricate pipework test piece by completing brazed and mechanical joints to industry standards

2 install pipework test piece to testing station

3 visually examine pipework on testing station for signs of leakage

4 remove fabricated test piece from the system and inspect for penetration by a cut and peel test, upon completion of refrigerant recovery.

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 7 Undertake pressure testing, evacuation and record completion

Assessment Criteria

The learner can:

1 determine appropriate test pressures to BS EN378 standards
2 conduct strength tests to BS EN378 standards
3 undertake leak / tightness pressure tests to BS EN378 standards
4 evacuate the system to below 2 Torr/2000 microns/2.7m bar/270 Pa
5 complete pressure testing and evacuation records.

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 8 Undertake refrigerant charging, leak checking and record keeping

Assessment Criteria

The learner can:

1 charge zeotropic blend into a system
2 record the weight of refrigerant charged (3 kg or more)
3 run a charged system
4 identify state of refrigerant in cylinder prior to charging
5 identify state of refrigerant in system while running
6 visually inspect the system for leaks
7 use **equipment** to accurately determine that the charge is correct
8 undertake an indirect leakage check
9 use an electronic leak detector to carry out a direct leak check to EU commission standard leak checking requirements
10 complete a leak check record
11 connect and disconnect gauges to/from running system with minimal refrigerant loss (by reducing gauge pressure to safe minimum) using a **valve**.

Range/Scope/Unit content

Equipment

- gauges
- thermometers
- refrigerant comparator
- liquid level indicator
- sight glasses
- refrigerant log book

Valve

- service
- Schrader

Unit 100 Handling fluorinated gases and ozone-depleting substances (category I personnel)

Outcome 9 Undertake recovery of refrigerant and oil and prepare for disposal

Assessment Criteria

The learner can:

1 recover refrigerant from system into recovery cylinder
2 record weight of refrigerant recovered
3 drain oil out of a compressor to meet health & safety requirements.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Level: 2

Credit value: 3

Unit aim(s)

The aim of this unit is to provide the learner with the knowledge and practical skills required to undertake leak checking, recovery, installation, service and maintenance of stationary refrigeration, air conditioning and heat-pump equipment that contains refrigerants which are classified as either fluorinated (F) gases or ozone depleting substances (ODS) to meet Category II theoretical and practical requirements. The learner will also become aware of the national and European regulations which legislate in the areas of refrigerant and other greenhouse gas emissions to atmosphere.

Successful candidates will demonstrate an understanding of how to work to legal requirements, work safely, work with due regard to the local and global environment, reduce greenhouse gas emissions, reduce energy usage in order to meet the theoretical requirements of Category II regulations. Successful candidates will demonstrate the application of practical skills to successfully fabricate and examine pipework, undertake refrigerant charging, leak checking and record keeping and undertake recovery of refrigerant and oil and prepare for disposal.

Successful candidates will be qualified to undertake installation, service and maintenance of equipment with a charge of less than 3 kg, (6kg if hermetically sealed) and leakage checking.

Learning outcomes

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

1 identify basic systems, terms, principles, units and how these relate to theory and thermodynamics of vapour compression cycles and refrigerants

2 identify the causes and effects of global warming and climate change

3 identify causes and effects of ozone depletion

4 identify stationary refrigerant, air conditioning and heat-pump system components, functions and leakage risk

5 identify the hazards and safe working practices for the installation, commissioning and handling of refrigerants

6 fabricate and examine pipework

7 undertake pressure testing, evacuation and record completion

8 undertake refrigerant charging, leak checking and record keeping

9 undertake recovery of refrigerant and oil and prepare for disposal.

Guided learning hours

It is recommended that 30 hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the SummitSkills Refrigeration and Air Conditioning National Occupational Standards.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by the Air Conditioning and Refrigeration Industry Board (ACRIB) and by SummitSkills.

Key Skills

This unit contributes towards the Key Skills in the following areas:

- Communication
- Working with Others
- Problem Solving

Assessment and grading

This unit will be assessed by an externally set and marked on-line examination (E-VOLVE) (unit 201) and practical assessment (unit 202).

Practical guidance

Please refer to the practical assessment guide in combination with learning outcomes 6-9 for detailed guidance on the practical assessment.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 1 Identify basic systems, terms, principles, units and how these relate to theory and thermodynamics of vapour compression cycles and refrigerants

Assessment Criteria

The learner can:

1 identify the **standard units** relating to category II systems

2 identify the terms and principles of **basic theory/thermodynamics** that relate to category II systems.

Range/Scope/Unit content

Standard Units

- temperature
- pressure
- mass
- density
- enthalpy

Basic theory/thermodynamics

- basic vapour compression cycle – key terms – four major components/processes, plots and uses basic pH diagram, function of each of the four major components (compressor, condenser, expansion device, evaporator)
- condition/state of refrigerant, (eg superheated vapour/saturated two phase mix/subcooled liquid) by use of refrigerant comparator or service gauge
- reasonable operating conditions (sat. temps) for condenser and evaporator, for a range of applications – (chill/frozen display/ storage, air conditioning/heat-pumping)
- features of zeotropic blends

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 2 Identify the causes and effects of global warming and climate change

Assessment Criteria

The learner can:

1 identify the stated causes of climate change
2 identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions
3 identify direct and indirect global warming potential (GWP) of the common hydrofluorocarbon (HFC) and hydrocarbon (HC) refrigerants
4 identify the importance of energy efficiency on greenhouse gas emissions to atmosphere
5 identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations
6 identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 3 Identify causes and effects of ozone depletion

Assessment Criteria

The learner can:

1 identify ozone depletion potential (ODP) of hydrochlorofluorocarbon (HCFC) refrigerants
2 identify the effect of chlorine on ozone depletion
3 identify the basic requirements of Regulation (EC) 2037/2000
4 identify the aims and impact of the Montreal Protocol

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 4 Identify stationary refrigerant, air conditioning and heat-pump system components, functions and leakage risk

Assessment Criteria

The learner can:

1 identify the function of and the role/importance of monitoring system performance for indications that leakage has occurred from **equipment (control and line components)** relating to category II systems

2 identify potential leakage points of refrigeration/air conditioning and heat pump equipment

3 identify the requirements and procedures for handling, storage, transportation and disposal of contaminated refrigerant and oil

4 identify how the state/condition of **equipment (major components)** can lead to refrigerant release

5 identify the risks of refrigerant release associated with **equipment (major, control and line components).**

Range/Scope/Unit content

Equipment (control and line components)

- valves – service, pressure relief
- thermostats/pressure controls
- liquid line, receiver sight glasses and indicators
- defrost controls
- overloads
- service gauge manifold and thermometer
- oil control and separator systems
- high pressure receivers
- low pressure accumulators

Equipment (major components)

- compressor
- condenser
- evaporator
- thermostatic expansion valves
- capillary tube restrictor

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 5 Identify the hazards and safe working practices for the installation, commissioning and handling of refrigerants

Assessment Criteria

The learner can:

1 identify the **hazards** and **safe working practices** associated with **flame brazing**

2 identify the **hazards** and **safe working practices** associated with **nitrogen pressure testing**

3 identify the **hazards** and **safe working practices** associated with **refrigerant release**.

Range/Scope/Unit content

Flame brazing hazards

- hot burns
- combustion
- fire
- explosion

Flame brazing safe working practices

- selection and use of appropriate personal protective equipment (PPE)
- storage of flammable gas in line with manufacturers instructions and current regulations
- transportation of flammable gas in line with manufacturers instructions and current regulations
- safe working practices for flame brazing in accordance with current Health & Safety at Work Act

Nitrogen hazards

- explosion
- physical injury due to incorrect handling and lifting techniques
- asphyxiation

Nitrogen safe working practices

- selection and use of appropriate Personal Protective Equipment (PPE)
- safe handling and lifting techniques
- pneumatic testing in line with recognised safe industry practices
- storage of nitrogen cylinders in line with manufacturers instructions and current regulations
- transportation of nitrogen cylinders in line with manufacturers instructions and current regulations
- gauge and regulator selection
- safe working practices for nitrogen in accordance with the Health & Safety at Work Act

Refrigerant release hazards

- cold burns
- asphyxiation
- thermal decomposition
- central nervous system (CNS) effect
- cardiac sensitisation

Refrigeration release safe working practices

- selection and use of appropriate personal protective equipment (PPE)
- safe working practices for refrigerant handling in accordance with the Health & Safety at Work Act

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 6 Fabricate and examine pipework

Assessment Criteria

The learner can:

1 fabricate pipework test piece by completing brazed and mechanical joints to industry standards

2 install pipework test piece to testing station

3 visually examine pipework on testing station for signs of leakage

4 remove fabricated test piece from the system and inspect for penetration by a cut and peel test, upon completion of refrigerant recovery.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 7 Undertake pressure testing, evacuation and record completion

Assessment Criteria

The learner can:

1 determine appropriate test pressures to BS EN378 standards
2 conduct strength tests to BS EN378 standards
3 undertake leak / tightness pressure tests to BS EN378 standards
4 evacuate the system to below 2 Torr/2000 microns/2.7m bar/270 Pa
5 complete pressure testing and evacuation records.

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 8 Undertake refrigerant charging, leak checking and record keeping

Assessment Criteria

The learner can:

1 charge zeotropic blend into system
2 record the weight of refrigerant charged (less than 3 kg)
3 run a charged system
4 identify state of refrigerant in cylinder prior to charging
5 identify state of refrigerant in system while running
6 visually inspect system for leaks
7 use **equipment** to accurately determine that the charge is correct
8 undertake an indirect leakage check
9 use an electronic leak detector to carry out a direct leak check to EU Commission Standard Leak Checking Requirements
10 complete a leak check record
11 connect and disconnect gauges to/from running system with minimal refrigerant loss (by reducing gauge pressure to safe minimum) using a **valve**.

Range/Scope/Unit content

Equipment

- gauges
- thermometers
- refrigerant comparator
- liquid level indicator
- sight glasses
- refrigerant log book

Valve

- service
- Schrader

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

Outcome 9 Undertake recovery of refrigerant and oil and prepare for disposal

Assessment Criteria

The learner can:

1 recover refrigerant from system into recovery cylinder
2 record weight of refrigerant recovered
3 drain oil out of a compressor to meet health & safety requirements.

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel)

Level: 2

Credit value: 2

Unit aim(s)

The aim of this unit is to provide the learner with the knowledge and practical skills required to undertake refrigerant recovery from stationary refrigeration, air conditioning and heat-pump equipment that contains refrigerants which are classified as either fluorinated (F) gases or ozone depleting substances (ODS) to meet Category III theoretical and practical requirements. The learner will also become aware of the national and European regulations which legislate in the areas of refrigerant and other greenhouse gas emissions to atmosphere.

Successful candidates will demonstrate understanding how to work to legal requirements, work safely, work with due regard to the local and global environment, reduce greenhouse gas emissions, reduce energy usage in order to meet the theoretical requirements of Category III regulations. Successful candidates will demonstrate the application of practical skills to successfully undertake recovery of refrigerant and oil and prepare for disposal.

Successful candidates will be qualified to undertake the recovery of refrigerants.

Learning outcomes

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

1 identify the causes and effects of global warming and climate change

2 identify causes and effects of ozone depletion

3 identify the hazards and safe working practices for the recovery, storage and transportation of recovered refrigerants

4 undertake recovery of refrigerant and oil and prepare for disposal.

Guided learning hours

It is recommended that 20 hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the SummitSkills Refrigeration and Air Conditioning National Occupational Standards.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by the Air Conditioning and Refrigeration Industry Board (ACRIB) and by SummitSkills.

Key Skills

This unit contributes towards the Key Skills in the following areas:

- Communication
- Working with Others

Unit 200 Handling fluorinated gases and ozone-depleting substances (category II personnel)

- Outcome 9 Problem Solving Undertake recovery of refrigerant and oil and prepare for disposal

Assessment Criteria

The learner can:

Assessment and grading

This unit will be assessed by an externally set and marked on-line examination (E-VOLVE) (unit 301) and practical assessment (unit 302).

Practical guidance

Please refer to the practical assessment guide in combination with learning outcome 4 for detailed guidance on the practical assessment.

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel)

Outcome 1 Identify the causes and effects of global warming and climate change

Assessment Criteria

The learner can:

1 identify the stated causes of climate change
2 identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions
3 identify direct and indirect global warming potential (GWP) of the common hydrofluorocarbon (HFC) and hydrocarbon (HC) refrigerants
4 identify the importance of energy efficiency on greenhouse gas emissions to atmosphere
5 identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations
6 identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards.

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel)

Outcome 2 Identify causes and effects of ozone depletion

Assessment Criteria

The learner can:

1 identify ozone depletion potential (ODP) of hydrochlorofluorocarbon (HCFC) refrigerants
2 identify the effect of chlorine on ozone depletion
3 identify the basic requirements of Regulation (EC) 2037/2000
4 identify the aims and impact of the Montreal Protocol

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel)

Outcome 3 Identify the hazards and safe working practices for the recovery, storage and transportation of recovered refrigerants

Assessment Criteria

The learner can:

1 identify the **hazards** and **safe working practices** associated with **refrigerant release**

2 identify the **safe working practices** associated with the recovery, storage and transportation of recovered refrigerant.

Range/Scope/Unit content Refrigerant release hazards

- cold burns
- asphyxiation
- thermal decomposition
- central nervous system (CNS) effect
- cardiac sensitisation

Refrigeration release, storage and transportation safe working practices

- selection and use of appropriate personal protective equipment (PPE)
- safe working practices for refrigerant handling, storage and transportation in accordance with the Health & Safety at Work Act

Unit 300 Handling fluorinated gases and ozone-depleting substances (category III personnel)

Outcome 4 Undertake recovery of refrigerant and oil and prepare for disposal

Assessment Criteria

The learner can:

1 connect and disconnect gauges to/from running system with minimal refrigerant loss (by reducing gauge pressure to safe minimum) using a **valve**

2 recover refrigerant from system into recovery cylinder

3 record weight of refrigerant recovered

4 drain oil out of a compressor to meet health & safety requirements.

Range/Scope/Unit content

Valve

- service
- Schrader

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Level: 2

Credit value: 2

Unit aim(s)

The aim of this unit is to provide the learner with the knowledge required to undertake leak checking of stationary refrigeration, air conditioning and heat-pump equipment that contains refrigerants which are classified as either fluorinated (F) gases or ozone depleting substances (ODS) to meet Category IV theoretical requirements. The learner will also become aware of the national and European regulations which legislate in the areas of refrigerant and other greenhouse gas emissions to atmosphere.

Successful candidates will demonstrate understanding of how to work to legal requirements, work safely, work with due regard to the local and global environment, reduce greenhouse gas emissions, reduce energy usage in order to meet the theoretical requirements of Category IV regulations. Successful candidates will demonstrate the application of practical skills to undertake leak checking and record keeping.

Successful candidates will be qualified to undertake leakage checking.

Learning outcomes

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

1 identify basic standard units

2 identify the causes and effects of global warming and climate change

3 identify causes and effects of ozone depletion

4 identify stationary refrigerant, air conditioning and heat-pump system leakage risk

5 identify the hazards and safe working practices for the leak checking of stationary refrigerant, air conditioning and heat-pump systems

6 undertake leak checking and record keeping.

Guided learning hours

It is recommended that 20 hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the SummitSkills Refrigeration and Air Conditioning National Occupational Standards.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by the Air Conditioning and Refrigeration Industry Board (ACRIB) and by SummitSkills.

Key Skills

This unit contributes towards the Key Skills in the following areas:

- Communication
- Working with Others
- Problem Solving

Assessment and grading

This unit will be assessed by an externally set and marked on-line examination (E-VOLVE) (unit 401) and practical assessment (unit 402).

Practical guidance

Please refer to the practical assessment guide in combination with learning outcome 6 for detailed guidance on the practical assessment.

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 1 Identify basic standard units

Assessment Criteria

The learner can:

1 identify the **standard units** relating to category IV systems.

Range/Scope/Unit content

Standard Units

- temperature
- pressure
- mass
- density
- enthalpy

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 2 Identify the causes and effects of global warming and climate change

Assessment Criteria

The learner can:

1 identify the stated causes of climate change

2 identify how the Kyoto Protocol aims to reduce the effect of effects of greenhouse gas emissions

3 identify direct and indirect global warming potential (GWP) of the common hydrofluorocarbon (HFC) and hydrocarbon (HC) refrigerants

4 identify the importance of energy efficiency on greenhouse gas emissions to atmosphere

5 identify the basic requirements of Regulation (EC) No 842/2006 and other relevant regulations

6 identify the equipment records/commissioning data requirements of Regulation (EC) No 842/2006 and all appropriate regulations and standards.

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 3 Identify causes and effects of ozone depletion

Assessment Criteria

The learner can:

1 identify ozone depletion potential (ODP) of hydrochlorofluorocarbon (HCFC) refrigerants
2 identify the effect of chlorine on ozone depletion
3 identify the basic requirements of Regulation (EC) 2037/2000
4 identify the aims and impact of the Montreal Protocol

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 4 Identify stationary refrigerant, air conditioning and heat-pump system leakage risk

Assessment Criteria

The learner can:

1 identify potential leakage points of refrigeration/air conditioning and heat pump equipment

2 identify the risks of refrigerant release associated with **equipment (major and line components).**

Range/Scope/Unit content Equipment

(line components)

- valves – service, pressure relief
- liquid line, receiver sight glasses and indicators

Equipment (major components)

- compressor
- condenser
- evaporator
- thermostatic expansion valves
- capillary tube restrictor

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 5 Identify the hazards and safe working practices for the leak checking of stationary refrigerant, air conditioning and heat-pump systems

Assessment Criteria

The learner can:

1 identify the **hazards** and **safe working practices** associated with **refrigerant release**.

Range/Scope/Unit content Refrigerant release hazards

- cold burns
- asphyxiation
- thermal decomposition
- central nervous system (CNS) effect
- cardiac sensitisation

Refrigeration release safe working practices

- selection and use of appropriate personal protective equipment (PPE)
- safe working practices for refrigerant handling in accordance with the Health & Safety at Work Act

Unit 400 Handling fluorinated gases and ozone-depleting substances (category IV personnel)

Outcome 6 Undertake leak checking and record keeping

Assessment Criteria

The learner can:

1 visually inspect system for leaks
2 use **equipment** to accurately determine that the charge is correct
3 undertake an indirect leakage check
4 use an electronic leak detector to carry out a direct leak check to EU Commission Standard Leak Checking Requirements
5 complete a leak check record.

Range/Scope/Unit content

Equipment

- gauges
- thermometers
- refrigerant comparator
- liquid level indicator
- sight glasses
- refrigerant log book

Appendix 1 Obtaining centre and qualification approval

Only approved organisations can offer City & Guilds qualifications. Organisations approved by City & Guilds are referred to as **centres**.

Centres must meet a set of quality criteria including:

- provision of adequate physical and human resources
- clear management information systems
- effective assessment and quality assurance procedures including candidate support and reliable recording systems.

An organisation that has not previously offered City & Guilds qualifications must apply for approval to become a centre. This is known as the **centre approval process** (**CAP**). Centres also need approval to offer a specific qualification. This is known as the **qualification approval process** (**QAP**), (previously known as scheme approval). In order to offer this qualification, organisations which are not already City & Guilds centres must apply for centre and qualification approval at the same time. Existing City & Guilds centres will only need to apply for qualification approval for the particular qualification.

Full details of the procedures and forms for applying for centre and qualification approval are given in *Providing City & Guilds qualifications - a guide to centre and qualification approval*, which is also available on the City & Guilds centre toolkit, or downloadable from the City & Guilds website.

Regional / national offices will support new centres and appoint a Quality Systems Consultant to guide the centre through the approval process. They will also provide details of the fees applicable for approvals.

Assessments must not be undertaken until qualification approval has been obtained.

City & Guilds reserves the right to withdraw qualification or centre approval for reasons of debt, malpractice or non-compliance with City & Guilds' policies, regulations, requirements, procedures and guidelines, or for any reason that may be detrimental to the maintenance of authentic, reliable and valid qualifications or that may prejudice the name of City & Guilds. Further details of the reasons for suspension and withdrawal of approval, procedures and timescales, are contained in *Providing City & Guilds qualifications.*

For further information about the online testing platform (e-volve), please visit our dedicated webpages: e-volve | City & Guilds (cityandguilds.com)

Appendix 2 Summary of City & Guilds assessment policies

Health and safety

The requirement to follow safe working practices is an integral part of all City & Guilds qualifications and assessments, and it is the responsibility of centres to ensure that all relevant health and safety requirements are in place before candidates start practical assessments.

Should a candidate fail to follow health and safety practice and procedures during an assessment, the assessment must be stopped. The candidate should be informed that they have not reached the standard required to successfully pass the assessment and told the reason why. Candidates may retake the assessment at a later date, at the discretion of the centre. In case of any doubt, guidance should be sought from the external verifier.

Equal opportunities

It is a requirement of centre approval that centres have an equal opportunities policy (see *Providing City & Guilds qualifications)*.

The regulatory authorities require City & Guilds to monitor centres to ensure that equal opportunity policies are being followed.

The City & Guilds equal opportunities policy is set out on the City & Guilds website, in *Providing City & Guilds qualifications*, in the *Online Catalogue*, and is also available from the City & Guilds Customer Relations department.

Access to assessment

Qualifications on the Regulated Qualifications Framework are open to all, irrespective of gender, race, creed, age or special needs. The centre co-ordinator should ensure that no candidate is subject to unfair discrimination on any ground in relation to access to assessment and the fairness of the assessment.

City & Guilds' *Access to assessment and qualifications guidance and regulations* document is available on the City & Guilds website. It 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.

Access arrangements are pre-assessment adjustments primarily based on history of need and provision, for instance the provision of a reader for a visually impaired candidate.

Special consideration refers to post-examination adjustments to reflect temporary illness, injury or indisposition at the time of the assessment.

Appeals

Centres must have their own, auditable, appeals procedure that must be explained to candidates during their induction. Appeals must be fully documented by the quality assurance co-ordinator and made available to the external verifier and/or City & Guilds.

Further information on appeals is given in *Providing City & Guilds qualifications*. There is also information on appeals for centres and learners on the City & Guilds website or available from the Customer Relations department.

Appendix 2 Summary of City & Guilds assessment policies

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