



## **National Unit specification:**

### **General information**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

**Unit code:** HF2D 45

**Superclass:** TH

**Publication date:** June 2016

**Source:** Scottish Qualifications Authority

**Version:** 01

### **Unit purpose**

This Unit is suitable for learners with little or no previous engineering, technical or employment experience. The learner will learn to identify specific safety requirements and safe working practices which apply to the installation of refrigeration and air conditioning systems. The learner will also learn to identify layouts and functions of components in refrigeration systems. Learners will also learn to identify the layouts and functions of air conditioning systems.

### **Outcomes**

On successful completion of the Unit the learner will be able to:

- 1 Identify specific safety requirements and safe working practices which apply to the installation of refrigeration and air conditioning systems.
- 2 Identify the layouts and functions of components in refrigeration systems.
- 3 Identify the layouts and functions of air conditioning systems.

### **Credit points and level**

1 National Unit credit at SCQF level 5: (6 SCQF credit points at SCQF level 5)

### **Recommended entry to the Unit**

Entry is at the discretion of the centre.

## **National Unit specification: General information (cont)**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

### **Equality and inclusion**

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## **National Unit specification: Statement of standards**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

### **Outcome 1**

Identify specific safety requirements and safe working practices which apply to the installation of refrigeration and air conditioning systems.

#### **Performance Criteria**

- (a) Identify specific safety requirements which apply to the installation of refrigeration and air conditioning systems.
- (b) Identify specific safe working practices which apply to the installation of refrigeration and air conditioning systems.

### **Outcome 2**

Identify the layouts and functions of components in refrigeration systems.

#### **Performance Criteria**

- (a) Identify the layouts of refrigeration systems.
- (b) Identify the functions of components in refrigeration systems.

### **Outcome 3**

Identify the layouts and functions of air conditioning systems.

#### **Performance Criteria**

- (a) Identify the layouts of air conditioning systems.
- (b) Identify the functions of air conditioning systems.

## National Unit specification: Statement of standards (cont)

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

### Evidence Requirements for this Unit

Evidence is required to demonstrate that learners have achieved all Outcomes and Performance Criteria.

The evidence may be produced by one or more than one assessment covering Outcomes 1–3.

Written and/or oral evidence should be produced for Outcomes 1–3 to demonstrate that the learner has achieved all the Outcomes and Performance Criteria. The evidence should be produced in open-book supervised and controlled conditions.

In terms of the specific Outcomes of this Unit:

#### Outcome 1: Written and/or oral evidence

Learners must be able to identify safety requirements and safe working practices which apply to the installation of refrigeration and air conditioning systems including the following:

- ◆ COSHH requirements of different refrigerants and other flammable liquids
- ◆ Working with refrigerants and the risks associated with individuals and the environment
- ◆ The hazards associated with pressurised refrigeration systems
- ◆ Regulations, codes of practice and health & safety information appropriate for fitting, service and maintenance and decommissioning of pressurised refrigeration systems
- ◆ The potential Global Warming effects of hydrofluorocarbon (HFC) and hydrocarbon (HC) refrigerants
- ◆ The procedures for handling, storage, transportation and disposal of contaminated refrigerants
- ◆ Recovery of refrigerant from the system into a recovery cylinder
- ◆ The hazards and safe working practices associated with brazing, nitrogen pressure testing and release of refrigerants

#### Outcome 2: Written and/or oral evidence

Learners must be able to identify the layouts and functions of components in refrigeration systems including the following:

- ◆ Heat transfer, pressure and temperature in refrigeration systems
- ◆ The refrigeration cycle and the layout of components and their positions
- ◆ Pressure-temperature relationship of refrigerants and using pressure-temperature gauges
- ◆ The functions of the components listed below:
  - Compressors
  - Condensers
  - Expansion Device
  - Evaporators
  - Vacuum pumps
  - Pressure controls and temperature controls

## **National Unit specification: Statement of standards (cont)**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

### **Outcome 3: Written and/or oral evidence**

Learners must be able to identify the layouts and functions of air conditioning systems including the following:

- ◆ The function of components in air conditioning systems
- ◆ Installation layouts of air conditioning systems
- ◆ Primary and secondary refrigerants
- ◆ Heating and cooling in air conditioning
- ◆ Humidification and dehumidification
- ◆ Recirculation
- ◆ The function of basic central air conditioning plant as below:
  - Fans
  - Filters
  - Cooling plant
  - Heater batteries
  - Humidifiers
  - Motorised dampers



## **National Unit Support Notes (cont)**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### **Guidance on the content and context for this Unit**

The content and context of this Unit is at a basic, introductory but industrially meaningful level. The main purpose of the Unit is to make Learners aware of, and prepare for employment within the refrigeration and air conditioning industry. There is a strong emphasis on key working principles of basic refrigeration and air conditioning systems throughout the Unit which would give Learners an insight into the refrigeration and air conditioning industry requirements for basic knowledge and understanding required for realistic work activity.

Outcome 1 covers the types of COSHH requirements of different refrigerants and other flammable liquids, working with refrigerants and the risks associated with individuals and the environment, the hazards associated with pressurised refrigeration systems and the regulations, codes of practice and health & safety information appropriate for fitting, service and maintenance and decommissioning of pressurised refrigeration systems. The learner will develop an understanding of the properties of refrigerants, the impact of refrigerants has on individuals and the environment including Global Warming potential. The learner will also develop an understanding of the handling of contaminated refrigerants through storage, transportation and disposal and how to recover refrigerant from the system. The learner will develop an understanding of the hazards and safe working practices associated with brazing, nitrogen pressure testing and the release of refrigerants.

Outcome 2 covers the layouts and working principles of refrigeration systems, where the Unit is focused on heat transfer, pressure and temperature in refrigeration systems, the function and operating principles of components in refrigeration systems and the installation layouts of refrigeration systems. Learners will develop an understanding of heat transfer processes, sensible and latent heat and how this affects the refrigeration cycle. Learners will also develop an understanding of the pressure-temperature relationship of refrigerants and how to measure pressure-temperature. Learner will develop an understanding of the operating principles of components and pressure-temperature controls in refrigeration systems and how refrigeration components are positioned within pipework layouts.

## National Unit Support Notes (cont)

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

Outcome 3 covers the layouts and working principles of air conditioning systems, where the Unit focuses on the general principles of air conditioning in Summer and Winter, the function and operating principles of components in air conditioning systems and the installation layouts of air conditioning systems. Learners will develop an understanding of primary and secondary refrigerants, heating and cooling in air conditioning, humidification and dehumidification. Learners will also develop an understanding of the working principles and layouts of air conditioning central plant, supply and extract ductwork and the purpose of recirculation in air conditioning systems.

### Guidance on approaches to delivery of this Unit

Learners should be given opportunities to work towards Outcomes in an integrated way whenever possible.

Theoretical classroom activities should be teacher/lecturer-led in that all equipment, techniques and processes should be explained, demonstrated and thoroughly understood before (learner) commencement. Demonstrations should be clear, logically sequenced and reflect current safe working practices to ensure learner understanding.

An integrated approach to learning and teaching across the Outcomes in this Unit, and relevant others, is suggested.

### Guidance on approaches to assessment of this Unit

Centres may use the method of assessment which they consider to be most appropriate but are encouraged to use the Assessment Support Pack (ASP) developed centrally by SQA. It is expected that learners will have to demonstrate current knowledge and understanding of safe working practice and risk assessment methods, etc prior to being set the assessment tasks.

Knowledge and Understanding of the processes involved in *Building Services Engineering: Basic Refrigeration and Air Conditioning Principles* (SCQF level 5) should be assessed before any practical assignments are carried out by learners.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

## **National Unit Support Notes (cont)**

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

### **Opportunities for developing Core and other essential skills**

There may be opportunities to develop the following Core Skills if this Unit is delivered as part of a Group Award and is holistically assessed with practical Units.

- ◆ *Communications*
- ◆ *Working with Others*
- ◆ *Problem Solving*
- ◆ *Numeracy*
- ◆ *Information and Communication Technology (ICT)*



## History of changes to Unit

Version	Description of change	Date

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## General information for learners

**Unit title:** Building Services Engineering: Basic Refrigeration and Air Conditioning Principles (SCQF level 5)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is designed to introduce you to skills required within the Building Services Engineering industry. The Unit will focus on basic refrigeration and air conditioning principles. Little or no experience is required of working in the industry.

Refrigeration and air conditioning principles are integral and key to the industry therefore throughout the Unit emphasis will be placed where appropriate on the application of refrigeration and air conditioning principles.

There will be a series of training exercises followed by multi choice knowledge assessment.

Completion of the Unit will provide you with basic knowledge necessary to progress to more complex aspects of Building Services Engineering which in turn will further develop your skills and knowledge.

There may be opportunities to develop the following Core Skills if this Unit is delivered as part of a Group Award and is holistically assessed with practical Units.

- ◆ *Communications*
- ◆ *Working with Others*
- ◆ *Problem Solving*
- ◆ *Numeracy*
- ◆ *Information and Communication Technology (ICT)*