



# **Skills for Work: Building Services Engineering SCQF level 4**

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## **Course Specification**

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**Valid from August 2015**

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Please refer to the note of changes at the end of this Course Specification for details of changes from previous version (where applicable).

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### History of changes to Course Specification

Version	Description of change	Date
02	2015 - Course re-coded as part of CfE development programme but no change to Course and Unit content.	August 2015

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# Course outline

**Course title:** Skills for Work: Building Services Engineering

**SCQF:** level 4 (24 SCQF credit points)

**Course code:** C278 74

## Mandatory Units

### Course Structure

SQA Ref	Unit	Status	SCQF level	Credits	SCQF points
FT85 10	Building Services Engineering: Introduction to Safe Working Practices	M	4	1	6
FT86 10	Building Services Engineering: Introduction to Energy	M	4	1	6
FT87 10	Building Services Engineering: Introduction to Science	M	4	1	6
FT88 10	Building Services Engineering: An Introduction	M	4	0.5	3
FT89 10	Building Services Engineering: Employability Skills	M	4	0.5	3

### Recommended entry

While entry is at the discretion of the centre, candidates would normally be expected to have attained Core Skills at SCQF level 3 or equivalent.

### Progression

The Building Services Engineering Course at SCQF level 4 has been designed as the starting point of a Building Services Engineering (BSE) career pathway. The Course can lead directly on to the National Progression Award: Building Services Engineering at (SCQF level 5) or allow successful candidates to apply for employment within the sector as appropriate. The award will also allow successful candidates to apply to the NC Building Services Engineering at (SCQF level 6) award delivered in the college environment.

Note that achievement of the Course will also allow candidates the opportunity to move to allied occupational areas, such as Construction, should they so wish.

## Credit value

The Building Services Engineering Course is allocated 24 SCQF credit points at SCQF level 4\*.

\*SCQF points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

## Core Skills

Achievement of the *Building Services Engineering: Employability Skills* Unit FT89 10 gives automatic certification of the following Core Skills component:

Critical Thinking at SCQF level 3  
Working with Others at SCQF level 3

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of the Unit specification for this Course.

## Links to National Occupational Standards

National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector. The relationship between the NOS and the Units is shown below:

SfW Unit	NOS (base Unit)	SummitSkills Reference
Building Services Engineering: An Introduction	Introduction to Building Services Engineering	ACC 04
Building Services Engineering: Introduction to Safe Working Practices	Understand and demonstrate fundamental safe working practices in building services engineering	ACC 01
Building Services Engineering: Introduction to Energy	Understand fundamental environmental protection measures within Building Services Engineering	ACC 02
Building Services Engineering: Introduction to Science	Understand fundamental scientific principles within building services engineering	ACC 03
Building Services Engineering: Employability Skills	No specific provision	N/A

## Equality and inclusion

This *Course 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. For further information please refer to the *Course Support Notes*.

# Rationale

The Building Services Engineering (BSE) sector is acutely aware of the demographic issues facing Scotland whereby the working population is ageing and there are (relatively) too few young people to replace them.

It was recognised that many young people miss the opportunity to enter the BSE sector because they simply don't know about it at the crucial decision-making points of their lives. Many young people will have an awareness of the Construction sector and many will consider it as a viable career option. However, evidence suggests that young people are not aware of the BSE sector or the many opportunities it affords for development and progression through the professional levels.

In order to address this situation the Skills for Work (SfW) qualification has been developed to make the 14–16 age group aware of the BSE sector and to allow them the opportunity to develop some basic knowledge and skills relevant to the industries and is based on National Occupational Standards (NOS). Environmental aspects are covered at the appropriate level and are likely to be attractive to the target population.

This Course is not designed to train people to full industrial competence and is aimed at those who do not necessarily have any prior experience or knowledge of the BSE sector and are therefore classed as 'new entrants'. Candidates can then build on the skills, knowledge and employability skills gained and, along with other awards, have a progression route through to an SVQ (which does confer full industrial competence), should they wish to do so.

More generally, the BSE sector will make a crucial contribution to the achievement of the Scottish Government 2020 Energy targets and clearly this can only happen through appropriately qualified people. Areas such as microgeneration and renewables are within the BSE footprint. It is anticipated that these areas in particular will raise the BSE sector profile over the next 10–15 years and that those working in the sector must be appropriately qualified and skilled.

The SfW Course is a vocationally-related qualification at a basic, introductory level. The main aim of the Course is to make candidates aware of, and prepare for employment within, the BSE sector in any of the main occupational areas of Plumbing; Electrotechnical; Heating and Ventilating; Refrigeration and Air Conditioning.

Skills for Work Courses are designed to help candidates to develop:

- ◆ skills and knowledge in a broad vocational area
- ◆ Core Skills
- ◆ an understanding of the workplace
- ◆ positive attitudes to learning
- ◆ skills and attitudes for employability

A key feature of Skills for Work Courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

## **COURSE** Building Services Engineering (SCQF level 4)

The Skills for Work Courses are also designed to provide candidates with opportunities for developing *Core Skills* and enhancing skills and attitudes for *employability*.

### **Core Skills**

The **five** Core Skills are:

- ◆ *Communication*
- ◆ *Numeracy*
- ◆ *Information and Communication Technology*
- ◆ *Problem Solving*
- ◆ *Working with Others*

### **Employability**

The skills and attitudes for employability, including self-employment, are outlined below:

- ◆ generic skills/attitudes valued by employers
  - understanding of the workplace and the employee's responsibilities, for example time-keeping, appearance, customer care
  - self-evaluation skills
  - positive attitude to learning
  - flexible approaches to solving problems
  - adaptability and positive attitude to change
  - confidence to set goals, reflect and learn from experience
- ◆ specific vocational skills/knowledge
  - Course specifications highlight the links to National Occupational Standards in the vocational area and identify progression opportunities

Opportunities for developing these skills and attitudes are highlighted in each of the Course and Unit specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.

### **Learning through practical experience**

- ◆ Learning/Teaching programmes should include some or all of the following:
  - learning in real or simulated workplace settings
  - learning through role play activities in vocational contexts
  - carrying out case study work
  - planning and carrying out practical tasks and assignments

## **Learning through reflecting at all stages of the experience**

- ◆ Learning/Teaching programmes should include some or all of the following:
  - preparing and planning for the experience
  - taking stock throughout the experience - reviewing and adapting as necessary
  - reflecting after the activity has been completed - evaluating and identifying learning points

## **Relationship between the Course and Curriculum for Excellence values, purposes and principles**

*A Curriculum for Excellence* (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- ◆ successful learners
- ◆ confident individuals
- ◆ responsible citizens
- ◆ effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability and Core Skills in these Courses contribute to meeting these aspirations.

## **Purpose and aims of the Course**

The primary target group for this Course is school candidates in S3 and S4. It is anticipated that, for this group of candidates, the Course will rely on and build on existing partnerships between schools and colleges (or other agencies). This may be particularly pertinent in the case of the Building Services Engineering Course due to the specialist expertise and facilities available in, for example, further education colleges and training providers. Nevertheless, the Course is designed at a level and scope such that it can be delivered in schools, if the school has suitable facilities and teaching expertise. The Course is also suitable for adult candidates who are seeking to enhance their employability and develop introductory vocational skills in the Construction sector.

The general aims of the Course are to:

- ◆ widen participation in vocationally-related learning
- ◆ allow candidates to experience vocationally-related learning
- ◆ provide candidates with a broad introduction to the Building Services Engineering sector
- ◆ encourage candidates to foster a good work ethic, including timekeeping, a positive attitude and other relevant employability skills
- ◆ provide opportunities to develop a range of Core Skills in a realistic context
- ◆ encourage candidates to take charge of their own learning and development
- ◆ provide a range of teaching, learning and assessment styles to motivate candidates to achieve their full potential
- ◆ facilitate progression to further education and/or training



In particular, the aims of this Course are to:

- ◆ give candidates the technical knowledge, skills and understanding associated with a range of Building Services Engineering career opportunities at this level
- ◆ develop an awareness that health and safety issues are central to the workplace
- ◆ encourage candidates to interact with their peers and tutors to complete practical tasks
- ◆ encourage candidates to develop a positive attitude to waste minimisation and environmental issues
- ◆ enable candidates to develop and apply practical, technical and communication skills as a foundation for future learning and progression
- ◆ encourage candidates to apply their knowledge and understanding of construction by using skills of evaluation and problem-solving in a vocational context
- ◆ encourage candidates to plan their work and review their progress
- ◆ prepare candidates for further learning opportunities, study and training for employment

### **Summary of Course content**

Basic knowledge and skills relevant to the Building Services Engineering (BSE) industries based on National Occupational Standards (NOS) and environmental aspects are covered at the appropriate level and are likely to be attractive to the target population.

The Course is a vocationally-related qualification at a basic, introductory level which is intended to make candidates aware of, and prepare for, employment within the BSE sector in any of the main occupational areas of; Plumbing, Electrotechnical, Heating and Ventilating, Refrigeration and Air Conditioning.

### **Summary of Course content**

Basic knowledge and skills relevant to the Building Services Engineering (BSE) industries based on National Occupational Standards (NOS) and environmental aspects are covered at the appropriate level and are likely to be attractive to the target population.

The Course is a vocationally-related qualification at a basic, introductory level which is intended to make candidates aware of, and prepare for, employment within the BSE sector in any of the main occupational areas of; Plumbing, Electrotechnical, Heating and Ventilating, Refrigeration and Air Conditioning.

## Summary of Unit content

**Unit title: Building Services Engineering: An Introduction**

### ***Summary***

This Unit is suitable for candidates with no previous engineering, technical or employment experience. Candidates will recognise the main industries (Plumbing, Electrical, Heating and Ventilating, Refrigeration and Air Conditioning) and will develop an understanding of the job opportunities and the career progression opportunities. Candidates will learn the basic systems associated with each of the main industries whilst recognising the importance and nature of legislation and codes of practice. Candidates then focus on the employability aspect by reviewing their own position in the context of future job opportunities within the BSE sector.

**Unit title: Building Services Engineering: Introduction to Safe Working Practices**

### ***Summary***

This Unit is suitable for candidates with no previous engineering, technical or employment experience. The candidate will learn to identify the fundamental Health and Safety requirements of the BSE sector and how to recognise and respond appropriately to common hazards and accidents in the BSE environment. Candidates will also learn how to apply safe working practices relevant to the BSE sector

**Unit title: Building Services Engineering: Introduction to Energy**

### ***Summary***

This Unit is suitable for candidates with no previous engineering, technical or employment experience. The candidate will learn to identify the main types of energy and their sources as well as the fundamentals of energy conservation as they apply to the BSE sector. Candidates will also learn the main types of material disposal used within the BSE sector.

**Unit title: Building Services Engineering: Introduction to Science**

### ***Summary***

This Unit 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 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 used within the BSE sector.

**Unit title: Building Services Engineering: Employability Skills**

**Summary**

This Unit is suitable for candidates with no previous engineering, technical or employment experience. Candidates will develop work practices and attitudes that enhance their employability in the context of the BSE sector. Candidates will also have an opportunity to review the skills they have developed.

**Industry links**

Centres are encouraged to establish links with local industry. Local companies, trades associations and chambers of commerce may be happy to offer support, for example, in the form of visits from representatives of their organisations. Visitors from industry will be able to give candidates a realistic view of jobs and conditions in the Building Services Sector.

It may be possible for centres to arrange visits to sites as part of the candidates' learning experience.

Visits to employer sites are often particularly useful because work in progress will be at different stages and candidates can see all of the different engineers working at the same time. Visits should be carefully arranged, organised and authorised. It would be preferable for those responsible for such visits to have prior knowledge of the site which would be visited.

**Health and Safety**

Risk assessment and compliance with health and safety legislation is of paramount importance in this Course. Due to the health and safety implications involved, legislation effectively precludes work placement for 14–16 year olds on building sites. The Building Services Engineering Units have been designed so that they can be taught and assessed in a classroom environment and this means that the Course does not require work placement.

It is the centre's responsibility to produce risk assessments. Centres should ensure that they comply with all current legislation.

The Course requires access to safe and suitably equipped classrooms, workshops or work areas to deliver and assess the Units. These areas should be of an appropriate size and have sufficient tools, equipment and resources to deliver and assess the Units for the number of learners in the class group.

This may take the form of a combined workshop/project area divided into suitable work areas for each learner. Storage areas for materials and personal protective equipment (PPE) should be provided.

It is recognised that some centres will not have facilities available to deliver all of the content in these qualifications; in these cases, appropriate partnership arrangements would provide the learning environments and/or expertise necessary to deliver the Course. In such situations, all partners involved should discuss health and safety and safe systems of work as a priority. They should also set up arrangements for ongoing communication between partners on health and safety.

## **Assessment**

To achieve the Course the candidate must successfully achieve all the Units which make up the Course.

### **Assessment objectives**

Assessment across the Units of the Course will ensure that the candidate achieves all Outcomes and Performance Criteria and to ensure that the candidate has an understanding of the BSE industries, safe working practices and opportunities for progression.

An integrated approach to assessment across the Course and Units is suggested. In addition, the project-based approach may be used to gather evidence of candidate achievement; this would allow integration across a number of Units. Centres may also wish to develop the employability skills of the candidates through role-play techniques where appropriate.

A suitable instrument of assessment covering all Performance Criteria could be practical exercises, undertaken in supervised and controlled conditions, where candidate achievement is recorded by means of an observation checklist completed by the teacher/lecturer.

Performance evidence, supported by candidate review sheets and assessor observation checklists are required to show that all Outcomes and Performance Criteria have been achieved.

Candidates will demonstrate the appropriate working practices and attitudes in practical contexts. They will then review and evaluate their own performance on candidate review sheets and plan for improvement. Candidates will also demonstrate basic skills in interpreting drawings and undertake practical measurement tasks.

### **Unit assessment**

An integrated approach to assessment across the Outcomes in all 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.

Further details about Unit assessment for this Course can be found in the Unit specifications.

## **Quality Assurance**

The Units of all National Courses are subject to internal verification and may also be chosen for external verification by SQA. This is to ensure that national standards are being applied across all subjects.

To assist centres, Senior Verifier reports are published on SQA's website [www.sqa.org.uk](http://www.sqa.org.uk)

## **Information about typical learners who might do the Course**

The Building Services Engineering Course at SCQF level 4 is designed as a starting point to equip students with the knowledge, understanding and skills required for success in employment or further study/training within the Scottish BSE sector. It is mainly aimed at school age candidates (14-16) who are interested in pursuing a career in one of the BSE sector industries.

This Course is not designed to train people to full industrial competence. There is an emphasis on developing the pre-vocational and employability skills normally taught to an apprentice at the very early stages of time-serving, and these basic skills will be very attractive to employers. Candidates can then build on these skills when working towards achieving an SVQ award relevant to their interest and capabilities.

The Course is designed to allow the candidate to develop an understanding of the BSE sector, the industries within it and the types of career opportunities presented by each of these industries. It is also designed to underline the importance of safety in the workplace as it applies to the candidate and to others. The Course also allows the candidate to understand the technical (or applied science) nature of the work that takes place within the BSE sector and introduces the concept of energy sources in terms of their carbon 'footprint'.

The programme should be delivered in the context of familiarisation with terminology, basic concepts and working practices and disciplines, including Health and Safety and Sustainability. It is intended that the Course will develop a broad appreciation of topics based on accepted BSE sector practices.

Candidates may go on to apply for an Apprenticeship as an Air Conditioning Engineer; Domestic Plumber; Ductwork Installer; Gas Fitter; Heating Installer; Industrial And Commercial Plumber; Installation Electrician; Maintenance Electrician; Refrigeration Engineer; Service And Maintenance Engineer. Candidates may also go on to higher levels of education, eg National Progression Award (NPA) or National Certificate awards.

# Course structure and conditions of award

## Course structure

The approach to assessment for the Building Services Engineering Course at SCQF level 4 is designed to ensure an appropriate level of rigour whilst not imposing excessive demands on centres or candidates. The design principles for the Course encourage a holistic approach to assessment, and this has been adopted in each Unit specification for the Course.

An integrated approach to assessment across the Outcomes in this Unit, and other relevant 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.

Each Unit specification includes guidance on delivery and assessment and, where appropriate, any potential opportunities for integrated delivery and assessment with other Units.

Centres can decide the order in which Units are delivered, based on candidate recruitment patterns, mode of delivery, resource issues and logical progression dictated by topics and Unit content and level.

Throughout all Units, emphasis should be placed where appropriate on the application of health and safety. Safe working practices should be considered in accordance with current safety codes of practice and regulations.

The assessments for the Building Services Engineering Course at SCQF level 4 will be challenging and meaningful, but nonetheless still achievable for all candidates who are prepared to work to achieve the Course. They are designed to familiarise candidates with a culture of attainment where assessments will challenge them, but they don't put unreasonable obstacles between the candidate and real achievement.

For all Skills for Work Units, assessment is based primarily on testing of knowledge, supported where appropriate, by practical activities, supervised where appropriate. Integrated assessment is encouraged.

## Learning and Teaching

The Building Services Engineering Course at SCQF level 4 is designed as a starting point to equip students with the knowledge, understanding and skills required for success in employment or further study/training within the Scottish BSE sector. It is mainly aimed at school age candidates (14-16) who are interested in pursuing a career in one of the BSE sector industries.

This Course is not designed to train people to full industrial competence. There is an emphasis on developing the pre-vocational and employability skills normally taught to an apprentice at the very early stages of time-serving, and these basic skills will be very attractive to employers. Candidates can then build on these skills when working towards achieving an SVQ award relevant to their interest and capabilities.

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The programme should be delivered in the context of familiarisation with terminology, basic concepts and working practices and disciplines, including Health and Safety and Sustainability. It is intended that the Course will develop a broad appreciation of topics based on accepted BSE sector practices.

Candidates may go on to apply for an Apprenticeship as an Air Conditioning Engineer; Domestic Plumber; Ductwork Installer; Gas Fitter; Heating Installer; Industrial And Commercial Plumber; Installation Electrician; Maintenance Electrician; Refrigeration Engineer; Service And Maintenance Engineer. Candidates may also go on to higher levels of education, eg National Progression Award (NPA) or National Certificate awards.

There are opportunities for integrated delivery of Units within the Course. Learning and Teaching for the *Building Services Engineering: Introduction to Safe Working Practices* could be integrated across the other Units. Similarly *Building Services Engineering: Introduction to Energy* could be integrated with *Building Services Engineering: An Introduction*. The Unit specifications will identify specific opportunities for integration with other Units.

It is recognised that the Building Services Engineering Course at SCQF level 4 focuses on the development of candidate awareness of the BSE sector supported by some practical skills.

There may be opportunities for the introduction of e-learning during the teaching and delivery of the Course. The learning and assessments of the knowledge-based Outcomes can be conducted either by using e-learning methods (this could also be used for teaching) or by traditional teaching techniques. For example, formal assessments may make use of IT systems and facilities when available, or alternatively can use the standard mode of supervising candidates during classroom paper-based assignments.

It is recognised that health and safety considerations and the age profile of candidates may present a challenge to centres. However, in order that the quality and integrity of assessments are maintained, centres are reminded that all practical assessments should take place in a realistic working or training environment with appropriate use of simulation where health and safety considerations are key. In addition, appropriate levels of supervision should be applied at all times.

## Assessment

The approach to assessment for the Building Services Engineering Course at SCQF level 4 is designed to ensure an appropriate level of rigour whilst not imposing excessive demands on centres or candidates. The design principles for the Course encourage a holistic approach to assessment, and this has been adopted in each Unit specification for the Course.

An integrated approach to assessment across the Outcomes in this Unit, and other relevant 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.

Each Unit specification includes guidance on delivery and assessment and, where appropriate, any potential opportunities for integrated delivery and assessment with other Units.

Centres can decide the order in which Units are delivered, based on candidate recruitment patterns, mode of delivery, resource issues and logical progression dictated by topics and Unit content and level.

Throughout all Units, emphasis should be placed where appropriate on the application of health and safety. Safe working practices should be considered in accordance with current safety codes of practice and regulations.

The assessments for the Building Services Engineering Course at SCQF level 4 will be challenging and meaningful, but nonetheless still achievable for all candidates who are prepared to work to achieve the Course. They are designed to familiarise candidates with a culture of attainment where assessments will challenge them, but they don't put unreasonable obstacles between the candidate and real achievement.

For all Skills for Work Units, assessment is based primarily on testing of knowledge, supported where appropriate, by practical activities, supervised where appropriate. Integrated assessment is encouraged.



## National Unit specification: general information

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

**Unit code:** FT88 10

### Summary

This is a mandatory Unit of the Building Services Engineering Course (SCQF level 4) and is suitable for candidates with no previous engineering, technical or employment experience. Candidates will recognise the main industries (plumbing, electrical, heating and ventilating, refrigeration and air conditioning) and will develop an understanding of the job opportunities and the career progression opportunities. Candidates will learn the basic systems associated with each of the main industries whilst recognising the importance and nature of legislation and codes of practice. Candidates then focus on the employability aspect by reviewing their own position in the context of future job opportunities within the Building Services Engineering (BSE) sector.

### Outcomes

- 1 Explain key aspects of the BSE sector.
- 2 Identify the main job opportunities and career pathways within the BSE sector.
- 3 Explain the nature and purpose of basic BSE industry systems and the importance of key legislation and codes of practice.

### Recommended entry

Entry is at the discretion of the centre.

### Credit points and level

0.5 National Unit credit at SCQF level 4 (3 SCQF credit points at SCQF level 4\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### 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: An Introduction  
(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**

Explain key aspects of the BSE sector.

#### **Performance Criteria**

- (a) Identify the main industries within the BSE sector.
- (b) Describe the main impact that the BSE sector has on people and buildings.
- (c) Describe how the BSE sector interacts with the construction sector.

### **Outcome 2**

Identify the main job opportunities and career pathways within the BSE sector.

#### **Performance Criteria**

- (a) Identify the main jobs within the BSE sector.
- (b) Identify the main career progression pathways within the BSE sector.

### **Outcome 3**

Explain the nature and purpose of basic BSE industry systems and the importance of key legislation and codes of practice.

#### **Performance Criteria**

- (a) Explain the nature and purpose of basic BSE industry systems.
- (b) Explain the importance of key legislation and codes of practices within the BSE sector.

### **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.

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

### Unit title: Building Services Engineering: An Introduction (SCQF level 4)

The evidence may be produced by one or more than one assessment covering all Outcomes. A suitable instrument of assessment covering all Outcomes could be by short answer, restricted response and structured questions lasting no more than 45 minutes in duration.

#### Outcome 1:

Candidates must be able to carry out the following:

- (a) Identify all of the following main industries within the BSE sector: electrical, heating and ventilating; plumbing; refrigeration and air conditioning.
- (b) Describe the main impact that the BSE sector has on buildings and on people in terms of services provision to the building.
- (c) Describe how the BSE sector interacts with the construction sector.

#### Outcome 2:

Candidates must identify all of the following:

- (a) The main jobs within the BSE sector including:
  - air conditioning engineer
  - domestic plumber
  - ductwork installer
  - gas fitter
  - heating installer
  - industrial and commercial plumber
  - installation electrician
  - maintenance electrician
  - refrigeration engineer
  - service and maintenance engineer
- (b) Career progression opportunities for four of the jobs listed above.

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

Candidates must explain the following:

- (a) The nature and purpose of the following:
  - ◆ Electrical: power circuits, lighting circuits
  - ◆ Heating and ventilating: cold water, hot water, heating, ductwork
  - ◆ Plumbing: cold water, hot water, heating, sanitation
  - ◆ Refrigeration and air conditioning: small refrigeration systems, small air conditioning systems
- (b) The importance of key legislation and codes of practice as they apply to the BSE industries.
- (c) The differences between British and European Standards, codes of practice and legislation.

## **National Unit specification: support notes**

**Unit title:** Building Services Engineering: An Introduction  
(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 20 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, and refrigeration and air conditioning.

#### **Outcome 1**

This Outcome ensures that the candidate understands the main industries within the BSE sector (electrical, plumbing, heating and ventilating, refrigeration and air conditioning). Identification of the main impact that the BSE sector has on people and buildings will allow a broader and deeper understanding of the BSE sector as will recognition of how the BSE sector interacts with the construction sector.

#### **Outcome 2**

This Outcome ensures that the candidate has an appreciation of the job and career development opportunities offered by the BSE sector.

#### **Outcome 3**

This Outcome covers the nature and purpose of basic BSE industry systems, ie the types of systems that the candidate may work with if employed within the BSE sector. Candidates will also begin to develop a focus on the importance of key legislation and codes of practices within the BSE sector.

### **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.

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

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

### **Opportunities for developing Core Skills**

Throughout this Unit there may be opportunities for candidates to develop the Core Skill of *Communication* at SCQF level 4. This may be possible whilst the candidate is describing and explaining the responses during the assessment process.

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

An integrated approach to assessment across the Outcomes in this Unit is suggested. If this Unit is being delivered as part of the Building Services Engineering Course (SCQF level 4) 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.

#### **Outcome 1**

It is recommended that candidates are assessed on their knowledge and understanding of the main industries within the BSE sector. This could be done by using a questioning method such as restricted response/short answer questions. This will ensure that candidates have the knowledge and understanding of the main industries within the BSE sector. It is also recommended that the questions used should sample across all Performance Criteria.

#### **Outcome 2**

It is recommended that candidates are assessed on their knowledge and understanding of how to identify the job opportunities and career pathways within the BSE sector. This could be done by using a questioning method such as restricted response/short answer questions. This will ensure that candidates have the knowledge and understanding of how to identify the job opportunities and career pathways within the BSE sector. It is also recommended that the questions used should sample across all Performance Criteria.

#### **Outcome 3**

It is recommended that candidates are assessed on their knowledge and understanding of how to recognise BSE industry systems and associated legislation. This could be done by using a questioning method such as restricted response/short answer questions. This will ensure that candidates have the knowledge and understanding of how to recognise BSE industry systems and associated legislation. It is also recommended that the questions used should sample across all Performance Criteria.

## National Unit specification: support notes (cont)

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

### 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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## National Unit specification: general information

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

**Unit code:** FT85 10

### Summary

This is a mandatory Unit of the Building Services Engineering Course at SCQF level 4 and is suitable for candidates with no previous engineering, technical or employment experience. The candidate will learn to identify the fundamental Health and Safety requirements of the Building Services Engineering (BSE) sector and how to recognise and respond appropriately to common hazards and accidents in the BSE environment. Candidates will also learn how to apply safe working practices relevant to the BSE sector.

### Outcomes

- 1 Explain the basic health and safety requirements.
- 2 Explain how to recognise and respond appropriately to common hazards and accidents.
- 3 Demonstrate safe working practices.

### 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\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### 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 Safe Working Practices (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**

Explain the basic health and safety requirements.

#### **Performance Criteria**

- (a) Explain the basic relevant Health and Safety legislation.
- (b) Explain the fundamental and relevant safe personal protection measures which may be required.
- (c) Explain the procedures and methods of working safely within the sector.

### **Outcome 2**

Explain how to recognise and respond appropriately to common hazards and accidents.

#### **Performance Criteria**

- (a) Explain how to recognise and respond appropriately to hazardous situations.
- (b) Explain how to respond appropriately to the dangers presented by asbestos.
- (c) Explain how to recognise and respond appropriately to accidents that occur.

### **Outcome 3**

Demonstrate safe working practices.

#### **Performance Criteria**

- (a) Apply manual handling techniques safely.
- (b) Use access equipment safely.

### **Evidence Requirements for this Unit**

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

Evidence should be produced for all Outcomes to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria.



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

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

### Outcome 1

Candidates must explain basic relevant Health and Safety legislation as it applies to all of the following:

- ◆ Relevant person including clients (customers), employees, and employers (including employer representatives).
- ◆ Protective equipment including: clothing protection (including high visibility), eye protection, foot protection, hand protection, head protection, and hearing protection.
- ◆ The types of equipment used to permit work at heights including: ladders, mobile elevated work platforms, and step ladders.
- ◆ Common electrical dangers including: faulty electrical equipment, signs of damaged or worn electrical cables (power tools and property hard wiring system), and trailing cables.
- ◆ Electrical tools and equipment on-site including: battery powered supplies, 110 volt supplies, 230 volt supplies.
- ◆ Visual inspection of a power tool for safe condition including: checking for a valid PAT test, and inspection for general condition.
- ◆ Range of types of heat producing equipment including: blowpipes, control valves, flashback arrestors, gauges, hoses, and nozzles.
- ◆ Safe use of gas heating equipment including: actions in the event of leakage, bottle location and position, and safe lighting and extinguishing procedure.

### Outcome 2

Candidates must be able to explain how to recognise and respond appropriately to common hazards and accidents in terms of all of the following:

- ◆ Types of general workplace hazards that may be encountered in the BSE workplace including: defective (unsafe) equipment, manual handling, site/work area cleanliness, slipping hazards, tripping hazards, and using equipment.
- ◆ Methods that can be used to prevent accidents or dangerous situations occurring during work activities including: firefighting signs, hazard signs, mandatory signs, prohibition signs, safety notices, working practices, and personal responsibilities under health and safety.
- ◆ Hazardous substances including: corrosive, harmful, irritant, and toxic.
- ◆ Situations where asbestos may be commonly found in the workplace including: asbestos cement materials, gutters, flues, tanks, coating materials (eg Artex), heat proofing materials, gaskets, boiler components, insulating material, sheeting materials, floors, roofs, walls within the building fabric.
- ◆ Actions that should be taken when an accident or emergency is discovered, including: raising the alarm, the role of the emergency services and contact methods, and typical emergency evacuation procedures.

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

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

- ◆ Method for fighting small localised fires that can occur in the workplace including: selection of extinguisher by fire type, types of extinguisher, how to use extinguisher effectively and when to avoid tackling fires.
- ◆ Procedures for dealing with minor/major injuries that can occur while working including: CPR method, cuts, electric shock, minor burns, objects in the eye, placing the casualty in the recovery position, and removal from any live electrical supply safely.
- ◆ Importance of recording accidents and near misses at work including: statutory requirements for the reporting of accidents/serious occurrences, the details to be recorded on a simple accident/incident report form, the use of company accident books.

### **Outcome 3**

Candidates must be able to demonstrate that they can safely carry out all of the following:

- ◆ Manual handling of heavy and bulky items including: assist in a two-person lift— plan the lift, and safely move the load.
- ◆ Use of ladders and step ladders.

## National Unit specification: support notes

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (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 Building Services Engineering (BSE) sector in any of the main occupational areas of plumbing, electrical, heating and ventilating, and refrigeration and air conditioning.

#### Outcome 1

This Outcome covers the aims of Health and Safety legislation in protecting the workforce and members of the public in the context of the BSE sector.

The candidate will develop an understanding of the responsibilities of relevant persons under Health and Safety legislation and the purpose of, and application of protective equipment.

The candidate will also develop an understanding of the situations where it may be necessary to work at height:

- ◆ the safety requirements for the types of equipment used to permit work at heights
- ◆ the relevant safety checks required to be carried out on access equipment before it is used

The candidate will also develop an understanding of the common electrical dangers encountered on construction sites and in private dwellings including:

- ◆ the methods of safely using electrical tools and equipment on site
- ◆ how to conduct a visual inspection of a power tool for safe condition before use
- ◆ the procedure that should be applied for tools and equipment that fail safety checks
- ◆ how to use bottle colours to identify the various types of gases used in pipe jointing processes.

The candidate will also develop an understanding of:

- ◆ the range of types of heat producing equipment (and the associated dangers) and specifically how gas heating equipment is safely used
- ◆ the three elements of the fire triangle and how combustion takes place
- ◆ the method for fighting small localised fires that can occur in the workplace

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

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

### **Outcome 2**

This Outcome covers the types of general workplace hazards that may be encountered in the BSE workplace and the methods that can be used to prevent accidents or dangerous situations occurring during work activities. The candidate will develop an understanding of how legislation classifies hazardous substances, the general precautions necessary for working with commonly encountered substances in the BSE environment and the action to take should a hazardous situation occur while at work.

The candidate will also develop an understanding of:

- ◆ the actions that should be taken when an accident or emergency is discovered
- ◆ the procedures for dealing with minor/major injuries that can occur while working
- ◆ the importance for recording accidents and near misses at work

### **Outcome 3**

This Outcome covers the manual handling of heavy and bulky items. The candidate will develop an understanding of:

- ◆ the procedures for manually handling heavy and bulky items
- ◆ how/why to carry out an assessment of a safe load that a person can lift through the application of safe kinetic lifting technique
- ◆ the use of simple mechanical lifting aids such as a sack trolley
- ◆ demonstrate the safe and appropriate method of assembly and use of fundamental access equipment.

## **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.

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

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

### **Opportunities for developing Core Skills**

Throughout this Unit there may be opportunities for candidates to develop the Core Skills of *Communication*, *Problem Solving* and *Working with Others* at SCQF level 4. If the assessment is integrated with other Units from the Building Service Engineering Course (SCQF level 4) the candidate will benefit from practical experience of how the Core Skills can be developed in the work place.

### **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 Course 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.

Assessment for this Unit with other Units within the Course could be done through a practical task carried out in a working environment, or under role play conditions in addition to the terms of the specific Outcomes of this Unit.

#### **Outcomes 1 and 2**

It is recommended that candidates are assessed on their knowledge and understanding of the fundamental health and safety requirements of the BSE sector and how to recognise and respond to hazards and accidents. This could be done by using a questioning method such as restricted response/short answer questions which will ensure that candidates have the knowledge and understanding of the fundamental health and safety requirements of the BSE sector. It is further recommended that the knowledge and understanding is assessed ahead of the candidates undertaking any practical work and that the questions used should sample across all Performance Criteria.

#### **Outcome 3**

A suitable instrument of assessment covering all Performance Criteria could be a practical exercise, undertaken in supervised and controlled conditions, where candidate achievement is recorded by means of an observation checklist completed by the teacher/lecturer.

## National Unit specification: support notes (cont)

**Unit title:** Building Services Engineering: Introduction to Safe Working Practices (SCQF level 4)

### 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)*.

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### History of changes to Unit

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## National Unit specification: general information

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

**Unit code:** FT86 10

### 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 candidate will be introduced to and learn to identify the main types of energy and their sources as well as the fundamentals of energy conservation as they apply to the household Building Services Engineering (BSE) sector. Candidates will also learn the main types of material disposal as they apply to the BSE sector.

### Outcomes

- 1 Describe the main types, sources and operating principles of energy and the reasons for reducing carbon emissions from households.
- 2 Explain the methods and types of energy conservation, and material disposal.

### 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\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### 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 Energy (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**

Describe the main types, sources and operating principles of energy and the reasons for reducing carbon emissions from households.

#### **Performance Criteria**

- (a) Describe the two main types of energy used in households.
- (b) Describe sources of energy that can be used in households.
- (c) Explain the main reasons for reducing carbon emissions from households and the contribution being made by the BSE sector to achieve it.

### **Outcome 2**

Explain the methods and types of energy conservation, and material disposal.

#### **Performance Criteria**

- (a) Explain the basic working practices associated with energy conservation and environmental protection.
- (b) Explain the main methods of conserving water and reducing wastage of water.
- (c) Explain the main types of material disposal.

### **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.



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

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

### Outcome 1

Candidates must correctly describe two of the main types of energy used in households in terms of the carbon footprint, from the following:

- ◆ High carbon energy sources from: natural gas/LPG, fuel oils, solid fuels (coal and peat), electricity (from non-renewable sources).
- ◆ Low carbon energy sources from: solar thermal, solid fuel (biomass), hydrogen fuel cells, heat pumps, combined heat and power (CHP), combined cooling, heat and power (CCHP).
- ◆ Zero carbon energy sources from: electricity (wind), electricity (tidal), hydroelectric, solar photovoltaic.

Candidates must also explain all of the following:

- ◆ The main reasons for reducing carbon emissions from households.
- ◆ How building services engineering industries are working to reduce carbon emissions from households.
- ◆ How and where to get more guidance and advice on energy saving and conservation techniques.

Candidates must also identify the basic operating principles of installations containing environmental energy sources, including solar thermal, wind turbine, solar photovoltaic.

### Outcome 2

Candidates must explain all of the following:

- ◆ The working practices associated with energy conservation and environmental protection including: planning work activities, accurate measurement and cutting, reuse of off-cuts.
- ◆ The basic working practices associated with water conservation within households, including three of the following:
  - flow reducing valves, spray taps, low volume flush WC
  - methods and reasons for capturing surface water
  - promoting user awareness
  - recycling used water
  - regular maintenance of terminal fittings and float valves
- ◆ The methods and processes of safely disposing of waste materials associated with licensed waste disposal; waste carriers license; recycling.
- ◆ The implications and dangers associated with incorrect waste disposal.

## **National Unit specification: support notes**

**Unit title:** Building Services Engineering: Introduction to Energy (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**

This Outcome covers the main types of energy used in households where these are categorised by their carbon footprint as high carbon, low carbon and zero carbon. The candidate will develop an understanding of the range of energy types and the main reasons for reducing carbon emissions from households. The candidate will also develop an understanding of the contribution being made by the BSE sector to reduce carbon emissions and of the basic operating principles of low and zero carbon environmental energy sources. The candidate will develop an understanding of how and where to get more guidance and advice on energy saving and conservation techniques.

#### **Outcome 2**

This Outcome covers the basic working practices associated with energy conservation and environmental protection as well as the key area of water conservation within households. The candidate should be encouraged to consider the implications of non-compliance with appropriate waste disposal methods.

### **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.

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

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

### **Opportunities for developing Core Skills**

Throughout this Unit there may be opportunities for candidates to develop the Core Skill of *Communication* at SCQF level 4. This may be possible whilst the candidate is describing and explaining the responses during the assessment process.

### **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 Building Services Engineering Course (SCQF level 4) 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.

Candidates could be assessed on their knowledge and understanding of the main types of energy and sources of energy used in the BSE sector by using a questioning method such as restricted response/short answer questions. This will ensure that candidates have the knowledge and understanding. It is also recommended that the questions used should sample across all the Performance Criteria.

### **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**

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## National Unit specification: general information

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

**Unit code:** FT87 10

### 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\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### 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**

Identify 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:

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

- ◆ area ( $m^2$ )
- ◆ volume ( $m^3$ )
- ◆ litres (L)
- ◆ density ( $kg/m^3$ )
- ◆ velocity (m/s)

#### Outcome 2:

Candidates must be able to identify types of 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 (SCQF level 4)

### **Outcome 3:**

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:**

Candidates must carry out the following:

- ◆ describe the principles of electricity including measurements of electrical flow, material conductivity and resistance, and direct and indirect current.
- ◆ 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**

This Outcome covers the basic SI 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**

This Outcome 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**

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

#### **Outcome 4**

This Outcome 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.

## National Unit specification: support notes (cont)

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

### 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.

### 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 Building Services Engineering Course (SCQF level 4), 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 how 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.

## National Unit specification: support notes (cont)

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

### 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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## National Unit specification: general information

**Unit title:** Building Services Engineering: Employability Skills (SCQF level 4)

**Unit code:** FT89 10

### 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. Candidates will develop work practices and attitudes that enhance their employability in the context of the Building Services Engineering (BSE) sector. Candidates will also have an opportunity to review the skills they have developed.

### Outcomes

- 1 Demonstrate work practices which enhance employability in the context of building services engineering.
- 2 Demonstrate behaviours which enhance employability in the context of building services engineering.
- 3 Use project drawings to record and check simple measurements.
- 4 Review and evaluate own skills developed in practical contexts.

### Recommended entry

Entry is at the discretion of the centre.

### Credit points and level

0.5 National Unit credit at SCQF level 4 (3 SCQF credit points at SCQF level 4\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

- ◆ Critical Thinking at SCQF level 3
- ◆ Working Co-operatively with Others at SCQF level 3

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

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

**Unit title:** Building Services Engineering: Employability Skills (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**

Demonstrate work practices which enhance employability in the context of building services engineering.

#### **Performance Criteria**

- (a) Undertake necessary planning and preparation prior to practical work.
- (b) Work co-operatively with others on specified tasks.
- (c) Maintain tidy work areas in accordance with health and safety requirements.
- (d) Check own practical work in accordance with prescribed schedule and standards.

### **Outcome 2**

Demonstrate behaviours which enhance employability in the context of building services engineering

#### **Performance Criteria**

- (a) Demonstrate positive attitudes to learning during practical exercises.
- (b) Show a willingness to follow instructions from the person with responsibility.
- (c) Respond positively to advice and feedback on performance.

### **Outcome 3**

Use project drawings to record and check simple measurements.

#### **Performance Criteria**

- (a) Accurately measure from a scaled project drawing.
- (b) Scale up the measurements taken to give full size values.
- (c) Check calculated full size values against actual recorded measurements.

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

**Unit title:** Building Services Engineering: Employability Skills (SCQF level 4)

### **Outcome 4**

Review and evaluate own skills developed in practical contexts.

#### **Performance Criteria**

- (a) Identify own strengths and weaknesses.
- (b) Identify learning points for self.
- (c) Identify action points for improvement for self.

#### **Evidence Requirements for this Unit**

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

Performance evidence should be produced for Outcomes 1–4 and should be integrated across all other Units within the Building Services Engineering (BSE) Course (SCQF level 4).

Written and/or oral evidence should also be produced for Outcomes 3 and 4 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.

### **Outcome 1**

Candidates must demonstrate, for two given practical exercises, that they work co-operatively with others to carry out all necessary planning and preparation, this will include:

- ◆ identification of roles for the two exercises
- ◆ maintain an appropriately tidy work area
- ◆ check own progress against schedules and standards for the two tasks.

### **Outcome 2**

Candidates must demonstrate, for two given practical exercises, positive behaviours which must include a willingness to seek, accept and follow instructions from the person with responsibility, and to respond to those instructions in a positive manner for the duration of those two exercises.

### **Outcome 3 (supported by written and/or oral evidence)**

Candidates must provide evidence, for two given exercises, that they can understand a scaled project drawing and take measurements accurately from it. Candidates must also provide evidence, for the same two given exercises, that they can scale up those measurements taken to give accurate full size values, and then check those full size values against the actual recorded measurements.

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

**Unit title:** Building Services Engineering: Employability Skills (SCQF level 4)

### **Outcome 4 (supported by written and/or oral evidence)**

Candidates must provide evidence, for two given exercises, that they are capable of identifying their own strengths and weaknesses and then use that to identify their own learning points and actions to be taken for improvement.

## National Unit specification: support notes

**Unit title:** Building Services Engineering: Employability Skills (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 20 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 prepare candidates for employment in the BSE industry. To this end the Unit focuses on encouraging candidates to develop the correct work practices and attitudes for employment such as good time-keeping and attendance, working co-operatively with others, willingness to learn, checking the quality of own work, and maintaining tidy work space. Candidates will be provided with an opportunity to review how well they have progressed in developing these work practices and attitudes by comparing their own evaluation with that of their assessors. Candidates will also be encouraged to develop skills in interpretation of drawings and taking and recording measurements, skills that are common to all parts of the building services engineering industry.

### 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 could be teacher/lecturer-led in that all equipment, techniques and processes be explained, demonstrated and thoroughly understood before the candidate commences the Unit. Demonstrations should be clear, logically sequenced and reflect current safe working practices to ensure candidate understanding.

### Opportunities for developing Core Skills

There are opportunities to develop aspects of the Core Skill *Problem Solving* in this Unit. Candidates are required to review and evaluate their own skills.

Throughout this Unit there may be opportunities for candidates to develop the Core Skills of *Communication*, *Problem Solving*, *Numeracy* and *Working with Others* at SCQF level 4. If the assessment is carried out using Performance Evidence, *Communication*, *Problem Solving* and *Working with Others* could be developed in Outcomes 1 and 2. *Communication*, *Numeracy* and *Problem Solving* could be developed in Outcome 3.



## National Unit specification: support notes (cont)

**Unit title:** Building Services Engineering: Employability Skills (SCQF level 4)

### 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 Building Services Engineering Course at SCQF level 4, 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 which would allow integration across a number of Units. Centres may also wish to develop the employability skills of the candidates through role-play techniques where appropriate.

A suitable instrument of assessment covering all Performance Criteria could be a practical exercise, undertaken in supervised and controlled conditions, where candidate achievement is recorded by means of an observation checklist completed by the teacher/lecturer.

Performance evidence, supported by candidate review sheets and assessor observation checklists are required to show that all Outcomes and Performance Criteria have been achieved.

Candidates will demonstrate the appropriate working practices and attitudes in practical contexts. They will then review and evaluate their own performance on candidate review sheets and plan for improvement. Candidates will also demonstrate basic skills in interpreting drawings and undertake practical measurement tasks. The evidence required will be:

- ◆ a minimum of two candidate review sheets, signed by the assessor, relating to a minimum of two practical activities
- ◆ an assessor observation checklist confirming that the candidate has successfully completed the practical measuring tasks as specified

### Opportunities for the use of e-assessment

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

**Unit title:** Building Services Engineering: Employability Skills (SCQF level 4)

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## Administrative information

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**Published:**            Month and year            (version 0            )

**Superclass:**            to be advised

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### History of changes to Course Specification

Course details	Version	Description of change	Authorised by	Date

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