



## **National Unit specification: general information**

**Unit title:** Building Services Engineering: Introduction to Science (SCQF level 4)

**Unit code:** FT87 10

**Superclass:** TH

**Publication date:** August 2011

**Source:** Scottish Qualifications Authority

**Version:** 01

## **Summary**

This is a mandatory Unit of the Skills for Work Building Services Engineering award and is suitable for candidates with no previous engineering, technical or employment experience. The Unit is designed to enable the candidate to recognise the mechanical and electrical SI units commonly used within the building services engineering (BSE) sector and to carry out simple calculations to enhance that understanding. Candidates will also learn to recognise fundamental properties of solid materials as well as the fundamental principles of heat, mechanical and electrical applications to the BSE sector.

## **Outcomes**

- 1 Recognise the standard SI units and use them in basic calculations.
- 2 Identify solid materials and describe their fundamental properties.
- 3 Explain the fundamental principles of heat and mechanics.
- 4 Describe and apply the fundamental electrical principles and properties.

## **Recommended entry**

Entry is at the discretion of the centre.

## **Credit points and level**

1 National Unit credit at SCQF level 4 (6 SCQF credit points at SCQF level 4)

## **General information (cont)**

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(SCQF level 4)

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the support notes of this Unit specification.

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

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

**Unit title:** Building Services Engineering: Introduction to Science  
(SCQF level 4)

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**

Recognise the standard SI units and use them in basic calculations.

#### **Performance Criteria**

- (a) State the standard SI units commonly used in the BSE sector.
- (b) Carry out simple calculations using standard SI units.

### **Outcome 2**

Identify solid materials and describe their fundamental properties.

#### **Performance Criteria**

- (a) Identify the different types of solid materials used in the BSE sector.
- (b) Describe the fundamental properties of solid materials used in the BSE sector.

### **Outcome 3**

Explain the fundamental principles of heat and mechanics.

#### **Performance Criteria**

- (a) Describe the relationship between Celsius and Kelvin temperature scales.
- (b) State clearly the terminology associated with a change of state.
- (c) Describe the main processes by which heat transfer occurs.
- (d) Describe the relationship between velocity, pressure and flow rate in systems.
- (e) Describe the principles of basic mechanics.

### **Outcome 4**

Describe and apply the fundamental electrical principles and properties.

#### **Performance Criteria**

- (a) Describe the main principles of electricity.
- (b) Carry out simple electrical calculations using the relevant SI units.

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

**Unit title:** Building Services Engineering: Introduction to Science (SCQF level 4)

### Evidence Requirements for this Unit

Evidence is required to demonstrate that the candidate has achieved all Outcomes and Performance Criteria.

Written and/or oral evidence should be produced to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria. The evidence should be produced in the form of open-book supervised and controlled conditions.

The evidence may be produced by one or more than one assessment covering all Outcomes.

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

Candidates must be able to state the following SI units and carry out a simple calculation for each:

- ◆ area (m<sup>2</sup>)
- ◆ volume (m<sup>3</sup>)
- ◆ litres (L)
- ◆ density (kg/m<sup>3</sup>)
- ◆ velocity (m/s)

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

Candidates must be able to identify types all of the following:

- ◆ metals
- ◆ plastics
- ◆ fireclays/ceramics

Candidates must be able to describe the fundamental properties of solid materials for three of the following:

- ◆ strength — tensile and compressive
- ◆ hardness
- ◆ ductility
- ◆ malleability
- ◆ conductivity — heat and electricity

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

**Unit title:** Building Services Engineering: Introduction to Science  
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### **Outcome 3: Written and/or oral evidence**

Candidates must explain all of the following:

- ◆ the relationship between Celsius and Kelvin temperature scales
- ◆ the terminology associated with a change of state (solid, liquid and gas)
- ◆ the processes by which heat transfer occurs, including conduction in solids, convection in liquids and gases, and radiation between two bodies
- ◆ velocity, pressure and flow rate and how this changes by altering pipe sizes
- ◆ the principles of basic mechanics, including two of the following: theory of moments, action and reaction, centre of gravity, and equilibrium

### **Outcome 4: Written and/or oral evidence**

Candidates must describe all of the following:

- ◆ the principles of electricity including measurement of electrical flow, material conductivity and resistance, and direct and indirect current

Candidates must also accurately apply Ohm's law calculations (for series circuits) using relevant SI units.

## National Unit specification: support notes

**Unit title:** Building Services Engineering: Introduction to Science (SCQF level 4)

This part of the Unit specification is offered as guidance. The support notes 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 level. The main purpose of the Unit is to make candidates aware of, and prepare for employment within, the BSE sector in any of the main occupational areas of plumbing, electrical, heating and ventilating, refrigeration and air conditioning.

Outcome 1 covers the basic units likely to be encountered in the BSE sector. The candidate will be able to recognise these units and will develop an understanding of how they relate to each other through carrying out straightforward calculations.

Outcome 2 covers the three main types of solid materials used in the BSE sector. Candidates will be able to recognise these materials and to develop an understanding of how these materials can be used in buildings through understanding the basic mechanical and electrical properties.

Outcome 3 covers both heat and mechanics. The candidate will develop an understanding of temperature, temperature scales and how these can relate.

Outcome 4 covers fundamental electrical principles and properties. The candidate will develop an understanding of what electricity is by understanding the basic electrical flow model and then going on to recognise that there is more than 'one type of electricity'. This understanding will be enhanced by carrying out some simple Ohm's law calculations for series circuits.

### Guidance on learning and teaching approaches for this Unit

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

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

### Opportunities for developing Core Skills

Throughout this Unit there may be opportunities for candidates to develop the Core Skills of *Communication*, *Problem Solving* and *Numeracy* at SCQF level 4. If candidates are set tasks this will allow them to develop the Core Skills of *Problem Solving* and *Communication*. Whilst completing the necessary calculations the Core Skill of *Numeracy* will be developed.

## **National Unit specification: support notes (cont)**

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### **Guidance on approaches to assessment for this Unit**

An integrated approach to assessment across the outcomes in this Unit is suggested. If this is being delivered as part of the Skills for Work award the use of holistic assessment with other applicable Units is suggested. In addition, the project-based approach may be used to gather evidence of candidate achievement. Centres may also wish to develop the employability skills of the candidates through role-play techniques where appropriate.

It is recommended that candidates are tested on their knowledge and understanding by explaining how the fundamental properties of materials, heat, mechanics and electrical properties affect each other. The candidate should also be able to carry out basic calculations and as they apply to the BSE industry in order to show how these effects can be measured. This could be done by using a questioning method such as restricted response/short answer questions, or by providing a specification or specifications for small tasks and asking the candidate to provide appropriate responses. This will ensure that candidates have the knowledge and understanding of the basic calculations as they apply to the BSE industry.

### **Opportunities for the use of 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 e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

### **Disabled candidates and/or those with additional support needs**

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements)

## History of changes to Unit

Version	Description of change	Date

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