

# Guide to Good Commercial Refrigeration Practice

## Part 9

### Skills, Qualifications and Training

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## 9.1 GENERAL – CHANGING REQUIREMENTS

Nationally recognised training and qualification policy in the UK is subject to regular changes and updates. These are necessary to take into account changes in technology, new legislation and a rolling programme of revision of employer requirements on which qualifications are based.

A Refrigeration, Air Conditioning and Heat Pump (RACHP) Engineering Technician Apprenticeship is now the recognised standard that technicians entering the workplace should attain. The Apprenticeship is based on a standard for Knowledge, Skills and Behaviours developed by employers. However, this Apprenticeship only became available in 2018 and is designed as a three year course. Therefore, most technicians at this point in time will hold one of the older Apprenticeships that were previously recognised by industry as part of a suite of Building Engineering Services Framework Apprenticeships based on older National Occupational Standards. In addition, there are a number of different qualifications currently and previously available, that have been taken independent of a formal Apprenticeship. Some of these qualifications require evidence of a technician’s practical skills, but some do not. Employers should investigate the content and style of qualification presented by an applicant or suggested by a training provider before making any decision about recruitment or committing to further training.

It is the responsibility of the engineer or technician to keep themselves up to date with changing technology and legal requirements in the sector. Recommended information sources include:

- ✳ Trade association written guidance, professional institute written guidance and events, manufacturer’s training courses, training provider short courses, employer training etc. Many organisations now issue attendance certificates or Certificates of Professional Development (CPD) as evidence of training.

It is a requirement of those registered with the Engineering Council at any level to maintain professional competency as evidence by recorded CPD activity.

### 9.1.1 LEGAL REQUIREMENTS RELATED TO TRAINING

There is a legal requirement for the certification of individuals for the handling of HCFC or HFC refrigerants which is linked to UK and EU legislation. It is an offence under this legislation to employ individuals to carry out work on a RACHP system containing these refrigerants if they do not hold this certificate. At the time of writing the relevant UK legislation was as follows:

Refrigerant	Legislation	Current Requirement One Of:
Ozone Depleting Substances (for example removal for disposal of R22)	UK Statutory Instrument 2006 No 1510 “The Ozone Depleting Substances (Qualifications) Regulations” and EC Regulation 2037/2000 On substances that deplete the ozone layer	City and Guilds 2078 CITB equivalent (J01)
F Gases (all HFC and HFO blends containing HFC)	UK Statutory Instrument 2018 No. 98 “The Fluorinated Greenhouse Gases (Amendment) Regulations” and Regulation (EC) No 517/2014 on certain fluorinated greenhouse gases	City and Guilds 2079 BESA training (Building Engineering Services Association) Logica Certification

### 9.1.2 OTHER LEGAL REQUIREMENTS

Employers must take into account other specific legal requirements depending on the nature of the work individuals are involved in and in relation to pipe fitting, welding, brazing and safety related matters.

Whilst there is no specific legislation relating to the handling of non-HFC refrigerants such as HFO, HC, Carbon Dioxide or Ammonia. Employers have a duty of care under the Health and Safety at Work Act & general Health and Safety legislation to ensure that their employees are adequately trained to carry out tasks required as part of their work.

## 9.2 RACHP SPECIFIC NATIONAL QUALIFICATIONS

A national qualification is one which is recognised as meeting a particular standard, usually described as a Level. Such qualifications have to go through a rigorous approvals and quality assurance process to gain the designation and are regulated by Government. The relevant national levels for UK, N Ireland and Wales are shown in the table below:

Level 2	Intermediate Apprenticeship, Level 2 Apprenticeship, Level 2 NVQ Equivalent to GCSE, CSE, O level at Grade A, B, C
Level 3	Advanced Apprenticeship, Level 3 NVQ, Equivalent to A Levels
Level 4	Level 4 NVQ, HNC etc.
Level 5	HNC, Foundation Degree etc.
Level 6	Degree with Honours, Degree Apprenticeships etc.

### 9.2.1 CURRENTLY AVAILABLE TECHNICIAN LEVEL QUALIFICATIONS

Number	Title	Levels	
6090	-20 Diploma in Refrigeration Air-conditioning and Heat Pump Systems	Level 2	Developed in 2018 and mapped to RACHP EngTech Apprenticeship. Designed to deliver underpinning knowledge.
	-30 Diploma in Refrigeration Air-Conditioning and Heat Pump Systems	Level 3	
7189	-02 Level 2 Diploma in Refrigeration, Air Conditioning and Heat Pump Systems	Level 2	Developed in 2015 as a RACHP knowledge qualification for those not following the national Building Services Apprenticeship route.
	-03 Level 3 Diploma in Refrigeration Air-Conditioning and Heat Pump Systems	Level 3	
6187	-01 NVQ Diploma in Installing, Testing and Maintaining Air Conditioning and Heat Pump Systems	Level 2	Developed in 2014 as part of the Building Services suite of qualifications, with significant mechanical services content, to deliver underpinning knowledge for a Mechanical Engineering Services Apprenticeship.
	-02 NVQ Diploma in Installing and Maintaining Refrigeration Systems	Level 2	
	-03 NVQ Certificate in Installing and Commissioning Air Conditioning and Heat Pump Systems	Level 3	
	-04 NVQ Certificate in Servicing and Maintaining Air Conditioning and Heat Pump Systems	Level 3	
	-05 NVQ Certificate in Installing and Commissioning Refrigeration Systems	Level 2	
	-06 NVQ Diploma in Servicing and Maintaining Refrigeration Systems	Level 2	

### 9.2.2 OTHER OLDER TECHNICIAN LEVEL QUALIFICATION

The following are no longer being offered but are still valid:

- ✳ City & Guilds 6087 (refrigeration and air conditioning at Level 2 or 3 designed to deliver apprenticeships)
- ✳ City & Guilds 207-2 (refrigeration & air conditioning, craft certificate)
- ✳ City & Guilds 207-3 (RAC advanced craft certificate)
- ✳ City & Guilds 236-2 (electrical installation certificate)
- ✳ City & Guilds 257 (technician certificate)
- ✳ BTEC National Certificate in Engineering Electrical/Electronic
- ✳ BTEC HNC Engineering (Electrical/Electronic)

### 9.2.3 OTHER TYPES OF QUALIFICATION OR CERTIFICATE

#### **Manufacturers' Certificates**

Provide supplemental evidence of product related knowledge or training. They have not usually been accredited to a national standard or have to undergo the rigours of external verification and checking by independent training experts. They often however provide very good, up to date and thorough training in that technology.

#### **Employers Training Programmes**

Some employers have developed training programmes that have been assessed as equivalent to a national level qualification. These can be of a very high standard, but are specific to the needs of that employer.

#### **Independent Training Provider Courses**

These courses fill a gap in the market for skills and knowledge where a national standard is not available. For example a course in Flammable Refrigerants, Brazing or Introduction to Refrigeration Principles is valuable training for the existing workforce who need to update their skills or for those new to the industry.

### 9.2.4 CONTINUED PROFESSIONAL DEVELOPMENT (CPD)

As the RACHP field is constantly changing both in terms of new technology and legislation, it is important the technicians commit to regular and continued professional development activity. In some cases, this will be part of a structured career development plan and review process put in place by the employer. However, this can also be carried out independently. There are many resources available to technicians to ensure that they keep up to date with industry developments, including, but not limited to:

- \* Trade magazines
- \* Online content from a reputable source
- \* Trade association technical output (events and publications)
- \* Professional institute membership resources
- \* Online training programmes from manufacturers, training institutes etc.
- \* Manufacturers' training course and technical materials

It is recommended that individuals keep a record of all CPD activity undertaken, for example by asking for a Certificate of Attendance or Completion to provide evidence of their ongoing CPD.

### 9.3 HIGHER LEVEL QUALIFICATIONS

- \* Foundation Degree and first Degree in Refrigeration is available from Grimsby College and Northumbria University
- \* Higher National Diplomas (HND)s in Building Engineering Services may have some refrigeration and air conditioning content
- \* BEng, MEng and PhD research opportunities are available in various universities throughout the UK

### 9.4 REGISTRATION OF PERSONNEL (ACRIB SKILLCARD)

The industry runs a voluntary register of personnel qualified to handle refrigerants through the Air Conditioning and Refrigeration Industry Board (ACRIB), as part of the Engineering Services Skillcard scheme. ACRIB F Gas Skillcard Registered personnel are issued with a photocard once they have proved that they have passed the legally required refrigerant handling assessment and a safety and environment test. The cards can also include additional qualifications that they hold as a record of their achievements. The cards can be updated when necessary.



The table below shows the requirements for the ACRIB Skillcard, card levels available and which supplementary qualifications can be added:

**Mandatory qualifications required for each card type**

White card	Blue Craft Level card	Gold Advanced Craft card
C&G2079 cat1 or BESA F-Gas Cat1 or appropriate unit of NVQ or 7189 as recognised by DEFRA or LCL/Logic 603/1917/3 (Cat1) or C&G 6090 Level 2 or 3 Diploma or Certificate or C&G 7189-02 Level 2 or 3 Diplomas or Certificates	As per the white card plus one of: Level 2 Apprenticeship Certificate in Refrigeration and Air Conditioning which includes an F Gas Unit or if not included in the apprenticeship as a separate F Gas Qualification C&G 6187 Level 2 NVQ Diplomas or Certificates Older NVQs e.g. 6087 L2, City & Guilds craft or advanced craft or SCOTVEC are only acceptable if the candidate also has an F Gas Qualification	As per the white card plus one of: Level 3 RACHP Engineering Technician Apprenticeship Level 3 Apprenticeship Certificate in Refrigeration and Air Conditioning which includes an F Gas Unit or if not included in the apprenticeship a separate F Gas Qualification C&G 6187 Level 3 NVQ Diplomas or Certificates Older NVQ 6087 L3 are only acceptable if the candidate also has an F Gas qualification

**Additional refrigerant handing competence recognised qualifications**

Card holders with the refrigerant qualifications below can have the relevant symbol added to the front of the ACRIB refrigeration SKILLCARD:

Ammonia	Hydrocarbon	Carbon Dioxide
C&G 2077 or 2078 ammonia or C&G Level 2 award in Ammonia RACHP (6187-31)	C&G Level 2 award in Hydrocarbon RACHP (6187-21 or 31) BESA Flammables qualification LCL (Logic) Flammables qualification	BRA Carbon Dioxide Course or C&G Level 2 award in Carbon Dioxide RACHP (6187-21)

Although the scheme is voluntary it provides a self-regulatory mechanism to ensure all engineers meet their legal requirement to take the refrigerant handling assessment and is often required contractually for engineers to gain access to sites.

The equipment owner and employer has a legal obligation to only allow competent personnel to work on stationary refrigeration, air conditioning and heat pump equipment containing F-Gas Refrigerants and this card helps them to ensure they are complying with this legal obligation.

Registration costs £40 and lasts for three years.

**Further information about F Gas Regulation Requirements**

There are a number of legal obligations in the F-Gas regulation placed on individuals, companies and equipment operators including registration of companies who employ operatives and recording of leak checks. Please refer to the Government F-Gas websites for further details:

<https://www.gov.uk/government/collections/fluorinated-gas-f-gas-guidance-for-users-producers-and-traders>

<https://www.gov.uk/guidance/qualifications-required-to-work-on-equipment-containing-f-gas>

## 9.5 CORE ATTRIBUTES OF ENGINEERING TECHNICIANS

Extracted from the RACHP Engineering Technician Apprenticeship Standard as approved by the UK Institute for Apprenticeship and Technical Education.

Knowledge	What is required
Legislation, Regulations and Standards	<ul style="list-style-type: none"> <li>✳ Understanding of relevant UK and international standards, technical and environmental legislation including health and safety, environmental protection, working with pressure systems, electrical circuits and flammable substances.</li> <li>✳ Familiarity with industry Codes of Practice and other sources of up to date information and advice on technical safety and legislative aspects of their work.</li> </ul>
Underpinning principles	<ul style="list-style-type: none"> <li>✳ Sound understanding of principles of thermodynamics, gas laws, psychrometrics, fluid flow, electricity, properties of refrigerant fluids and lubricants.</li> </ul>
Data analysis	<ul style="list-style-type: none"> <li>✳ Ability to understand relevant diagrams, calculations, tools, charts, tables and formulae and apply them as appropriate.</li> </ul>
System fundamentals	<ul style="list-style-type: none"> <li>✳ Understanding of the function and operation of system components and how they interact in a range of different systems and applications.</li> </ul>
Sustainability	<ul style="list-style-type: none"> <li>✳ Understanding of environmental impact of refrigerants, maximising efficient system performance and mitigation of direct and indirect carbon emissions.</li> <li>✳ Understanding of environmental technologies employed in the sector such as heat recovery, low Global Warming Potential (GWP) refrigerants, and other equipment which can be used to reduce heat gain, cooling load or energy use.</li> </ul>
Skills	What is required
Safe working practices	<ul style="list-style-type: none"> <li>✳ Installation, commissioning, testing, fault diagnostics, rectification of systems, component/refrigerant suitability and selection.</li> <li>✳ Working with pressure systems and electrical circuits and systems.</li> <li>✳ Evaluating and mitigating risks of refrigerants including toxicity, flammability and other potential risks or hazards to self and the general public.</li> <li>✳ Decommissioning, safe recovery and disposal of equipment and hazardous waste transfer.</li> </ul>
Control circuit application	<ul style="list-style-type: none"> <li>✳ Electrical and electronic control systems setting, testing and fault finding; and their integration with system-associated communication networks.</li> </ul>
Mechanical operations	<ul style="list-style-type: none"> <li>✳ Positioning, fixing, jointing and testing of pipework, electrical circuits and water circuits where relevant.</li> </ul>
Application of mathematical principles	<ul style="list-style-type: none"> <li>✳ Determining heating and cooling loads and selecting and balancing appropriate components and systems for maximum performance and efficiency.</li> </ul>
Sustainable system operation	<ul style="list-style-type: none"> <li>✳ Using system operating parameters for efficient performance to achieve measurable and sustained reductions in carbon emissions.</li> <li>✳ Routine and reactive service and maintenance, testing, fault finding, reporting and rectification.</li> <li>✳ Retrofitting and refilling of existing equipment to lower GWP refrigerants including safety, reliability and environmental considerations.</li> </ul>
Behaviours	What is required
Safety approach	<ul style="list-style-type: none"> <li>✳ Disciplined approach to assessing, managing, mitigating and avoiding risk in a variety of situations to themselves, colleagues, the public and the environment.</li> </ul>
Strong work ethic	<ul style="list-style-type: none"> <li>✳ Positive ethical attitude and behaviours including reliability, willingness to take responsibility. Commitment to completing tasks and ability to work as part of a multidisciplinary team.</li> </ul>

Behaviours	What is required
Logical problem solver	✳ Employs logical thinking and determined attitude to problem solving and technical challenges.
Focus on quality	✳ Attention to detail, following procedures, planning and preparation, verifying compliance.
Personal responsibility	✳ Takes responsibility for work and interactions with colleagues, customers, suppliers or subcontractors.
Communicates well	✳ Uses a range of communication methods effectively, positively and in a timely fashion.
Adaptable	✳ Able to adapt to changes in conditions, technologies, situations and a wide variety of different working environments.
Self-motivated	✳ Willingness to learn and commitment to professional development and to applying principles of sound engineering and sustainability of engineering systems.

## 9.6 CORE ATTRIBUTES OF DESIGN/APPLICATIONS ENGINEERS

Working draft from an employers group formed to develop a standard for Design and Applications Engineers in the RACHP sector (2017):

Knowledge	Will require a comprehensive understanding of:
Legislation, Regulations and Standards	<ul style="list-style-type: none"> <li>✳ How to design systems in accordance with relevant UK or international standards, technical and environmental legislation including health &amp; safety, environmental protection, working with pressure systems, electrical circuits and flammable substances.</li> <li>✳ Compliance with industry Codes of Practice and other sources of up to date information and advice on technical safety and legislation related to their work.</li> </ul>
Underpinning principles	<ul style="list-style-type: none"> <li>✳ Impact on systems design of thermodynamics, gas laws, psychometrics, fluid flow, heat transfer, heating and cooling integration, electricity, properties of refrigerant fluids and lubricants, mechanical fluid handling and local conditions/requirements.</li> <li>✳ Refrigeration cycles.</li> <li>✳ Issues and opportunities of integrated utilities, acoustics and vibration, materials properties, and balancing heating and cooling demands.</li> </ul>
Data analysis	✳ Use of diagrams, calculations, tools, charts, tables and formulae in the design process, data use in commissioning, and fault finding.
System design fundamentals	<ul style="list-style-type: none"> <li>✳ Integration of components in an effective system including hydraulic pipework.</li> <li>✳ The role of specialist consultants in the design process e.g. architects, building services, heating and ventilation and structural engineers.</li> </ul>
Planning	✳ Critical path project planning, resourcing, costing & financial awareness.
Sustainability	<ul style="list-style-type: none"> <li>✳ Total environmental impact of RACHP systems, including total life cycle costing, direct and indirect carbon emissions.</li> <li>✳ Opportunities for heat recovery, the integration of heating and cooling, and minimising cooling/heat loads.</li> <li>✳ New and emerging technologies and design principles to reduce the environmental impact of equipment/systems.</li> </ul>
Skills	Will have the ability to effectively
Safe working practices	✳ Plan and manage the work of all members of a design team with due regard to safe working practices and assessment of risks.
Computer literacy	✳ Use software (e.g. Excel, CAD), charts, and tables for modelling, component and pipe sizing, preparing load calculations, and to prepare and interpret design drawings.



Project and team management	<ul style="list-style-type: none"> <li>✳ Interpret end user requirements, applications and processes to prepare, propose and adjust suitable design options and specifications.</li> <li>✳ Participating in and managing multidisciplinary teams involved in the design process.</li> <li>✳ Communicate and present complex concepts and data</li> </ul>
Application of design process	<ul style="list-style-type: none"> <li>✳ Follow through on design process to deliver to customer requirements.</li> <li>✳ Use control strategies, troubleshooting methodology, logic and sequencing.</li> </ul>
Sustainable operation	<ul style="list-style-type: none"> <li>✳ Interpret system operating parameters for efficient performance against design and achieve sustained reductions in carbon emissions.</li> </ul>
<b>Behaviours</b>	<b>Will display a mindset to</b>
Safety management	<ul style="list-style-type: none"> <li>✳ Manage and apply safe working practices – take responsibility for assessing, managing, mitigating and avoiding risk throughout the design process to themselves, colleagues, the public and the environment.</li> </ul>
Ethical	<ul style="list-style-type: none"> <li>✳ Positive ethical approach in line with professional Codes of Conduct.</li> <li>✳ Manage projects and their own work in an ethical manner.</li> </ul>
Personal responsibility	<ul style="list-style-type: none"> <li>✳ Take responsibility for work and interactions with colleagues, customers, suppliers or subcontractors.</li> <li>✳ Attention to detail, following procedures, plans, preparation, compliance.</li> <li>✳ Apply evidence-based approaches to problem solving/technical challenges.</li> <li>✳ Able to adapt to changes in conditions, technologies, situations and a wide variety of different working environments.</li> </ul>
Communicates at all levels	<ul style="list-style-type: none"> <li>✳ Communicate effectively in all business circumstances.</li> <li>✳ Problem-solving with colleagues, customers and interdisciplinary teams.</li> </ul>
Personal and social skills	<ul style="list-style-type: none"> <li>✳ Committed to high personal standards at work; to their own continuous professional development and to applying principles of sound engineering and sustainability of engineering systems.</li> </ul>

## 9.7 EMPLOYING APPRENTICES

### 9.7.1 INTRODUCTION

It is important that new people are encouraged to join the company as Apprentice Refrigeration and Air Conditioning Engineering Technicians so that the company can secure its future with well-trained and experienced personnel. New people with the correct type of aptitude can in three years' time with suitable training, experience and employer support, become competent Service and Installation Engineers.

Once you take on a government funded apprentice you, as an employer are responsible for providing “on the job” training for them, i.e. that they are doing meaningful work, as well as ensuring that they receive adequate “off the job” training provided internally or by a specialised training provider.

Refrigeration and air conditioning engineers need a good balance of manual skills and theory. Without a good grounding in theory it would be almost impossible to diagnose problems associated with refrigeration systems. Current apprenticeship programmes are designed therefore to be substantial in content and delivered over three years. The RACHP Engineering Technician is graded as a Level 3 apprenticeship.

### 9.7.2 AGE OF APPRENTICE

There is no longer any limit to the age of the apprentice, and government apprenticeship funding is available to all. Nevertheless it is important that an apprentice demonstrates sufficient maturity for this type of work.

### 9.7.3 OFF THE JOB TRAINING WITH COLLEGES AND INDEPENDENT TRAINING PROVIDERS

A list of centres offering apprenticeship training and other training or qualifications is available at [www.acrib.org.uk](http://www.acrib.org.uk). You can also contact the qualification awarding organisations for information about which

centres are registered to deliver their training. Current awarding organisations for the RACHP Eng Tech Apprenticeship are City and Guilds and BESA Training.

#### **Block release or day release?**

Block release is when the student goes to college for up to a period of six weeks at a time. Day release is when the student goes to college one day per week.

Where block release is concerned management know that the student is away from work for a six week period and therefore can plan in advance for this event. A disadvantage is the loss of the student's skills for this period of time may put added pressure on the branch organisation. Accommodation would also have to be paid for by the company.

It may be easier to plan when the student is away for one day a week on day release, but problems could be associated with having to cover for the student's regular absence of one day a week on installation work for instance, which could put additional pressures on management having to find a replacement for one day every week. Some managers state that this type of arrangement is in fact easier to plan for and they would rather have the student away for one day a week for which they can cover, especially in the summer period, than for six weeks which creates serious problems with labour. With day release only the travelling expenses are required to be paid.

### **9.7.4 APPRENTICESHIP FUNDING**

Whether you are a levy paying organisation or not you are entitled to draw down apprenticeship funding for apprentices registered on apprenticeship programmes. The amount you get depends on whether you pay the apprenticeship levy or not.

You pay the levy if you're an employer with a pay bill over £3 million each year. If you pay the levy you'll receive funds to spend on training and assessing your apprentices. The government will add 10%.

If you do not need to pay the levy you pay 5% towards the cost of training and assessing your apprentice. You need to: agree a payment schedule with the training organisation and pay them directly for the training. The government will pay the rest (95%) up to the funding band maximum directly to the training organisation. You could be eligible for extra funding depending on both your and your apprentice's circumstances.

The National Apprenticeship Service on 0800 015 0600 can assist you with apprenticeship funding queries. Alternatively, you can speak direct to the training provider you are using for advice.

### **9.7.5 APPRENTICESHIP CONTRACTS – YOUR RESPONSIBILITY**

Employers, training providers and the apprentice must sign a three-way contract which outlines the responsibilities and obligations of each party. The employer is responsible for ensuring that the apprentice is doing meaningful work that will allow them to develop their practical skills and collect evidence for their journal. The training provider ensures that their theory knowledge is adequate and that they can practice skills in a safe environment. The employer is responsible for managing this process.

### **9.7.6 QUALIFICATIONS**

Apprentices need to be able to comprehend and understand the underpinning principles of vapour compression systems and to be able to understand and use data, as well as communicate with colleagues and clients. Therefore they should have the ability to use English and Maths to the appropriate level and those receiving government funding must be able to achieve the equivalent of Grade C or above in English and Maths by the time they finish their apprenticeship.

It is a mandatory requirement that they complete an F-Gas qualification as part of their apprenticeship.

Whilst it is not mandatory for apprentices to have undertaken any additional qualifications, employers may require them to follow a structured training programme with regular incremental assessment. Assessment bodies such as City & Guilds have made available qualifications to support the delivery of knowledge for this apprenticeship. City & Guilds 6090 Diplomas at Level 2 and 3 is mapped to the Apprenticeship Standard

for example. Other older qualifications such as the City & Guilds 6187 may also be used at Level 2 or 3 but the apprentice will require additional training to ensure they have covered all of the requirements of the Apprenticeship Standard.

### **9.7.7 APPRENTICESHIP DEVELOPMENT JOURNAL**

The Apprentice Development Journal is a collection of evidence that demonstrates the development of an apprentice's knowledge, skills and behaviours whilst on the job, across the duration of the 'on-programme' segment of the apprenticeship (usually over a period of three years). Apprentices will present a synopsis of this journal, based on three complete jobs, for discussion as part of their final apprenticeship exam (known as the End Point Assessment). The element of the End Point Assessment based on the Journal Synopsis takes the form of a one-to-one discussion as a professional interview with an independent assessor.

### **9.7.8 GATEWAY INTERVIEW**

The apprentice, employer and training provider will have a meeting towards the end of the apprenticeship, at which they will confirm that everything is in place for the apprentice to start preparing to take their final End Point Assessment. This is a formal, documented meeting. The apprentice will not be put forward for the End Point Assessment until their employer is satisfied that they are ready. When the employer is satisfied they will complete a Gateway Assessment Form.

### **9.7.9 APPRENTICESHIP END POINT ASSESSMENT**

The End Point Assessment consists of three different forms of examination:

1. A multiple choice theory test taken under exam conditions.
2. A practical test including refrigerant recovery, change and fault finding exercises.
3. A professional interview with an independent assessor at which the Apprentice discusses examples of their work, which has been collected in a Journal Synopsis.

Full details of the End Point Assessment process is available at <https://ior.org.uk/careers/apprenticeship-trailblazers>

### **9.7.10 AWARDING OF AN APPRENTICESHIP**

Once the apprentice has passed the End Point Exams they will be awarded a Level 3 Engineering Technician Apprenticeship Certificate. They will be eligible to apply to the Engineering Council for registration at Engineering Technician level.

## ANNEX A – QUALIFICATIONS AND SKILLS TESTS

### **Safe Handling of F Gas Refrigerant (C&G 2079-11, BESA or Logica Certification)**

This is a specialist assessment of candidates' skills in handling refrigerant safely, primarily from an environmental point of view, whether in recovering it from systems or in charging it into systems. The assessment also tests understanding of the relevant environmental legislation concerning phase down of refrigerants, minimising both leakage and adverse effects on the environment. It is a mandatory legal requirement for anyone handling F-Gas or Ozone Depleting Substances (ODS) refrigerants or blends containing these substances.

### **Flammable Refrigerants Training**

ACRIB, the Air Conditioning and Refrigeration Industry Board, has produced a specification for training courses covering hydrocarbon and HFO refrigerants (flammable and lower flammable classification) endorsed by the various trade bodies and associations in the sector. This is not a mandatory requirement. BESA and LCL have produced qualifications in line with this specification.

City & Guilds offers a Level 2 Award in Hydrocarbon RACHP installation, service and maintenance system as part of the CPD Pathways Unit 6187-21.

### **Carbon Dioxide Training**

The BRA produced a specification for a short course in carbon dioxide and training certificates in line with this are available from a number of training centres and businesses.

City & Guilds offers a Level 3 Award in Carbon Dioxide for RACHP as part of the CPD Pathways Unit 6187-31.

### **Ammonia Training**

City & Guilds offers an Ammonia short course (2078)

### **Pipework and Brazing – SEP & Category 1 Joints**

SEP and Category 1 joints under the Pressure Equipment Directive (PED), Pressure Systems Safety Regulations (PSSR) are covered by this specification of a simple procedure for jointing copper pipework for refrigeration systems, which also incorporates a practical means of assessing an individual's competence at this task (both on site and in workshop situations) to a standard acceptable to the industry and the end users of its equipment, systems and services. Published by British Refrigeration Association (BRA) and endorsed by Air Conditioning and Refrigeration Industry Board (ACR(B)), copies are available from Federation of Environmental Trade Association (FETA) [www.feta.co.uk](http://www.feta.co.uk).

Reference: Specification of procedures for manual flame brazing and brazer assessment.

(ISBN 8 870623 09 6)

City & Guilds offers a Level 2 Award in Brazing Techniques for RACHP system as part of the CPD Pathways Unit 6187-21.

## **ANNEX B – CERTIFICATES NO LONGER BEING OFFERED**

Employees may present themselves with other suitable evidence of competence as below. The qualifications are no longer available for new candidates, but they are still current and recognised by industry:

### **C&G 207-2 Certificate, Refrigeration and Air Conditioning, Part 2**

College taught course with final written examination externally marked by City & Guilds and some college assessed project work. The course content included: tools and equipment; materials; refrigeration theory; assembly; piping and wiring; commissioning and testing systems, maintenance and fault diagnosis, health & safety, working communications.

### **C&G 207-3 Certificate, Refrigeration and Air Conditioning, Part 3**

College taught course with final written examination externally marked by City & Guilds and some college assessed project work. The course content included: refrigeration science and calculations; electrical applications; building construction; plus either commercial refrigeration systems and applications; or air conditioning systems and applications; or industrial refrigeration systems and applications; or heat pumps and heat recovery.

### **C&G 236-0 Certificate, Electrical Installation Work, Part 2**

College taught course designed to provide the necessary academic qualifications for grading as an electrical technician, as defined by the Joint Industry Training Board for the electrical contracting industry, with an end test administered by City & Guilds.

### **C&G 257 Certificate, Refrigeration and Air Conditioning Technician**

College taught course with approximately 50% classroom teaching and 50% workshop practice, with a final examination externally assessed by City & Guilds and some college assessed project work. The syllabus is intended to include drawing and mathematics and science associated with refrigeration and air conditioning. Workshop practice includes installation and service techniques on pipework and electrics.

### **BTEC National Certificate in Building Services Engineering (Refrigeration)**

College taught course in which subjects are studied at BTEC levels NII and NIII and are made up of 10 units examined by BTEC (Business and Technical Education Council).

### **BTEC National Certificate in Engineering (Electrical & Electronic)**

College taught course designed in collaboration with local industry to teach practical and theoretical skills needed by electrical technicians. It develops skills in and knowledge of basic electrical circuits and power transmission and basic electrical and electronic applications and microprocessor systems.

### **BTEC National Diploma in Refrigeration and Air Conditioning**

College taught course in two levels (II & III).

### **BTEC National Diploma in Building Services Engineering (Refrigeration)**

College taught course which is structured with nine units studied in the first year and eight in the second year examined by BTEC (Business and Technical Education Council).

### **BTEC Higher National Certificate in Building Services Engineering (Refrigeration)**

College taught course comprising 10 units, which are self contained and independently assessed. Certificates are awarded to students who satisfactorily complete all 10 units and a design project.

### **BTEC High National Certificate in Engineering (Electrical and Electronic)**

College taught course preparing candidates for work as electrical and electronic technician engineers, design in collaboration with local industry. Students gain practical and theoretical understanding of the subject area and can select options which are appropriate to their chosen career path. Topics can include: electronics; microprocessor systems; communications, electrical power and transmission, power control.

## ANNEX C – SUGGESTED DEFINITIONS OF GRADES OF EMPLOYEES

Definitions of Grades (Service) Categories of employees covered by these 'Benchmark' Conditions of Employment are normally as follows:

1. Trainee/Apprentice
  - ✧ Trainees should have achieved appropriate educational requirements (preferably with practical skills) and should be required to undertake a formal training course in refrigeration and/or air conditioning including F Gas certificate for at least 3 years.
2. Improver (Mature Student) – will normally:
  - ✧ Have been in the industry at least 1 year
  - ✧ Be considered to have the aptitude to become an engineering technician
  - ✧ Have satisfactorily completed, or be undertaking a formal training course
  - ✧ Have achieved or be working towards an F Gas certificate
3. Refrigeration/air conditioning engineering technician – will normally:
  - ✧ Have been in the industry at least three years
  - ✧ Be suitably qualified (including holding an industry recognised certificate of competence to handle refrigerant)
  - ✧ Have completed an apprenticeship
4. Senior refrigeration/air conditioning engineering technician – will normally:
  - ✧ Have a minimum of five years' continuous experience in the industry as a refrigeration/air conditioning engineer.
  - ✧ Possess technical knowledge and skill beyond that of a refrigeration/air conditioning engineer including competence, both practical and theoretical, in commissioning and testing of systems; layout and installation of plant and associated pipework and electrical work; fault diagnosis (and rectification).
  - ✧ Have general competence and organising ability beyond that of a refrigeration/air conditioning engineer so that he is able, without supervision, to set out jobs from drawings and specification, requisition sundry materials, work in an efficient and economical manner and liaise effectively with other trades.
  - ✧ Be qualified to Level 3 or above in an industry recognised certificate.

### Definition of Grades (Maintenance):

1. Maintenance Engineer – will normally
  - ✧ Have been in an approved electrical or mechanical engineering services industry at least 1 year.
  - ✧ Hold or be working towards a qualification as required under the F-Gas Regulation.

Definitions of Grades (Installation) Categories of employees covered by these 'Benchmark' Conditions of Employment are normally as follows:

1. Trainee/Apprentice
  - ✧ Trainees should have achieved appropriate educational requirements (preferably with practical skills) and shall be required to undertake an approved training course in refrigeration and/or air conditioning (see note for guidance).
2. Mate – will normally
  - ✧ Have the aptitude to assist installation engineers (including setting out; bending and forming; brazing and welding; lagging/insulating).
3. Installation Engineer – will normally
  - ✧ Have been in the industry for a minimum of three years.

- ✱ Be competent to lay out, bend and form, braze and weld, support and insulate refrigerant plant and associated pipework.
  - ✱ Be competent to leak and pressure test, evacuate and charge systems.
  - ✱ Hold or be working towards an industry recognised qualification.
4. Commissioning Engineer – will normally
- ✱ Have a minimum of 5 years continuous experience in the industry as an installation/refrigeration/air conditioning engineer.
  - ✱ Possess a technical knowledge and skill beyond that of an installation/refrigeration/air conditioning engineer including competence, both practical and theoretical, in:
    - ✱ Commissioning and testing of systems
    - ✱ Layout and installation of plant and associated pipework and electrical wiring
    - ✱ Fault diagnosis and rectification
  - ✱ Have general competence and organising ability beyond that of an installation/refrigeration/air conditioning engineer, so that he is able, without supervision, to set out jobs from drawings and specification, requisition sundry materials, work in an efficient and economical manner and liaise effectively with other trades.
  - ✱ Be generally considered suitable at the employers discretion.
  - ✱ Hold or be working towards an industry recognised qualification.

All employees are required to adopt efficient and safe working procedures and methods at all times.

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This guide was published in nine parts covering introduction, design, installation, commissioning, operation and maintenance, servicing of breakdowns, decommissioning of components and systems, and training. The contents and format of the guide are currently under revision.

Sections recently updated are:

Part 2 System Design and Component Selection

Jul 2019 2nd edition

Part 9 Assessment of Skills Related Competence and Training

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The BRA and IOR work regularly together to ensure good practice guidelines are available to the refrigeration, heat pump and air conditioning professional community. The nine titles in this series and other literature are available from both organisations, contact details below.

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