Higher National Unit Specification

General information for centres

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

Unit code: DW4N 35

Unit purpose: This Unit is designed to develop the candidate's understanding of the factors which affect human thermal comfort. It will also seek to provide the candidate with an understanding of the purpose, installation and processes of ventilation and air conditioning equipment and associated refrigeration plant. It will enable candidates to interpret the ventilation and air conditioning requirements of a building, to develop practical air conditioning schemes for a range of environments and to evaluate the effectiveness of alternative schemes. The Unit is intended for candidates participating in courses predominately in construction.

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

1 Identify human and environmental factors influencing thermal comfort.
2 Select appropriate ventilation systems for comfort and smoke control.
3 Select appropriate air conditioning systems.
4 Select appropriate cooling plant and associated equipment for air conditioning systems.

Credit points and level: 1 HN 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 Access 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 and HN 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, Problem Solving, in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

General information for centres (cont)

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.

Higher National Unit specification: statement of standards

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

Unit code: DW4N 35

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 & 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

Identify human and environmental factors influencing thermal comfort.

Knowledge and/or skills

- Physiological factors affecting thermal comfort
- Psychological factors affecting thermal comfort
- Thermal indices

Evidence Requirements

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

- identify body mechanisms and the characteristics of an internal environment which might influence the energy balance of a human body
- explain the use of thermal indices as design criteria

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all 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 2, 3 and 4 to form a single assessment paper.

Higher National Unit specification: statement of standards (cont)

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

Outcome 2

Select appropriate ventilation systems for comfort and smoke control.

Knowledge and/or skills

- Ventilation requirements of buildings
- Natural ventilation
- Mechanical ventilation

Evidence Requirements

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

- identify the factors affecting the need for ventilation
- explain the essential characteristics and components of ventilation systems used for comfort and contaminant control

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all 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, 3, and 4 to form a single assessment paper.

Outcome 3

Select appropriate air conditioning systems.

Knowledge and/or skills

- Building and client requirements
- Air conditioning systems characteristics

Evidence Requirements

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

- identify client and building requirements for air conditioning systems
- explain alternative strategies for providing air conditioning systems
- explain the operational characteristics of air conditioning plant in common use within the Building Services Industry
- compare the merits of central and packaged type air conditioning plants with reference to performance, space requirements, capital and operating costs

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all 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, 2, and 4 to form a single assessment paper.

Outcome 4

Select appropriate cooling plant and associated equipment for air conditioning systems.

Knowledge and/or skills

- Vapour compression and absorption refrigeration systems
- Refrigeration plant and equipment

Evidence Requirements

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

- explain the basic concepts of refrigeration cycles
- summarise the characteristics of refrigeration plant and equipment

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all 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.

Higher National Unit specification: statement of standards (cont)

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

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, 2, and 3 to form a single assessment paper.

Administrative Information

Unit code: DW4N 35

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

Superclass category: TH

Date of publication: June 2006

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

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 is designed to develop the candidate's understanding of the factors which affect human thermal comfort. It will also seek to provide the candidate with an understanding of the purpose, installation and processes of ventilation and air conditioning equipment and associated refrigeration plant. It will enable candidates to interpret the ventilation and air conditioning requirements of a building, to develop practical air conditioning schemes for a range of environments and to evaluate the effectiveness of alternative schemes.

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 **Human and environmental factors influencing thermal comfort (8 hours)**

Physiological and psychological factors: Affecting human sensations, thermal indices and their use in the design of building services systems. Methods of predicting and assessing thermal comfort and the reliability of design criteria

2 **Selection of ventilation systems for comfort and safety (12 hours)**

Ventilation Requirements of Buildings

Factors to be considered:	Natural ventilation
	Mechanical ventilation
	Comfort
	Contaminants including Fire/smoke
System selection covering:	Ducting design
	Fan characteristics and selection
	Air distribution in spaces

3 **Selection of air conditioning systems (12 hours)**

Specification and Requirements

Analysis and interpretation:	Clients requirements
	Building operational requirements
	Design standards and publications
	Aesthetic considerations

	Energy requirements
Systems in use:	All air systems
	Air-water systems
	Unitary systems
	Low velocity
	High velocity
	Central plant
	Dual duct
	Perimeter induction
	Fan coil
	VAV systems
	Split systems
	Packaged equipment

4 **Operation and application of a refrigeration system (6 hours)**

Basic Concepts

Refrigeration systems:	Vapour compression
	Absorption system

Practical and Operating Characteristics

Components to be considered:	Refrigerants
	Compressors
	Condensers
	Evaporators
	Generators

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.

Higher National Unit specification: support notes (cont)

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

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 development 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	✓	✓	✓	✓	
Writing	✓	✓	✓	✓	
Oral					
2 Numeracy					
Using Number					
Using Graphical Information					
3 IT					
Using Information Technology					
4 Problem Solving					
Critical Thinking	✓	✓	✓	✓	
Planning and Organising					
Reviewing and Evaluating	✓	✓	✓	✓	
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.

Higher National Unit specification: support notes (cont)

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs,* which is available on the SQA website **www.sqa.org.uk.**

General information for candidates

Unit title: Building Services: Ventilation, Air Conditioning and Refrigeration

This Unit has been designed to provide you with an understanding of the factors which affect human thermal comfort. It will also seek to provide you with a broad understanding of the purpose, installation and processes of ventilation and air conditioning equipment and associated refrigeration plant. It will enable you to interpret the ventilation and air conditioning requirements of a building, to develop practical air conditioning schemes for a range of environments and to evaluate the effectiveness of alternative schemes. The Unit is intended for candidates participating in courses predominately in construction.

On completion of the Unit you should be able to:

1 Identify human and environmental factors influencing thermal comfort.
2 Select appropriate ventilation systems for comfort and smoke control.
3 Select appropriate air conditioning systems.
4 Select appropriate cooling plant and associated equipment for air conditioning systems.

The formal assessment for this Unit could consist of a single assessment paper lasting two hours. Alternatively four 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.