

National Unit Specification: general information

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

CODE F1AV 12

SUMMARY

This Unit will be suitable for candidates who have limited or no experience of Air Conditioning and Ventilation Technology within a Building Services Engineering environment.

This Unit aims to develop candidate knowledge and understanding of the principles of design, installation, commissioning, maintenance and operation of ventilation and air conditioning systems in non-complex low-rise commercial and industrial applications. It will enable candidates to interpret the ventilation and air conditioning requirements of a building, to develop practical solutions for a range of environments and to select appropriate plant and equipment.

OUTCOMES

- 1 Identify, describe and select design parameters and establish ventilation and air conditioning needs for non-complex commercial and industrial buildings.
- 2 Identify and calculate heating and cooling loads and select appropriate air conditioning systems for non-complex commercial and industrial buildings.
- 3 Determine ductwork and terminal device designs to satisfy the ventilation and air conditioning needs of non-complex commercial and industrial buildings.
- 4 Describe and identify commissioning, operational and maintenance requirements for ventilation and air conditioning systems for non-complex commercial and industrial buildings.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: XH

Publication date: February 2007

Source: Scottish Qualifications Authority

Version: 01

© Scottish Qualifications Authority 2007

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this Unit Specification can be purchased from the Scottish Qualifications Authority. The cost for each Unit Specification is £2.50. (A handling charge of £1.95 will apply to all orders for priced items.)

National Unit Specification: general information (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

CREDIT VALUE

1 credit at Higher (6 SCQF credit points at SCQF level 6*)

**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

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

- ◆ Numeracy (SCQF level 6)
- ◆ Problem Solving (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

This information will be provided by the NQ Product Team.

National Unit Specification: statement of standards

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

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 the Scottish Qualifications Authority.

OUTCOME 1

Identify, describe and select design parameters and establish ventilation and air conditioning needs for non-complex commercial and industrial buildings.

Performance Criteria

- (a) Identify and describe appropriate ventilation requirements for non-complex commercial and industrial buildings.
- (b) Describe the key factors influencing the choice of air conditioning and ventilation system.
- (c) Select an appropriate ventilation and air conditioning system for non-complex commercial and industrial buildings.

OUTCOME 2

Identify and calculate heating and cooling loads and select appropriate air conditioning systems for non-complex commercial and industrial buildings.

Performance Criteria

- (a) Identify and select design criteria for air conditioning systems using relevant industry guidelines.
- (b) Accurately calculate heating and cooling loads for non-complex commercial and industrial buildings.
- (c) Identify key psychrometric processes for air conditioning equipment and systems.
- (d) Compare the main characteristics of air conditioning systems.
- (e) Select appropriate air conditioning systems for non-complex commercial and industrial buildings.

OUTCOME 3

Determine ductwork and terminal device designs to satisfy the ventilation and air conditioning needs of non-complex commercial and industrial buildings.

Performance Criteria

- (a) Identify appropriate supply and extract air requirements for non-complex commercial and industrial buildings.
- (b) Define appropriate ductwork layout/s for non-complex commercial and industrial buildings.
- (c) Determine duct sizes and fan duties using relevant industry guidelines and manufacturer's data for non-complex commercial and industrial buildings.
- (d) Specify appropriate ductwork terminal devices for non-complex commercial and industrial buildings.

National Unit Specification: statement of standards (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

OUTCOME 4

Describe and identify commissioning, operational and maintenance requirements for ventilation and air conditioning systems for non-complex commercial and industrial buildings.

Performance Criteria

- (a) Explain the use of the main air flow measurement techniques and devices for the commissioning of air systems for non-complex commercial and industrial buildings.
- (b) Describe the key pre-commissioning requirements for air systems in non-complex commercial and industrial buildings.
- (c) Describe appropriate procedures for commissioning and system balancing.
- (d) Identify the key operational sequences and safety checks for ventilation and air conditioning systems.
- (e) Identify essential planned maintenance requirements for ventilation and air conditioning systems.

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.

In any assessment of Outcome 1, 2, 3 and 4 **all** content items should be assessed.

Candidates may be assessed on an Outcome by Outcome basis, combinations of Outcomes or by a single, holistic assessment covering Outcomes 1, 2, 3 and 4.

For Outcomes 1, 2, 3 and 4 written and/or oral evidence must be produced in controlled, supervised, closed-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 based on case study material. Candidates must not bring notes, textbooks or handouts to the assessment.

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

National Unit Specification: support notes

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

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 an optional Unit within the National Certificate in Building Services Engineering (SCQF level 6).

This Unit aims to develop candidate knowledge and understanding of the principles of design, installation and operation of ventilation and air conditioning systems in non-complex low-rise commercial and industrial applications. It will enable candidates to interpret the ventilation and air conditioning requirements of a building, to develop practical solutions for a range of environments and to select appropriate plant and equipment.

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 & 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

When delivered as part of the National Certificate in Building Services Engineering (SCQF level 6) this Unit has links with the Building Services Engineering Science (SCQF level 6), Building Services Engineering: Thermofluids (SCQF level 6), Refrigeration Technology (SCQF level 6) and Heating and Plumbing Technology (SCQF level 6) Units, it is recommended that it be delivered after or in parallel with these Units.

The use of case study material is particularly recommended for both the learning and assessment of this Unit.

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.

Formative work for the Unit could specifically include group discussion. Such an approach could be particularly beneficial to candidates with no industrial experience.

National Unit Specification: support notes (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

Opportunities for developing Core Skills

Accuracy in interpreting graphic information and the ability to calculate, apply and present complex data underpins delivery of the Unit. Numeracy involves a wide range of skills and requires a flexible approach to Air Conditioning technology which should be encouraged and developed as candidates undertake the award. Integrative assignments and project work will help to link this Unit with other related Units and foster skills development in a practical context.

Individual and group discussion of case studies is particularly recommended in formative work to support the development of practical problem solving skills, and to provide a stimulus for creative thinking and best practice. As candidates develop practical solutions for a range of environments they will evaluate factors affecting the design of ventilation and air conditioning systems. Numeracy should be a tool to be used and applied efficiently and critically in determining ductwork and terminal device designs and establishing a full range of commissioning, operational and maintenance requirements. Evaluation of systems will involve analysis and consideration of actual and potential effectiveness.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

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

The use of case study material is particularly recommended for both the learning and assessment components of this Unit.

Candidates may be assessed on an Outcome by Outcome basis, combinations of Outcomes or by a single, holistic assessment. In this Unit an appropriate instrument of assessment could be a question paper consisting of a balance of short answer, restricted response and structured questions based on case study material.

Preparation for assessment should include formative work with opportunities for constructive feedback. Well planned assignments and project work will also be useful preparation.

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 appropriate Units. For example:

- ◆ *Building Services Engineering Science* (SCQF level 6)
- ◆ *Building Services Engineering: Thermofluids* (SCQF level 6)
- ◆ *Refrigeration Technology* (SCQF level 6)
- ◆ *Heating and Plumbing Technology* (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.

National Unit Specification: support notes (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

National Unit Specification: statement of standards

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

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.

This Unit aims to develop the candidates knowledge and understanding of the principles of design, installation and operation of ventilation and air conditioning systems in **non-complex low-rise commercial** applications

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

- 1 Identify, describe and select design parameters and establish ventilation and air conditioning needs for non-complex commercial and industrial buildings (8 hours).

Specification and Requirements

- ◆ Analysis and interpretation:
 - Clients requirements
 - Building operational requirements
 - Ventilation
 - Air conditioning
 - Design standards and publications
- ◆ Factors influencing the decision:
 - Mechanical ventilation only
 - Air conditioning
 - Natural ventilation
- ◆ Inter-relation between:
 - Ventilation
 - Air conditioning
 - Mechanical building services

National Unit Specification: statement of standards (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

- 2 Identify and calculate heating and cooling loads and select appropriate air conditioning systems for non-complex commercial and industrial buildings (14 hours).

Heating and Cooling Load

Factors contributing to heating and cooling loads for an air-conditioned building:

- ◆ Fabric load
- ◆ Occupancy
- ◆ Lighting
- ◆ Electrical equipment
- ◆ Solar gain
- ◆ Use of tables and charts
- ◆ Rules of thumb for load estimating

Design of Air Conditioning Systems

- ◆ Classifications:
 - All air, low velocity, systems
 - Air-water systems
 - Unitary systems
- ◆ Systems in use:
 - Central plant
 - Dual duct
 - Split systems
 - VRV systems
 - Packaged equipment
 - Selection for application/building
- ◆ Design implications:
 - Space required
 - Maintenance
 - Capitol

Summer and Winter Psychrometric Cycles

- ◆ Psychrometric chart
- ◆ Processes on psychrometric chart
- ◆ Summer cycles
- ◆ Winter cycles

National Unit Specification: statement of standards (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

- 3 Determine ductwork and terminal device designs to satisfy the ventilation and air conditioning needs of non-complex commercial and industrial buildings (10 hours).

Duct Sizing

- ◆ Methods used to size ductwork:
- ◆ Total, static and velocity pressure
- ◆ Constant velocity
- ◆ Constant pressure drop
- ◆ Duct sizing charts
- ◆ Pressure loss through fittings

Fan Selection

- ◆ Fan types and characteristics:
 - Centrifugal fans
 - Propeller fans
 - Axial flow fans
 - Fan laws
 - Fan characteristics
 - Fan/system characteristics
 - System balancing
- 4 Describe and identify commissioning, operational and maintenance requirements for ventilation and air conditioning systems for non-complex commercial and industrial buildings (8 hours).

Commissioning

- ◆ Air flow measurement and control:
 - Total, static and velocity pressure
 - Manometers
 - Inclined manometer
 - Anemometers
 - Pitot-static tube
 - Duct traverse
 - Dampers
 - Terminal Units

National Unit Specification: statement of standards (cont)

UNIT Air Conditioning and Ventilation Technology (SCQF level 6)

Operational Sequences and Safety

- ◆ Factors for continued operation:
 - Operating sequences
 - Dampers
 - Fire dampers
 - Smoke control
 - Monitoring techniques

Maintenance Requirements

- ◆ Typical maintenance schedules:
 - Ductwork checks
 - leakage
 - cleaning
 - dampers
 - terminal Units
 - fan/motor
 - Air handling plant
 - filters
 - cooling coils
 - heater batteries
 - pipe-work and associated valves
 - water systems