



National Unit specification: general information

Unit title: Building Services Engineering Technology (SCQF level 5)

Unit code: F1AP 11

Superclass: XH

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Source: Scottish Qualifications Authority

Version: 02

Summary

This Unit will be suitable for candidates who have limited or no experience of Building Services Engineering Technology.

It is designed to provide the candidate with an introduction to the application of elementary mechanical building services design technology incorporating thermal comfort, systems layout and pipe sizing in the context of low-rise non-complex domestic or commercial buildings within the Building Services Engineering Industry.

Outcomes

- 1 Explain factors that influence levels of human comfort in buildings.
- 2 Identify factors affecting building heat loss and gain.
- 3 Describe and compare Low Pressure Hot Water (LPHW) heating systems and Domestic Hot Water (DHW) systems.
- 4 Produce elementary design pipe sizing calculations for Low Pressure Hot Water (LPHW) heating and Domestic Hot Water (DHW) systems in accordance with current industry standards.

Recommended entry

Entry is at the discretion of the centre.

General information (cont)

Unit title: Building Services Engineering Technology (SCQF level 5)

Credit points and level

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

**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.*

6 credit points, indicates a notional Unit design length of 40 hours of contact and 20 hours of self-directed learning.

Core Skills

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

The Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Numeracy (SCQF level 5)
- ◆ Problem Solving (SCQF level 5)

These opportunities are highlighted in the support notes of this Unit specification.

National Unit specification: statement of standards

Unit title: Building Services Engineering Technology (SCQF level 5)

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

Outcome 1

Explain factors that influence levels of human comfort in buildings.

Performance Criteria

- (a) Explain the main physiological and psychological factors affecting human comfort.
- (b) Explain the main physiological factors affecting thermal comfort.
- (c) Explain the main environmental factors affecting thermal comfort.

Outcome 2

Identify factors affecting building heat loss and gain.

Performance Criteria

- (a) Using recognised industry guidelines identify climatic factors that might affect building heat loss and gain.
- (b) Using recognised industry guidelines identify structural factors that might affect building heat loss and gain.

Outcome 3

Describe and compare Low Pressure Hot Water (LPHW) heating systems and Domestic Hot Water (DHW) systems.

Performance Criteria

- (a) Describe standard plant and equipment for LPHW heating systems.
- (b) Describe standard plant and equipment for DHW systems.
- (c) Compare the key characteristics of alternative LPHW system layouts.
- (d) Compare the key characteristics of alternative DHW systems.

Outcome 4

Produce elementary design pipe sizing calculations for Low Pressure Hot Water (LPHW) heating and Domestic Hot Water (DHW) systems in accordance with current industry standards.

Performance Criteria

- (a) Identify appropriate design values for LPHW and DHW systems in accordance with current industry standards.
- (b) Produce accurate design calculations for LPHW and DHW systems
- (c) Determine appropriate pipe sizes for LPHW and DHW systems using tabulated and graphical data.

National Unit specification: statement of standards (cont)

Unit title: Building Services Engineering Technology (SCQF level 5)

Evidence Requirements for this Unit

The Appendix to this Unit details the mandatory content for each Outcome.

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

For Outcomes 1, 2 and 3 written and/or oral evidence must be produced in open-book conditions. In this Unit an appropriate Instrument of Assessment could be a question paper consisting of a balance of multiple-choice, short answer, restricted response and structured questions. Candidates must not bring notes, textbooks or handouts to the assessment.

Product evidence in the form of a complete set of low pressure hot water and domestic hot water pipe sizing calculations for a low-rise building which demonstrates that the candidate has achieved Outcome 4 to the standard specified in the Outcome and Performance Criteria. The assessment will be carried out under supervised conditions.

Assessments must be manageable and practicable for centres and candidates and a single assessment covering all Outcomes should not exceed 2 hours in duration.

The Assessment Support Pack for this Unit provides appropriate sample assessment materials. Where centres wish to develop their own assessment materials they should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit specification: support notes

Unit title: Building Services Engineering Technology (SCQF level 5)

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 Appendix to this Unit details the mandatory content for each Outcome.

This Unit is a mandatory Unit within the National Certificate in *Building Services Engineering* (SCQF level 6).

This Unit aims to provide the candidate with an introduction to elementary mechanical Building Services Engineering Technology, in the context of low-rise non-complex domestic or commercial buildings. Candidates may also undertake specific technology optional Units that will broaden the content of this Unit and also provide an option for specialisation.

Emphasis in the delivery of the Unit should be on familiarisation with terminology and basic concepts.

When delivered as part of the National Certificate in Building Services Engineering (SCQF level 6) this Unit has links with the Heating and Plumbing Technology (SCQF level 6) optional Unit. It is recommended that it be delivered before this Unit. The Unit also has links with the Building Services Engineering: Thermofluids (SCQF level 6) optional Unit and might be delivered after or in parallel with that Unit.

Health and Safety and Sustainability are integral and key to the Building Services Engineering industry therefore throughout the Unit emphasis will be placed where appropriate on the application of Health and Safety and Sustainability. Safe working practises should be looked at in accordance with current safety codes of practise and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

Guidance on learning and teaching approaches for this Unit

The use of case study material based on low-rise non-complex domestic or commercial buildings is particularly recommended for both learning and assessment.

The learning environment for this Unit will be mainly classroom based however where possible opportunities to enhance learning may include workshop and industrial visits.

Suggested teaching and learning methods for this Unit could include: the use of visual aids, ICT, group lectures and discussion, practical demonstrations, question and answer sessions, directed study, industrial/site visits.

National Unit specification: support notes (cont)

Unit title: Building Services Engineering Technology (SCQF level 5)

Guidance on approaches to assessment for this Unit

To be read in conjunction with the **Evidence Requirements**.

Candidates may be assessed on an Outcome by Outcome basis, combinations of Outcomes or by a single, holistic assessment covering Outcomes 1, 2 and 3. In this Unit an appropriate Instrument of Assessment for Outcomes 1, 2 and 3 could be a question paper consisting of a balance of short answer, restricted response and structured questions. Such responses might be based on an appropriate case study.

For Outcome 4 candidates may produce using traditional or a suitable computer software package evidence in the form of a complete set of low pressure hot water and domestic hot water pipe sizing calculations for a low-rise building.

Preparation for assessment should include formative work with opportunities for constructive feedback.

Where the Unit is taken as part of the National Certificate in Building Services Engineering (SCQF level 6), there may be opportunities to integrate the assessments for this Unit with other Units contained in the award. For example the Unit has links with Heating and Plumbing Technology (SCQF level 6) and Building Services Engineering: Thermofluids (SCQF level 6).

Planning should allow time for re-assessment. Given that assessment for this Unit must be conducted in controlled conditions, centres should ensure that a different assessment is given for re-assessment purposes and that similar controlled conditions apply.

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)*.

Opportunities for developing Core Skills

Accuracy in interpreting graphic information and the ability to calculate, apply and present complex data is an aspect of best practice and is contained within this Unit. Numeracy involves a wide range of skills and underpins a flexible approach to Building Services Engineering Technology which should be encouraged and developed as candidates undertake the Unit. It is recommended that evidence is achieved through well-planned course work, assignments and projects. Integrative assignments and project work will help to link this Unit with other related Units. Individual and group discussion with assessor support could develop problem solving skills. Analytical discussion of case studies could provide a stimulus to creative thinking and a guide to best practice. The emphasis should be on Numeracy as a tool to be used and applied efficiently and critically, with consideration of factors such as sustainability, the effect and impact on the environment of not implementing sustainability and the legislation promoting sustainability.

National Unit specification: support notes (cont)

Unit title: Building Services Engineering Technology (SCQF level 5)

Open learning

Where appropriate materials and facilities are available, this Unit could be delivered by distance learning which might include some degree of online support. Centres must ensure that for all modes of delivery the same assessment conditions, standards and quality assurance procedures apply to all candidates.

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.

National Unit specification: statement of standards

Unit title: Building Services Engineering Technology (SCQF level 5)

Appendix — Content and Context for this Unit

The content specified in this Appendix is within the statement of standards, ie the mandatory requirements of the Unit.

Recommended time allocations for each Outcome are given as guidance on the depth of treatment which might be applied to each topic and are inclusive of time teaching, learning and assessment. This guidance has been used in the design of Assessment Support Pack material provided with the Unit.

- 1 Explain factors that influence levels of human comfort in buildings (5 hours).
 - ◆ **Comfort**
Psychological factors affecting comfort.
 - ◆ **Mental state**
Visual stimuli — colour, texture, lighting.
 - ◆ **Thermal Comfort**
 - Human physiology.
 - Body temperature and heat balance of the human body.
 - Effects of different activity rates.
 - Mechanisms of heat loss from the body. Reactions to inadequate or excessive heat loss.
 - Psychology of colour related to apparent 'temperature'.
 - ◆ **Environmental factors**
 - Air temperature and velocity.
 - Humidity.
 - Mean radiant temperature of surrounding surfaces.
 - Ventilation requirements.
- 2 Explain factors affecting building heat loss and gain (10 hours).
 - ◆ **Building heat loss and gain**
 - Indoor and external design temperatures.
 - Mass/weight of structure.
 - Thermal properties of the structure.
 - Glazing.
 - Exposure.
 - Occupancy patterns.
 - Lighting. Machinery.
 - Solar radiation.
 - Elementary heat loss calculations.
 - 'Rules of thumb'.

National Unit specification: statement of standards (cont)

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- 3 Describe and compare Low Pressure Hot Water (LPHW) heating systems and Domestic Hot Water (DHW) systems (10 hours).
 - ◆ **LPHW and DHW**
 - Boiler/s.
 - pump/s.
 - Heat exchangers.
 - Alternative system layouts.

- 4 Produce elementary design pipe sizing calculations for Low Pressure Hot Water (LPHW) heating and Domestic Hot Water (DHW) systems in accordance with current industry standards (15 hours).
 - ◆ **LPHW**
 - Pressure available and pressure loss in pipework and equipment.
 - Elementary pipe sizing.
 - Pump characteristic.
 - Need for 'balancing' system.

 - ◆ **DHW**
 - Pressure available.
 - Demand variability.
 - Single and multi-pipe systems.
 - Elementary pipe sizing.

History of changes to Unit

| Version | Description of change | Date |
|---------|---|------------|
| 02 | Update from 'closed-book' assessment to 'open-book' assessment. | 14/07/2011 |
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