

SQA Advanced Unit Specification

General information for centres

Unit title: Building Services: Heating, Lighting and Acoustics

Unit code: HR41 48

Unit purpose: This Unit seeks to provide the candidate with a broad understanding of the design process and the selection and specification of heating and lighting systems for various types of buildings. The candidate will also develop a knowledge and understanding of the principles of room acoustics and the mechanics of sound and vibration insulation techniques. The Unit is intended for candidates participating in courses predominately in construction.

On completion of the Unit the candidate should be able to:

- 1 Determine space heating loads and energy requirements for heating schemes.
- 2 Investigate the design and installation requirements of simple lighting applications.
- 3 Investigate the characteristics, transmission and effects of sound and vibration.

Credit points and level: 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*).

**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 National 1 to Doctorates.*

Recommended prior knowledge and skills: It would be an advantage for candidates to have a basic understanding and knowledge of building services, building science and building technology.

Possession of basic knowledge and understanding may be evidenced by possession of appropriate NC, NQ or SQA Advanced Units.

The Unit includes all the basic principles necessary to allow candidates possessing other qualifications or experience to succeed in this Unit.

Core Skills: There are opportunities to develop the Core Skill(s) of Communication, Numeracy, Problem Solving, in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: It is possible to assess candidates either on an individual Outcome basis, combinations of Outcomes or by a single holistic assessment combining all Outcomes. The assessment paper/s should be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be conducted under supervised, controlled conditions. A single assessment covering all outcomes should not exceed two hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

An exemplar instrument of assessment and marking guidelines have been produced to provide an example of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 7.

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Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

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.

Outcome 1

Determine space heating loads and energy requirements for heating schemes.

Knowledge and/or skills

- ◆ Thermal Comfort
- ◆ Steady State Heat Transfer in Buildings
- ◆ Non-Steady State Heat Transfer in Buildings
- ◆ Total Heating Loads & Heating Plant Capacity

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify, explain and quantify the energy requirements for heating schemes in buildings

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of four** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

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The assessment for this Outcome might be combined with that for Outcomes 2 and 3 to form a single assessment paper

Outcome 2

Investigate and design and installation requirements of simple lighting applications.

Knowledge and/or skills

- ◆ Lamps and luminaries
- ◆ Energy requirements for lighting installations
- ◆ Lighting layouts and supply circuits
- ◆ Controlling lighting installations
- ◆ Emergency lighting installations

Evidence Requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify characteristics of and installation requirements for lighting schemes

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions. This assessment might be based on a case study.

The assessment for this Outcome might be combined with that for Outcomes 1 and 3 to form a single assessment paper.

Outcome 3

Investigate the characteristics, transmission and effects of sound and vibration.

Knowledge and/or skills

- ◆ Sound
- ◆ Room acoustics
- ◆ Vibration

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Evidence Requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify and explain the characteristics and propagation of sound and vibration in the context of room acoustics

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of three** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this Outcome might be combined with that for Outcomes 1 and 2 to form a single assessment paper.

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Administrative Information

Unit code:	HR41 48
Unit title:	Building Services: Heating, Lighting and Acoustics
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Unit specification: support notes

Unit title: Building Services: Heating, Lighting and Acoustics

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

This Unit seeks to provide the candidate with a broad understanding of the design process and the selection and specification of heating and lighting systems for various types of buildings. The candidate will also develop a knowledge and understanding of the principles of room acoustics and the mechanics of sound and vibration insulation techniques. It should be delivered using practical examples and, where possible, related to system design procedures. The candidate should be encouraged to produce solutions using design data and software.

The Unit is intended for candidates participating in courses primarily in construction and is not intended to provide the depth of knowledge required by candidates who are following the specialist building services options.

Recommended time allocations to each Outcome are given as guidance towards the depth of treatment which might be applied to each topic.

This guidance has been used in the design of the assessment exemplar material provided with the Unit.

1 Space heating loads and energy requirements (14 hours)

Thermal Comfort: factors effecting thermal comfort, predicting thermal satisfaction. Effect of radiation on comfort, local discomfort and asymmetry.

Steady State Heat Transfer in Buildings: steady state energy transfer networks. Steady state heating loads to maintain comfort and space temperatures.

Non-Steady State Heat Transfer in Buildings: transient heat transfer factors and equations, the admittance method, response factor. Pre-heat periods, heating loads with intermittent and highly intermittent heating

Total Heating Loads & Heating Plant Capacity: factors contributing to heating plant capacity for buildings, assessment of total heat losses and heating plant output, effect of building construction and orientation on its thermal inertia and heating load. Compliance with energy efficiency targets and standards. Use of computer software to determine heating loads for rooms, zones and building.

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2 Simple lighting applications (10 Hours)

General Lighting: lighting terms and units, essentials for good quality lighting, selection of appropriate levels of illuminance. Glare and its control. Characteristics and application of lamps in common use. Use of photometry data. Design of lighting layout by Lumen method.

Legislation and Industrial Standards

Energy efficiency: requirements, luminaries output, control, green issues, Legislation

Emergency Lighting: maintained, non-maintained, lighting levels, positioning, escape routes, maintenance and testing requirements, Legislation and Industrial Standards

3 Sound and vibration (14 hours)

Sound: Decibel scales, measurement of sound, equivalent continuous noise levels, sound power level (SPL), sound intensity level (SIL). Sound power/frequency spectra for external and internal noise sources. Propagation of acoustic energy, sound insulation and attenuation

Room acoustics: Room characteristics, background and total sound levels, and reverberation time.

Vibration: Simple harmonic motion, modes of vibration, characteristics of springs, static and dynamic modulus of materials and natural frequency. Transmissibility, vibration isolation.

Guidance on the delivery and assessment of this Unit

The Unit should be delivered using practical examples and, where possible, related to system design procedures. The unit could be delivered as a standalone package, but may be integrated with other building services units in the framework produce a more holistic approach to building services.

It is recommended that evidence for learning outcomes is achieved through well-planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each candidate, group work and role-play activities may contribute to the assessment. Integrative assignments and project work will help to link this unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme. In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills units.

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Opportunities for developing Core Skills

The following grid provides a general guide to opportunities for the development of Core Skills in this Unit. Opportunities for the developing of Core Skills at the output level are more fully identified in the Core Skills Signposting Guide.

Core Skill	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5
1 Communication					
Reading	3	3	3		
Writing	3	3	3		
Oral					
2 Numeracy					
Using Number	3	3			
Using Graphical Information					
3 IT					
Using Information Technology					
4 Problem Solving					
Critical Thinking	3	3	3		
Planning and Organising					
Reviewing and Evaluating	3	3	3		
5 Working with Others					

Open learning

Given that appropriate materials exist this unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment/s were conducted under controlled, supervised conditions.

Equality and inclusion

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

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

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General information for candidates

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On completion of the Unit you should be able to:

- 1 Determine space heating loads and energy requirements for heating schemes.
- 2 Investigate the design and installation requirements of simple lighting applications.
- 3 Investigate the characteristics, transmission and effects of sound and vibration.

The formal assessment for this Unit could consist of a single assessment paper lasting two hours. Alternatively three separate assessments could be used to gather assessment evidence. The assessment will be conducted under closed book supervised conditions in which you will not be allowed to take notes, textbooks etc. into the assessment. You will sit this assessment paper/s at the end of the Unit our Outcome as appropriate.