Unit 40: Refrigerant Handling

Unit code: L/601/5310

QCF Level 3: BTEC National

Credit value: 2

Guided learning hours: 10

Aim and purpose

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to handle refrigerants.

Unit introduction

The increasing number of land based vehicles being fitted with air conditioning systems as standard or retro fitted, along with the increase in number of cold storage facilities, has led to an increase in the demand for refrigerant engineers.

This unit develops learners knowledge of the gasses involved in refrigerant systems, their handling and the legislative requirements surrounding these.

Learners will develop their knowledge of different air conditioning systems, their components and which refrigerant is used in these system. They will recover refrigerant from a system, reusing or disposing of the gas safely.

Learners will explore a refrigerant operating cycle, including the testing and recharging of systems, the differing types of refrigerant and how they should be handled. They will discover how these operations are carried out to minimise refrigerant leakage.

Learning outcomes

On completion of this unit a learner should:

1 Be able to handle refrigerants in accordance with legislation

2 Know how to handle refrigerants in accordance with legislation.

Unit content

1 Be able to handle refrigerants in accordance with legislation

Refrigerant handling: identification and location of air conditioning systems and components; refrigerant types and system capabilities according to application; use of appropriate tools and equipment; flushing and recharging; health and safety; risk assessment (testing, recovery and recharging of mobile and fixed refrigerant systems); current relevant legislation; appropriate record keeping

2 Know how to handle refrigerants in accordance with legislation

Mobile Air Conditioning (MAC): operating principles; function; recognition of characteristics associated with different refrigerant handling equipment including basic and automatic equipment; procedures relevant to the safe handling of refrigerants; safe and appropriate waste management in line with relevant legislation and codes of practice

Fixed plant refrigeration systems: operating principles; function; components; recognition of characteristics associated with different refrigerant handling equipment including basic and automatic equipment; procedures relevant to the safe handling of refrigerants; safe and appropriate waste management in line with relevant legislation and codes of practice

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 identify and locate air conditioning systems and their components	**M1** compare different tools and equipment used to recover refrigerant	**D1** discuss the importance of identifying the different types of refrigerant, and the importance of installing the correct gas in refrigerant systems.
P2 identify the correct refrigerant types and system capacities according to application [IE]		
P3 use the appropriate tools and equipment to carry out refrigerant handling activities recovery [TW, SM, EP]		
P4 follow safety procedures to collect and transfer any waste material in accordance with relevant legislation and policies		
P5 maintain and process appropriate records		
P6 describe the operating principles and function of Mobile Air Conditioning (MAC) and fixed plant refrigeration systems and components	**M2** assess refrigerant handling risks in detail.	
P7 describe types of refrigerants and their properties, characteristics and environmental impact		

Assessment and grading criteria			
To achieve a pass grade the evidence must show that the learner is able to:		**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P8	describe how to handle refrigerants including recovery, testing (pressure or vacuum), flushing and recharging in Mobile Air Conditioning and fixed plant refrigeration systems		
P9	describe how to work in a way which minimises the risk of any refrigerant emissions. [RL]		

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit is likely to be delivered in combination with *Unit 41: Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment*.

Delivery of this unit will involve practical assessments, written assessment, visits to suitable collections and will have links to industrial experience placements.

Whichever delivery methods are used, it is essential that tutors stress the importance of sound environment management and the need to manage equipment using legal methods.

Health and safety issues relating to workshop situations must be stressed and regularly reinforced, and risk assessments must be undertaken prior to practical activities. Adequate PPE must be provided and used following the production of suitable risk assessments; this is very important due to the presence of pressurised gasses in refrigeration units

The equipment used for assignments can be mobile or static, depending on the learners' requirements.

Learning outcome 1 is mainly practical looking at the identify of different systems and their components, the different types of refrigerant, and how they are handled, their collection and the transfer of refrigerant and completion of necessary records.

Learning outcome 2 looks at the theory of refrigeration, the types of refrigerant and how handling operations should be carried out.

Outline Learning Plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value.**

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction to unit.
Assignment 1: Air Condition Systems, Components and Refrigerant types (P1, P2, M1)
Refrigeration types and systems.
Assignment 2: Recovery and Disposal of Refrigerant/Waste (P3, P4, P5)
Recovery and reinstalling equipment.
Recovery and reinstating of refrigerant.
Assignment 3: Refrigeration and Air Conditioning Systems – Safe Uses and the Environment (P6, P7, P8, P9, M2, D1)
Refrigerant legislation.
Environmental impacts and how to reduce these.
Maintaining appropriate records.

Assessment

For P1, P2, P3, P4 and P5, learners must identify and locate the air conditioning components, systems, and refrigerants, the tools used for refrigerant handling, along with the necessary safety procedures and record keeping. Evidence for these assessment criteria is likely to be in the form of recorded practical observations during workshop sessions, along with the use of correct recording of work carried out.

For P6, P7, P8 and P9, learners must provide information on the operating principles, types of refrigerant, and their properties, characteristics and possible environmental impact. Evidence for these assessments could be written, it could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or written assignment.

For M1, learners must compare equipment available for refrigerant handling with their features and benefits. Evidence for this could be written, it could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or written assignment.

For M2, learners must assess risks of refrigerant handling, this could be evidenced through the development and use of a detailed risk assessment and must cover testing, recovery and recharging of mobile and fixed refrigerant systems.

For D1, learners must discuss the need to install the correct gas in the refrigeration systems and the consequences of wrong fitment. Evidence for these assessments could be written assignment, or part of an oral assignment.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1	Air Condition Systems, Components and Refrigerant types	You are contracted to work for a frozen farm food distribution depot. One of your key roles is to monitor and manage refrigerant handling in the depot. You have been asked to provide an overview of the air conditioning and refrigerant systems used in a given area as well as the tools and equipment used.	Practical. Report.
P3, P4, P5	Recovery and Disposal of Refrigerant/Waste	As part of a maintenance routine you need to safely use tools and equipment to handle and store refrigerants and manage waste materials completing appropriate documentation.	Observation records and/or Witness Statements.
P6, P7, P8, P9, M2, D1	Refrigeration and Air Conditioning Systems – Safe Uses and the Environment	You have been asked to develop a new refrigerant user guide, you need to provide information on different air conditioning and refrigerant systems and why their proper use and maintenance is important.	User Guide.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Service and Repair Electrical Systems on Land-based Equipment	Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment
	LEO 27 Refrigerant Handling

Essential resources

Learners need access to diagnostic gauges, Vacuum Pump, refrigerant, storage container, lubricant, PPE, thermometer and multimeters.

Indicative reading for learners

Textbooks

Bell B – *Farm Machinery* (Old Pond Publishing, 2005) ISBN 1903366682

Culpin C – *Farm Machinery, 12th Edition* (Blackwell Scientific, 1992) ISBN 063203159X

Hawker M and Keenlyside J – *Horticultural Machinery, 3rd Edition* (Longman Higher Education, 1985) ISBN 0582408075

Journals

Farmers' weekly

Profi

Other Publications

Mobile air conditioning training manual – Autoclimate Limited

Websites

www.bagma.com	British Agricultural and Garden Machinery Association
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.environment-agency.gov.uk	Environment Agency
www.howstuffworks.com	HowStuffWorks
www.hse.gov.uk	Health and Safety Executive
www.iagre.org	Institution of Agricultural Engineers
www.lantra.co.uk	Lantra Sector Skills Council
www.profi.com	Profi

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	exploring different refrigerant types and system capabilities
Reflective learners	considering new ways to reduce refrigerant emissions
Team workers	using tools and equipment safely to carry out refrigerant handling activities recovery
Self-managers	organising own time and resources when handing refrigerants
Effective participators	discussing issues of concern, seeking resolution where needed.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Creative thinkers	developing risk assessments for new refrigerant and/or air conditioning scenarios.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	using computer-based manufacturer's data and handbooks
Follow and understand the need for safety and security practices	
Troubleshoot	
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	recording system test results
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	giving presentation to peers on the handling of refrigerant and air conditioning systems and components
Evaluate the selection and use of ICT tools and facilities used to present information	
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	explaining the use and function of refrigerant systems and their components
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	using manufacturer's data sheets, manuals and specifications
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	writing an evaluation of the use of air conditioning systems.