
REGULATED QUALIFICATION FRAMEWORK (RQF)

QUALIFICATION SPECIFICATION

LCL Level 3 Certificate in the Installation, Service and Maintenance of Refrigeration, Air Conditioning and Heat Pump (RACHP) systems. - 603/3807/6

1. Objective:

The qualification allows learners to continue to learn, develop and practise the skills required for employment within the RACHP sector, helping to reduce direct greenhouse gas emissions by limiting the release of fluorinated and other greenhouse gases and thereby reducing the indirect greenhouse gas emissions and improving the energy efficiency of stationary refrigeration equipment.

The aim of this qualification is to provide the learner with the knowledge and skills to install, service, maintain, commission, de-commission, recover and leak checking of RACHP equipment that contains refrigerants classified as fluorinated greenhouse gases as required by Regulation (EU) 2015/2067 and includes the safe use of all A1, CO₂ high pressure systems, flammable refrigerants A2L, A2, A3 and is designed to meet the legal requirements of learners who work or intend to work with fluorinated gases.

The qualification includes: -

- LCL Awards Level 3 Award in the Requirements for Electrical Installations BS7671:2018. (2022)
- LCL Awards Level 3 Award in F-Gas: Install, Service, Maintain, Recovery, Decommission and Leakage Checking of Systems (Category I).
- LCL Awards Level 3 Award in Understanding the properties and use of flammable refrigerants in accordance with ACRIB specification (A2L, A2 and A3).
- LCL Awards Level 3 Award in Oxy-Fuel Brazing within the RACHP Sector.

The Fluorinated Greenhouse Gases Regulations 2015 (England and Wales) and The Fluorinated Greenhouse Gases Regulations (NI) 2015 means it is an offence for an individual to work with fluorinated greenhouse gases without holding one of the qualifications listed within the regulations.

Logic Certification Limited (T/A LCL Awards) is recognised by DEFRA as a designated certifier and evaluation body for the issue of certificates for natural persons for stationary refrigeration, air conditioning, heat pump equipment and refrigerated trucks and trailers containing fluorinated greenhouse gasses.

The target groups for the qualification are those learners who are;

1. Updating occupational competence, continuous professional development and or obtaining a licence to practice.
2. Preparing for further learning or training and/or developing knowledge and or skills in a subject area who are existing workers in the occupation seeking to extend their range of work

2. Qualification Framework:

The qualification comprises of 6 mandatory Units;

Unit Title	Unit Reference Number	Type of Unit	Level	Credit Rating	Pass Mark
Service and Maintain RACHP Electrical Systems including Safe Isolation of Single/Multi-phase systems	LCL-E3009	Knowledge and Practical	3	5	75%
Understand the Requirements of Electrical Installations BS 7671	LCL-E3004 (2022)	Knowledge only	3	4	60%
Understand and carry out "Oxy fuel" brazing techniques for RACHP systems	LCL-F3004	Knowledge and Practical	3	1	75%
F-Gas: Install, Service, Maintain, Recovery, Decommission and Leakage Checking of Systems (Category I)	LCL-F3001	Knowledge and Practical	3	3	75%
Understanding the properties and use of flammable refrigerants in accordance with ACRIB specification	LCL-F3003	Knowledge and Practical	3	1	75%
Installation, Commissioning and Service Commercial CO ₂ refrigeration systems	LCL-F3005	Knowledge and Practical	3	1	75%

Qualification Structure:

- **LCL Level 3 Certificate in the Installation, Service and Maintenance of Refrigeration, Air Conditioning and Heat Pump (RACHP) systems**
- QAN - **603/3807/6**
- The Guided Learning Hours (GLH) are **132 hours**
- The Total Qualification Time (TQT) is **150 hours**
- The total credit required to achieve the qualification is **15**

Condition of certification:

Note: Certificates issued within this qualification are valid for a period of **5 years** from the date of issue.

3. Unit Grading Structure:

The learner is required to successfully achieve a pass (*Required minimum percentage listed in table above*) for each unit for this qualification to be awarded. Performance assessments will require 100% to achieve a pass.

4. Unit specification:

Unit LCL-E3009: Service and Maintain RACHP Electrical Systems including Safe Isolation of Single/Multi-phase systems. (Assessments via M/C and OP)

Learning Outcome 01: Know the electrical standards that apply to RACHP systems.

The learner can:

- 1.01 State the statutory and non-statutory regulations, legislation and guidance information that applies to electrical supply and control of industrial and commercial, RACHP systems and their components, including those for:
 - health and safety
 - construction specific requirements
 - RACHP
 - professional body guidance
 - codes of practice
 - industry standards
 - manufacturers' installation and service/maintenance instructions
 - manufacturer technical/user instructions
- 1.02 Identify the range of information that would be detailed on an electrical installation certificate, for an installation of an electrical supply and control of industrial and commercial RACHP systems and their components.

Learning Outcome 02: Know the inspection and testing requirements of electrically operated RACHP components.

The learner can:

- 2.01 Specify the requirements of a visual inspection of completed electrical installation work for RACHP systems, prior to electrical inspection and testing.
- 2.02 State the requirements for the equipment used for electrical testing of RACHP components and its calibration requirements.
- 2.03 State the importance of carrying out tests on dead circuits wherever possible.
- 2.04 Interpret meter readings to inform decisions to be made in reference to safety and functionality of systems and components.
- 2.05 State the purpose of the electrical testing procedures for new and existing circuits:
 - polarity
 - earth continuity
 - insulation resistance
 - earth fault loop impedance
 - residual current device
- 2.06 Clarify the requirements for carrying out functional testing of electrical components
- 2.07 State the procedure for final handover of electrical circuits that supply electrically operated industrial and commercial RACHP components:
 - confirmation with appropriate competent personnel that the circuit(s) is in accordance with relevant statutory and non-statutory requirements
 - demonstration to the user
 - electrical installation completion certification (purpose only).

Learning Outcome 03: Understand and carry out the inspecting and testing of electrically operated RACHP systems.

The learner can:

- 3.01 Carry out the inspection and testing of a completed electrical system for the control of RACHP systems and their components from an existing supply outlet:
- visual inspection
 - selection and use of appropriate test equipment
 - appropriate circuit testing
 - polarity
 - earth continuity
 - insulation resistance
 - functional testing.
- 3.02 Understand the inspection and testing of existing electrical circuit for electrically operated mechanical components following the replacement of electrical conductors and/or components.
- 3.03 Understand the procedure for the final handover of electrical circuits that supply electrically operated industrial and commercial mechanical components, including:
- confirmation with appropriate competent personnel that the circuit(s) is in accordance with relevant statutory and non-statutory requirements
 - demonstration to the user
 - providing information for the completion of an electrical installation completion certification.

Learning Outcome 04: Know the procedures for safely diagnosing and rectifying faults in electrically operated RACHP components.

The learner can:

- 4.01 State the methods of obtaining details of system faults from end users.
- 4.02 Identify and use manufacturer instructions and industry standards to establish the diagnostic requirements of electrical system components.
- 4.03 Identify the electrical test equipment used to undertake fault diagnostics.
- 4.04 State the appropriate test equipment scale for the range of electrical tests.
- 4.05 Identify the situations in which dead testing of components can be carried out.
- 4.06 Identify the situations in which live testing of components may be necessary and the safety precautions required.
- 4.07 Define how to perform a range of routine checks and diagnostics on electrical system components as part of a fault-finding process. Checking for correct operation of:
- appliance components:
 - printed circuit boards (fused)
 - motors (single and multi-phase, DC (EC and other variants))
 - pumps
 - fans
 - compressors
 - heaters
 - coils
 - solenoid valves
 - relays and contactors
 - warning lamps/ LED
 - transformers
 - control components:
 - over temperature
 - over current

- protection devices
 - time and sequence control
 - electrically operated control valves
 - thermistors
 - motor starting devices
 - switches:
 - pressure operated
 - temperature operated
 - time operated.
- 4.08 State the methods used for correcting faults in electrical components:
- inadequate earthing provision
 - defective cable positioning (aged cables/proximity to other services)
 - failed electrical components
 - incorrect polarity
 - provision of inadequate circuit protection devices
 - incorrect phase-sequence

Learning Outcome 05: Be able to apply the procedures for safely diagnosing and rectify faults in electrically operated RACHP components.

The learner can:

- 5.01 Safely isolate electrical systems or components to prevent them being brought into operation before the work has been fully completed.
- 5.02 Carry out diagnostic checks to electrical circuits to identify:
- Inadequate earthing provision
 - Defective termination
 - Incorrect polarity
 - Provision of inadequate circuit protection devices
 - Incorrect phase-sequence
- 5.02.1 Carry out diagnostic tests to locate faults in electrical components and carry out repair work:
(select 1 from the following)
- Refrigeration components replacement
 - Air conditioning components replacement
 - Heat pump component replacement.

Learning Outcome 06: Know the fundamental principles of the electrical supply, RACHP systems and components.

The learner can:

- 6.01 Describe the fundamental principles of electrical supply and control in relation to RACHP systems in terms of:
- Voltage
 - Resistance
 - Impedance
 - Current:
 - Alternating
 - Direct
 - Power
 - Capacitance
 - Inductance
 - Conductors

- Insulators
- Magnetism
- Frequency
- Generation:
 - Single phase
 - Three-phase

Learning Outcome 07: Know the features of electrical circuits and components in buildings.

The learner can:

- 7.01 Describe the potential hazards of working with or near electrical supply systems:
 - Electrical shock
 - Fire
 - Water
- 7.02 Define the operating principles of electrical circuit protection devices:
 - circuit breakers
 - residual current devices (RCD's) including RCBO's
 - fuses:
 - rewirable
 - cartridge
 - high breaking capacity
- 7.03 Identify types of electrical circuits used in buildings:
 - Ring final circuit
 - Radial circuit
 - Spurs and (switched or non-switched) fused-connection units
- 7.03.1 State conductor identification requirements in accordance with the current edition of BS7671
- 7.04 State the applications and limitations of the types of cable and conductors used for the installation of electrical equipment in RACHP systems (cable types).
 - Applications:
 - low temp; high temp; defrost; signal; control; data
 - Limitations: fire risk;
 - explosion; corrosion; environment
- 7.05 Identify the differences between class 1 and class 2 types of electrical equipment
- 7.06 State the functions of electrically operated components used in RACHP systems:
Appliance components:
 - Printed circuit boards
 - Motors (single and three-phase, DC (EC and other variants)):
 - Pumps
 - Fans
 - Compressors
 - Heaters
 - Coils:
 - Solenoid valves
 - Relays and contactors
 - Warning Lamps/LED
 - Transformers
 - Control components:
 - Over temperature
 - Over current
 - Protection devices
 - programmers/timers
 - electrically operated control valves

- Thermistors
 - Motor starting devices
 - Switches:
 - Pressure operated
 - Temperature operated
 - Time operated
- 7.07 Clarify the need for, and requirements of earthing systems.
- Main earthing systems:
 - TT system
 - TN-S system
 - TN-C-S system
 - Protective equipotential bonding
 - High risk rooms (zones)
 - Supplementary earthing (bonding)
 - Temporary continuity bonding
- 7.08 Identify the warning notices to be applied.

Learning Outcome 08: Understand the principles, regulatory requirements and procedures for completing the safe isolation of an electrical circuit.

The learner can:

- 8.01 Specify the correct procedure for completing safe isolation of an electrical circuit (both single and multi-phase) with regard to:
- Carrying out safe working practices
 - Correct identification of circuit(s) to be isolated
 - Identifying suitable points of isolation
 - Selecting correct test and proving instruments in accordance with relevant industry guidance and standards
 - Correct testing methods
 - Selecting locking devices for securing isolation
 - Correct warning notices
 - Correct sequence for isolating multi-phase circuits
- 8.02 State the implications of carrying out safe isolations to:
- Other personnel
 - Customers/clients
 - Public
 - Building systems (loss of supply)
- 8.03 State the implications of not carrying out safe isolations to:
- Self
 - Other personnel
 - Customers/clients
 - Public
 - Building systems (presence of supply).

Learning Outcome 09: Be able to apply the principles, regulatory requirements and procedures for completing the safe isolation of an electrical circuit.

The learner can:

- 9.01 Carry out the safe isolation of an electrical circuit (s) in accordance with regulatory requirements for:
- Correct identification of circuit(s) to be isolated.
 - Identifying suitable points of isolation.

- Selecting correct test and proving instruments in accordance with relevant industry guidance and standards.
- Correct testing methods.
- Selecting locking devices for securing isolation.
- Correct warning notices.
- Correct sequence for isolating circuits.

Learning Outcome 10: Know the requirements for the installation and connection of electrical systems for the supply and control of industrial and commercial RACHP systems and their components.

The learner can:

- 10.01 Identify the work required prior to be carrying out in order to install, commission, decommission or maintain electrical systems or components for RACHP systems.
- 10.02 Identify the protection measures to be applied to the building fabric or customer property, during and on completion of work on electrical systems and components:
- Building wall/floor surfaces
 - Existing and new electrical systems
 - Building décor and carpets
- 10.03 Identify the hand and power tools required to complete work on electrical systems.
- 10.04 State the method used to identify that existing electrical supplies and circuits are suitable for the proposed installation of electrical equipment used in industrial and commercial RACHP systems.
- 10.05 State the factors which effect the selection of cables and conductors:
- length
 - load
 - ambient temperatures
 - grouping of cables
 - protective device
 - insulation
- 10.06 Identify the cable, materials and fittings required to complete work on electrical systems.
- 10.07 Specify the requirements for protecting cables installed in the building fabric and terminating in enclosures:
- Protection methods in wall and floor surfaces:
 - permitted zones – depth, direction, application of RCD protection
 - Exposed (containment)
 - Within timber/metal stud partitions
 - Within timber floor's
 - Junction boxes
 - Switch/socket boxes:
 - Surface mounted
 - External influences:
 - IP rating
- 10.08 State the application and limitations of cable termination methods.
- 10.09 State the method of installation, connection and termination for fixed electrical equipment:
- RACHP systems and their components

Learning Outcome 11: Be able to demonstrate and apply the requirements for the installation and connection of electrical systems for RACHP systems and their components.

The learner can:

- 11.01 Check the safety of the work location in order for the work to safely proceed:

- Safe access and exit
 - Immediate work location e.g. tripping hazards
 - Appropriate risk assessments/ method statements are followed
- 11.02 Wear personal protective equipment relevant to the installation, decommissioning, servicing or maintenance tasks being carried out.
- 11.03 Carry out the wiring and connection of an electrical system for the control of RACHP systems.
- 11.04 Apply temporary continuity bonding to metallic pipework prior to making pipework connections.
- 11.05 Safely carry out the disconnection of an electrical supply from an RACHP unit.
- 11.06 Safely carry out the connection of an electrical supply to an RACHP unit.

Unit LCL-E3004: Understand the Requirements of Electrical Installations BS 7671
(Assessments via M/C)

Learning Outcome 01: The learner will know the scope, object and fundamental principles of BS7671.

The learner can:

- 1.01 Identify the scope of BS7671.
- 1.02 Identify the object of BS7671.
- 1.03 Identify the fundamental principles of BS7671.

Learning Outcome 02: The learner will understand the definitions used within BS7671

The learner can:

- 2.01 Interpret the definitions used within BS7671.
- 2.02 Relate the definitions to the regulations and appendices of BS7671.

Learning Outcome 03: The learner will understand how to assess the general characteristics of electrical installations

The learner can:

- 3.01 Interpret the requirements of assessing the general characteristics of electrical installations within the scope of BS7671.

Learning Outcome 04: The learner will understand requirements of protection for safety for electrical installations

The learner can:

- 4.01 Identify the requirements of protection for safety within the scope of BS7671.
- 4.02 Interpret how this applies to electrical installations within the scope of BS7671 to include:
 - protection against electric shock
 - protection against thermal effects
 - protection against over current
 - protection against voltage disturbances and electromagnetic disturbances.

Learning Outcome 05: The learner will understand the requirements for selection and erection of equipment for electrical installations.

The learner can:

- 5.01 Identify the requirements for selecting and erecting equipment within the scope of BS7671.
- 5.02 Interpret how this applies to electrical installations within the scope of BS7671 to include:
 - common rules
 - selection and erection of wiring systems
 - protection, isolation, switching, control and monitoring
 - earthing arrangements and protective conductors
 - other equipment
 - safety services

Learning Outcome 06: The learner will understand the requirements of inspection and testing of electrical installations.

The learner can:

- 6.01 Identify the requirements for inspection and testing.
- 6.02 Interpret how this applies to electrical installations.

Learning Outcome 07: The learner will understand the requirements of special installations or locations as identified in BS7671.

The learner can:

- 7.01 Identify the requirements for special installations and locations.
- 7.02 Interpret how these affect the general requirements of the regulations.

Learning Outcome 08: The learner will understand the information contained within the appendices of BS7671.

The learner can:

- 8.01 Identify the information in the appendices of BS7671.
- 8.02 Specify how the information contained in the appendices is used to support electrical installation activities.
- 8.03 The information contained in Part 8 of BS 7671.

Unit LCL-F3004: Understand and carry out oxyfuel brazing techniques for RACHP systems (assessments via M/C and OP)

Learning Outcome 01: The learner will understand the working principles of RACHP Oxy-Fuel brazing processes.

The learner can:

- 1.01 Identify the working principles of all the following items of Oxy-Fuel brazing equipment:
 - oxyfuel, compressed inert gas cylinders
 - single and two stage regulators
 - flashback arresters
 - non-return valves
 - brazing torches
 - brazing nozzles

- oxyfuel hoses.

Learning Outcome 02: The learner will understand the legislative and organisational procedures related to RACHP oxyfuel brazing processes.

The learner can:

- 2.01 Interpret and apply appropriate sources of health, safety information, regulations, codes of practice, industry recommendations and brazing specifications as it relates to:
 - oxyfuel, compressed inert gases
 - brazing equipment
 - brazing processes
 - materials handling
- 2.02 State appropriate persons whom it may be necessary to advise before undertaking brazing processes.
- 2.03 Define the actions that should be taken upon completion of brazing processes in terms of:
 - quality control, check for leaks
 - appropriate documentation
- 2.04 Explain how to perform a safe shut down of brazing equipment after completion of work operations.

Learning Outcome 03: The learner will understand how to complete preparation work for RACHP oxyfuel brazing activities.

The learner can:

- 3.01 Explain how to complete a suitable risk assessment for the completion of brazing in the work location.
- 3.02 Specify the content of a method statement for the completion of brazing processes.
- 3.03 Identify the personal protective equipment appropriate to the work activity being carried out.
- 3.04 State the preparation requirements for:
 - joining pipework by brazing
 - identify and test for faults on brazed pipework sections
 - commissioning method for brazed pipework sections
 - decommissioning method for brazed pipework sections
- 3.05 Identify pipework materials and fittings required to complete brazing processes and check them for defects.
- 3.06 Identify suitable tools and equipment required to carry out brazing processes.
- 3.07 State the procedures for checking and maintaining brazing tools and equipment.

Learning Outcome 04: The learner will be able to complete preparation work for RACHP oxyfuel brazing activities.

The learner can:

- 4.01 Carry out a suitable risk assessment for the completion of brazing processes in the work location.
- 4.02 Understand and apply a method statement for brazing to ascertain requirements for:
 - storage of materials and finished products
 - availability of service supplies
 - informing appropriate people at key stages in the brazing process
 - reporting problems
 - joining procedures
 - job instructions

- permit to work
- 4.03 Select personal protective equipment appropriate to the work activity being carried out as per the risk assessment and method statement.
- 4.04 Select pipe and materials for brazing processes and confirm that they are appropriate for the work activity.
- 4.05 Select equipment for the completion of brazing processes and confirm that is appropriate for the work activity.
- 4.06 Confirm that preparations have been completed in line with organisational procedures and method statement.

Learning Outcome 05: The learner will understand how to connect RACHP pipework with oxyfuel brazing.

The learner can:

- 5.01 Identify and interpret engineering drawings and brazing specifications for the completion of brazing procedures.
- 5.02 State the methods for setting up and using brazing equipment, including:
- oxyfuel, compressed inert gas cylinders
 - single and two stage regulators
 - flashback arresters
 - non-return valves
 - brazing torches
 - brazing nozzles
 - oxy-fuel hoses.
- 5.03 Describe the basic principles for inspecting, testing and maintaining oxyfuel brazing equipment.
- 5.04 Identify procedures for brazing the following refrigeration grade materials in accordance with industry standards:
- copper pipe, steel pipe
 - bends and elbows
 - tees
 - copper, brass and steel couplings
 - In line components including capillary fittings
 - manually formed sockets up to 7/8" OD pre-annealed copper pipe
- 5.05 Define the procedures for:
- checking brazed joints for compliance
 - testing for defects.

Learning Outcome 06: The learner will be able to connect RACHP pipework by Oxyfuel brazing.

The learner can:

- 6.01 Complete checks to establish that:
- joint preparation
 - brazing equipment
 - Consumables and materials
 - Confirm that the system complies with specifications and is fit for purpose
- 6.02 Select tools and equipment required to carry out RACHP Oxyfuel brazing of pipework and confirm they are fit for purpose.
- 6.03 Set up brazing equipment in accordance with industry standards and regulations.
- 6.04 Braze the following pipework materials to conform with assessment specifications:

- copper pipe, steel pipe
 - bends and elbows
 - tees
 - copper, brass and steel couplings
 - In line components including capillary fittings
 - manually formed sockets on pre-annealed copper pipe
- 6.05 Confirm that equipment has been safely isolated upon completion of brazing activities.
- 6.06 Conduct industry approved checks and tests on brazed joints to:
- confirm compliance with assessment specification
 - identify any defects
 - identify any corrective actions
- 6.07 Complete relevant documentation including brazed joint test reports.

Unit LCL-F3001 F-Gas: Install, Service, Maintain, Recovery, Decommission and Leakage Checking of Systems (Category I) (assessments via M/C and OP)

Learning Outcome 01: The learner will know the fundamental principles of thermodynamics.
The learner will know:

- 1.01 State the ISO standard units as for temperature, pressure, mass, density, and energy.
- 1.02 The following thermodynamic terms;
- Superheat,
 - High Side, Heat of Compression,
 - Enthalpy, Refrigeration Effect,
 - Low Side, (Sub-cooling), properties
 - Thermodynamic transformations of refrigerants including the identification of zeotropic blends and fluid states.
- 1.03 How to interpret tables and diagrams in the context of;
 Indirect leakage checking (including checking of the good operation of the system),
- A log p/h diagram,
 - Saturation tables of a refrigerant,
 - A single compression refrigeration cycle.
- 1.04 The function of the main components in the system.
- Compressor,
 - Evaporator,
 - Condenser,
 - Thermostatic expansion valves
 - The thermodynamic transformations of the refrigerant.
- 1.05 The operation of the following components used in a refrigeration system and their role and importance for refrigerant leakage prevention and identification;
- a. Valves (ball valves, diaphragms, globe valves, relief valves),
 - b. Temperature and pressure controls,
 - c. Sight glasses and moisture indicators,
 - d. Defrost controls,
 - e. System protectors,
 - f. Measuring devices
 - g. Oil control systems,
 - h. Receivers,
 - i. Liquid and oil separators.
- 1.06 The specific;
- Behaviour,
 - Physical parameters,

- Solutions, systems,
- Deviances of alternative refrigerants in the refrigeration cycle and components for their use.

Learning Outcome 02: The learner will know the environmental impact of refrigerants and corresponding environmental regulations.

The learner will know:

- 2.01 Outline the EU and international climate change policy, including the United Nations Framework Convention on Climate Change.
- 2.02 The;
 - Concept of Global Warming Potential (GWP),
 - The use of fluorinated greenhouse gases and other substances as refrigerants,
 - The impact of the emissions of fluorinated greenhouse gases on the climate (order of magnitude of their GWP)
 - The relevant provisions of Regulation (EU) No 517/2014 and of the relevant implementing acts

Learning Outcome 03: The learner will be able to carry out checks before putting in operation, after a long period of non-use, after maintenance or repair intervention, or during operation.

The learner can:

- 3.01 Carry out a pressure test to check the strength of the system.
- 3.02 Carry out a pressure test to check the tightness of the system.
- 3.03 Use a vacuum pump.
- 3.04 Evacuate the system to remove air and moisture according to standard practice.
- 3.05 Fill in the data in the equipment records and fill in a report about one or more tests and checks carried out during the examination.

Learning Outcome 04: The learner will be able to check for leakage

The learner can:

- 4.01 Identify the potential leakage points of refrigeration, air conditioning and heat pump equipment.
- 4.02 Check equipment records prior to a check for leakage and identify the relevant information on any repeating issues or problem areas to pay special attention to.
- 4.03 Make a visual and manual inspection of the whole system in accordance with the current Commission Regulation (EC).
- 4.04 Carry out a check for leakage of the system using an indirect method in accordance with the current Regulation (EC) and the instruction manual of the system.
- 4.05 Use portable measuring devices including:
 - Manometer sets
 - Thermometers
 - Multi meters for measuring Volt/Amp/Ohm in the context of indirect methods for leakage checking and interpret the measured readings.
- 4.06 Carry out a check for leakage of the system using one of the direct methods referred to in the current Regulation (EC).
- 4.07 Carry out a check for leakage of the system using one of the direct methods which does not entail breaking into the refrigeration circuit, referred to in the current Regulation (EC).

Learning Outcome 05: The learner will be able to environment friendly handle the system and refrigerant during installation, maintenance, servicing or recovery.

The learner can:

- 5.01 Connect and disconnect gauges and lines with minimal emissions.
- 5.02 Empty and fill a refrigerant cylinder in both liquid and vapour state.
- 5.03 Use a recovery set to recover refrigerant and connect and disconnect recovery set with minimal emissions.
- 5.04 Drain F-gas contaminated oil out of a system.
- 5.05 Identify refrigerant state (liquid, vapour) and condition (subcooled, saturated or superheated) prior to charging, to ensure correct method and volume of charge.
- 5.06 Fill the system with refrigerant (both in the liquid and vapour phase) without loss of refrigerant.
- 5.07 Choose the correct type of scales and use them to weigh the refrigerant.
- 5.08 Fill in the equipment records with all relevant information concerning the refrigerant recovered or added.
- 5.09 Follow the requirements and procedures for handling, reusing, reclaiming, storage and transportation of contaminated refrigerant and oils.

Note: The examination for category I learners shall cover at least one of the following skill and knowledge groups 6, 7, 8 or 9 (Cat I)

Learning Outcome 06: The learner will be able to put into operation and maintain reciprocating, screw and scroll compressors, single and two-stage.

The learner can:

- 6.01 Explain the basic functioning of a compressor (including capacity control and lubricating system) and risks of refrigerant leakage or release associated to it.
- 6.02 Install a compressor, including control and safety equipment, so that no leak or major release occurs once the system is put into operation.
- 6.03 Adjust the safety and control switches.
- 6.04 Adjust the suction and discharge valves.
- 6.05 Check the oil return system.
- 6.06 Start up and shut down a compressor and check the working conditions of the compressor, including by making measurements during the operation of the compressor.
- 6.07 Write a report about the condition of the compressor which identifies any problems in the functioning of the compressor that could damage the system and eventually lead to refrigerant leakage or release should no action be taken.

Learning Outcome 07: The learner will be able to install, put into operation and maintain air cooled and water-cooled condensers.

The learner can:

- 7.01 Explain the basic functioning of a condenser and risks of leakage associated to it
- 7.02 Adjust a discharge pressure control of the condenser.
- 7.03 Install a condenser/outdoor unit, including control and safety equipment, so that no leak or major release occurs when the system has been put into operation.
- 7.04 Adjust the safety and control switches.
- 7.05 Check the discharge and liquid lines.
- 7.06 Purge non-condensable gases out of the condenser using a refrigeration purging device.
- 7.07 Start up and shut down a condenser and check the working condition of the condenser including by making measurements during operation.
- 7.08 Check the surface of the condenser.
- 7.09 Write a report about the condition of the condenser which identifies any problems in the functioning that could damage the system and eventually lead to refrigerant leakage or release should no action be taken.

Learning Outcome 08: The learner will be able to install, put into operation and maintain air cooled and water-cooled evaporators.

The learner can:

- 8.01 Explain the basic functioning of an evaporator (including defrosting system) and risks of leakage associated to it.
- 8.02 Adjust an evaporating pressure control of the evaporator.
- 8.03 Install an evaporator including control and safety equipment, so that no leak or major release occurs when the system has been put into operation.
- 8.04 Adjust the safety and control switches.
- 8.05 Check the liquid and suction pipelines in the correct position.
- 8.06 Check the hot gas defrost pipeline.
- 8.07 Adjust evaporation pressure regulation valve.
- 8.08 Start up and shut down an evaporator and check the working condition of the evaporator, including by making measurement during operation.
- 8.09 Check the surface of the evaporator.
- 8.10 Write a report about the condition of the evaporator which identifies any problems in the functioning that could damage the system and eventually lead to refrigerant leakage or release should no action be taken.

Unit LCL-F3003 Understanding the properties and use of flammable refrigerants in accordance with ACRIB specification (A2L, A2 and A3) (assessments via M/C and OP)

Learning Outcome 01: Understand the different classes of flammability as recognised by legislation, safety standards such as BS EN 378, ISO5149, BS EN 60335 and manufacturers' instructions. Understand specific health and safety.

The learner can:

- 1.01 Identify the hazards associated with these refrigerants:
 - flammability
 - low boiling point
 - asphyxiation
 - LFL
 - UFL
 - sources of ignition
 - practical limits
 - density
- 1.02 State and identify the commonly used refrigerant designations (eg "R" numbers, toxicity and flammability class).
- 1.03 State the requirements of specific risk assessments.
- 1.04 Identify the appropriate fire extinguishers for work on RACHP systems.

Learning Outcome 02: Understand the legislative and organisational procedures for installation, servicing, maintaining and decommissioning.

The learner can:

- 2.01 State the appropriate sources of health and safety information when installing, servicing, maintaining and de-commissioning of RACHP systems.
- 2.02 State the regulations, codes of practice, and industry recommendations appropriate to the installation, servicing, maintaining and de-commissioning of RACHP systems, including working with refrigerants.

- 2.03 State the location classification and charge limits for RACHP systems.
- 2.04 State charge size limitations for human comfort cooling and heating for air conditioning systems.

Learning Outcome 03: Understand the differences between different refrigerant classes in a variety of RACHP systems.

The learner can:

- 3.01 Identify the specific system features and components which apply to RACHP systems:
 - electrical devices
 - electrical enclosures
 - associated electrical devices (including devices specifically designed for use with flammable refrigerants)
 - compressors (including starter and associated electrics)
- 3.02 Identify the features and characteristics of:
 - critical charge systems
 - oil compatibility
- 3.03 State the properties, advantages and disadvantages of different classes of refrigerants including:
 - leakage implications (direct and indirect)
 - thermodynamic properties
 - cooling capacity and energy efficiency
 - density
 - odour
- 3.04 Explain why these refrigerants are not suitable for retro-filling.
- 3.05 Identify typical applications of RACHP systems.

Learning Outcome 04: Understand the procedures for planning and preparing for work on RACHP systems.

The learner can:

- 4.01 State the requirements for completing a risk assessment for work on RACHP systems.
- 4.02 State the requirements for creating and maintaining a safe working area.
- 4.03 Identify appropriate tools and equipment for work on RACHP systems.

Learning Outcome 05: Be able to plan and prepare for work on RACHP systems.

The learner can:

- 5.01 Understand a location specific risk assessment.
- 5.02 Establish and maintain a safe working area.
- 5.03 Select tools, equipment and PPE for work on RACHP systems which are suitable for the refrigerant (including but not limited to refrigerant detector, ventilation fan, vacuum pump and recovery unit).

Learning Outcome 06: Understand the specific requirements for installing and testing RACHP systems.

The learner can:

- 6.01 Identify access category as designated in safety standards (BS EN 378, ISO 5149).
- 6.02 Identify the maximum refrigerant charge based on location classification.
- 6.03 Calculate the maximum charge based on the toxicity and practical limit.
- 6.04 Determine from calculations the system specific maximum charge.
- 6.05 State the methods and procedures for:

- strength testing
 - tightness testing
 - leak testing
 - evacuation and dehydration
- 6.06 State the procedures for charging refrigerant into systems.
- 6.07 State the procedures for determining when charge is correct.
- 6.08 State the records to be completed prior to handover.
- 6.09 State the requirements for system labelling.
- 6.10 Understand the importance of following manufacturers' installation instructions.
- 6.11 Specify the information that should be provided to customers, including:
- operation of system and controls
 - using only appropriately trained servicing personnel
 - restrictions on the relocation of equipment
 - compliance with the F-Gas Regulation where appropriate

Learning Outcome 07: Understand service and maintenance procedures.

The learner can:

- 7.01 Identify manufacturers' recommended replacement components for the following:
- electrical devices
 - electrical enclosures
 - associated electrical devices
 - compressors (including starter and associated electrics)
- 7.02 State the importance of maintaining the integrity of certified electrical equipment.
- 7.03 State appropriate methods for accessing and sealing RACHP systems.
- 7.04 Specify the requirements for recovering refrigerant with regard to safety and environmental implications (including situations where it may be safe to vent less than 0.15kg of hydrocarbon refrigerant to atmosphere).
- 7.05 State the requirements for the safe use of recovery machines.
- 7.06 State the requirements for the safe use of vacuum pumps.

Learning Outcome 08: Be able to service and maintain RACHP systems.

The learner can understand how to:

- 8.01 Calculate the safe fill weight for the recovery cylinder (density difference between refrigerants).
- 8.02 Connect equipment in preparation for recovery.
- 8.03 Recover refrigerant to a prescribed pressure.
- 8.04 Follow a procedure by which they purge the circuit with inert gas (eg oxygen free nitrogen OFN), evacuate the circuit to a pressure of 0.3 abs, purge the circuit a second time with inert gas (eg OFN).
- 8.05 Remove the specified component while monitoring lower flammability level.
- 8.06 Replace the specified component while purging OFN through pipework if brazing.
- 8.07 Prove system is leak tight (containment).
- 8.08 Evacuate to below 2000 microns.
- 8.09 Re-charge with specified refrigerant weight.
- 8.10 Run system and check operation.
- 8.11 Remove charging equipment.
- 8.12 Seal system and complete leak test with appropriate equipment.
- 8.13 Complete service records as appropriate.

Learning Outcome 09: Understand the decommissioning procedures for RACHP systems.

The learner can:

- 9.01 Identify the safe procedures for handling, storage and disposal or recovery of refrigerant and other potentially hazardous materials.
- 9.02 Identify work sequences for decommissioning and making a system safe in accordance with appropriate industry procedures and manufacturers' instructions.

Unit LCL-R3005: Installation, Commissioning and Service Commercial CO₂ refrigeration systems. (Assessments via M/C and OP)

Learning Outcome 01: The learner will be able to plan and prepare for the installation and commissioning of commercial CO₂ refrigeration systems.

The learner can:

- 3.03 Understand the properties of CO₂ R744 including:
- State of matter, changes of states
 - Characteristics – safety classification, saturation temperature, practical limit, density and critical temperature
 - Refrigerant comparisons between HFC, HFO, HC and R744
 - Pressure temperature relationship
 - Cooling capacities comparison
 - Super critical, trans critical and sub critical
- 1.01 Produce a suitable risk assessment of the installation to identify any factors which may impact upon the work.
- 1.02 Produce a suitable method statement to confirm that relevant people have been provided with job information (as appropriate) and identify points within the work process when liaison with identified relevant persons may be necessary.
- 1.03 Identify manufacturers' instructions, regulations and industry standards to determine installation and commissioning requirements for systems and components.
- 1.04 Use manufacturer's instructions, regulations and industry standards to determine requirements for systems and components, including procedures to:
- confirm that components have suitable pressure ratings for carbon dioxide systems and are suitable for use
 - confirm that fittings have suitable pressure ratings for carbon dioxide systems and are suitable for use
 - determine strength test pressure(s) from the system maximum allowable pressure(s)
 - determine tightness test pressure(s) from the system maximum allowable pressure(s)
- 1.05 Select appropriate PPE for the completion of work activities.

Learning Outcome 02: The learner will be able to carry out the installation of commercial CO₂ refrigeration systems.

The learner can:

- 2.01 Identify and interpret appropriate sources of information which impact upon the installation of commercial CO₂ refrigeration pipework, systems and components, including:
- regulatory documents
 - industry codes of practice
 - manufacturer's instructions
 - installation specification
- 2.02 Assemble and join commercial CO₂ refrigeration system components to meet the requirements of the installation specification.

- 2.03 Position and fix commercial CO₂ refrigeration system components and pipework correctly, in respect of:
 - Support spacing for pipe
 - To allow for pipework to expand and contract
 - Insulation and vapour seals
- 2.04 Confirm that system components and pipework are correctly installed in accordance with the design specification.
- 2.05 Adjust and set safety and control features as appropriate.
- 2.06 Complete procedures to remove and refit components to commercial CO₂ refrigeration systems.

Learning Outcome 03: The learner will be able to carry out the commissioning of commercial CO₂ refrigeration systems.

The learner can:

- 3.03 Use manufacturer's instructions, regulations and industry standards to prepare a pre-commissioning checklist for RACHP systems.
- 3.04 Conduct the following checks on commercial CO₂ refrigeration equipment and systems:
 - visual inspection of:
 - pipework for leakage
 - pipework for adequate support
 - of insulation and vapour seals
 - for high moisture levels
 - of pressure relief valves and relief piping
- 3.05 Demonstrate procedures for testing commercial CO₂ refrigeration systems, including:
 - establishing system allowable pressure(s)
 - conducting a strength pressure test
 - conducting a tightness pressure test
- 3.04 Demonstrate procedures for charging commercial CO₂ refrigeration systems, including:
 - Evacuating a system
 - Breaking a vacuum with carbon dioxide vapour
 - Charging a system with oil
 - Charging a system with carbon dioxide liquid
- 3.05 Demonstrate commercial CO₂ refrigeration system operation to confirm that system and equipment is functioning correctly
- 3.06 Demonstrate procedures for adjusting system operating parameters through:
 - adjusting safety and system controls
 - additional refrigerant as required
 - additional oil as required
 - safely vent CO₂, avoiding deposition "dry ice"
- 3.07 Produce documentary records to provide system users with information necessary for continuing operation of commercial CO₂ refrigeration systems, including:
 - records of:
 - refrigerant quantity added
 - refrigerant quantity removed
 - oil quantity added
 - oil quantity removed
 - commissioning data

Learning Outcome 04: The learner will be able to carry out the de-commissioning of commercial CO₂ refrigeration systems.

The learner can:

- 4.01 Produce appropriate risk assessments and method statements to ensure decommissioning activities can be completed safely.
- 4.02 Demonstrate work sequences for permanently decommissioning:
 - a complete commercial CO₂ refrigeration system
 - part of a commercial CO₂ refrigeration system
- 4.03 Describe how oil and refrigerant could be safely removed from a system and disposed of.

5. National Occupational Standard:

The Units used in this qualification have a direct relationship with the National Occupational Standards for the areas of work contained within.

Unit LCL-E3004 is based on BS7671:2018 and has been written and approved by The Electrical Skills Partnership (TESP)

Unit LCL-F3001 is based on Regulation (EU) 2015/2067 and has been written and approved by DEFRA for category I applicants.

Unit LCL-F3003 has been written and approved by the Air Conditioning and Refrigeration Industry Board (ACRIB).

6. RQF Descriptor Level 3.

Knowledge descriptor: *(the learner can)*

- *Has factual, procedural and theoretical knowledge and understanding of a subject or field of work to complete tasks and address problems that while well-defined, may be complex and non-routine.*
- *Can interpret and evaluate relevant information and ideas.*
- *Is aware of the nature of the area of study or work.*
- *Is aware of different perspectives or approaches within the area of study or work.*

Skills Descriptor *(the learner can)*

- *Identify, select and use appropriate cognitive and practical skills, methods and procedures to address problems that while well defined, may be complex and non-routine.*
- *Use appropriate investigation to inform actions.*
- *Review how effective methods and actions have been.*

7. Prior knowledge, skills or understanding which the learner is required to have before taking the qualification. (Pre-requisites)

none.

8. Units which a learner must have completed before the qualification will be awarded and any optional routes.

none.

9. Other requirements which a learner must have satisfied before the learner will be assessed or before the qualification will be awarded.

Learners Should hold a valid F-Gas certificate prior to the Level 3 Award in Understanding the properties and use of flammable refrigerants in accordance with ACRIB specification (A2L, A2 and A3) qualification being issued.

10. The design and delivery of the examination associated with these units are based on the following documents:

BS7671:2018 +A2:2022
 Regulation (EU) 2015/2067
 ACRIB training specification for flammable refrigerants (Classification A2L, A2, & A3)
 IOR Safety code of Practice CO₂
 IOR Safety code of practice Flammable Lower Toxicity Refrigerants (Groups A2L, A2 & A3)
 IOR Safety code of Practice for non-flammable, low toxicity refrigerants (Group A1)
 BRA Jointing of copper pipework for refrigeration systems.

11. The criteria against which learners’ level of attainment will be measured.

The Learning Outcomes and Assessment Criteria against which learners’ level of attainment will be measured are detailed in Section 4 of this specification.

12. Planned exemptions

Learners holding one or more of the regulated qualifications listed below will be exempted from completing the appropriate unit from this qualification.

<i>Title of Qualification held</i>	<i>Unit exemption</i>
Level 3 Award in the Requirements for Electrical Installations BS7671:2018	LCL-E3004
Level 3 Award in F-Gas: Install, Service, Maintain, Recovery, Decommission and Leakage Checking of Systems (Category I) <i>Note: learners holding a Level 2 F-Gas certificate within 5 years of issue will be able to undertake the LCL Awards: RPL route.</i>	LCL-F3001
Level 3 Award in Understanding the properties and use of flammable refrigerants in accordance with ACRIB specification (A2L, A2 and A3)	LCL-F3005
<i>The original certificate must be present to the centre and the centre must retain an authenticated copy of these certificates within the learner’s portfolio</i>	

13. Specimen assessment materials.

F-Gas workbook 517/2014. (ISBN 978-0-9927604-2-7)

14. Specified levels of attainment

Learners must achieve the overall pass mark as listed above to pass the multiple-choice assessments and **100%** for all practical assessments for the qualification to be awarded.

15. Other information

SSAs: 4.1 Engineering

Review Date: Dec 26