



Higher National Unit specification

General information

Unit title: Aircraft Environmental Systems: Cabin Conditioning and Pressurisation (SCQF level 8)

Unit code: H94L 35

Superclass: XP

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Version: 01

Unit purpose

This Unit is designed to explain the operation and necessity of aircraft environmental systems. The learner will also gain knowledge of the relationship between cabin pressurisation and cabin conditioning. In addition the learner will gain knowledge of the requirement for and operation of aircraft oxygen systems.

The Unit is primarily aimed at learners who wish to work in the aircraft engineering industry.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Describe how the air conditioning system maintains and distributes suitable cabin air.
- 2 Analyse the function of cabin pressurisation control systems.
- 3 Evaluate the requirement for and operation of various oxygen systems.

Credit points and level

1 Higher National Unit credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. The Unit has no pre-requisites, however, it would be beneficial if the learner has a basic knowledge of aircraft and/or engineering theory. This may be evidenced by possession of the HNC Aircraft Engineering certificate.

Higher National Unit specification: General information (cont)

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Core Skills

There are opportunities to develop the Core Skill of *Communication* (Written Communication) at SCQF level 5 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.

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.

Higher National Unit specification: Statement of standards

Unit title: Aircraft Environmental Systems: Cabin Conditioning and Pressurisation (SCQF level 8)

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 how the air conditioning system maintains and distributes suitable cabin air.

Knowledge and/or Skills

- ◆ Ventilation
- ◆ Temperature
- ◆ Humidity control
- ◆ Unpressurised aircraft cabin air conditioning system
- ◆ Pressurised aircraft cabin air conditioning system
- ◆ No-bleed aircraft cabin air conditioning system

Outcome 2

Analyse the function of cabin pressurisation control systems.

Knowledge and/or Skills

- ◆ The requirements for cabin pressurisation
- ◆ How aircraft pressure is controlled
- ◆ Methods of cabin sealing and pressure testing

Outcome 3

Evaluate the requirement for and operation of various oxygen systems.

Knowledge and/or Skills

- ◆ The requirement for aircraft oxygen systems
- ◆ Methods of oxygen supply
- ◆ Testing and servicing
- ◆ Safety precautions

Higher National Unit specification: Statement of standards (cont)

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Evidence Requirements for this Unit

Outcomes 1 to 3 could be assessed individually or as part of a combined end of Unit assessment. Learners are required to provide written and/or oral recorded evidence, for all Outcomes, generated under closed-book supervised conditions.

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

Outcome 1

- ◆ define and explain the requirements for aircraft ventilation.
- ◆ define and explain the requirements for aircraft temperature control.
- ◆ define and explain the requirements for aircraft humidity control.
- ◆ describe unpressurised aircraft cabin conditioning — to include the principle of exhaust heat exchange; gas turbine exhaust heat exchanger; and the principle of combustion heating.
- ◆ describe a pressurised aircraft air conditioning system — to include the air supply or charge air; system components; the use of ram air; temperature control and air cycling; humidity control; filtration; distribution and zones.
- ◆ describe a no-bleed aircraft air conditioning system — to include the air supply; system components; the use of ram air; temperature control and air cycling; humidity control; filtration; distribution and zones.

Outcome 2

- ◆ analyse the requirement for cabin pressurisation — to include the physiological effects of altitude; differential altitude and aircraft structural limitations; and identification of standards of pressurisation.
- ◆ explain how aircraft pressure is controlled using one of the following methods; mechanical; electrical and/or computer controlled.
- ◆ explain various methods of cabin sealing and pressure testing.

Outcome 3

- ◆ evaluate the requirement for aircraft oxygen systems from an aircraft certification and physiological perspective.
- ◆ analyse one of the various methods of oxygen supply — to include the continuous flow oxygen system; pressure demand oxygen system; gaseous; chemical; liquid and/or sieve.
- ◆ explain the testing and servicing of one oxygen system to include pressure, leak testing and charging of the oxygen system.
- ◆ identify safety precautions during the servicing of one oxygen system — to include fire prevention and system contamination.



Higher National Unit Support Notes

Unit title: Aircraft Environmental Systems: Cabin Conditioning and Pressurisation (SCQF level 8)

Unit Support Notes are offered as guidance and 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 explain the operation and necessity of Aircraft Environmental Systems. The learner will also gain knowledge of the relationship between cabin pressurisation and cabin conditioning. In addition the learner will gain knowledge of the requirement for and operation of oxygen systems found on aircraft.

Content/context corresponding to Outcomes

The list of topics is given below for each Outcome to offer lecturers guidance on the level of coverage for each Outcome.

Outcome 1

- ◆ Explain ventilation, temperature, and humidity control:
 - Define each of the above
 - Explain the requirement for each of the above
- ◆ Describe an unpressurised aircraft cabin conditioning:
 - Describe the principle of exhaust heat exchange
 - Describe the principle of a gas turbine exhaust heat exchanger
 - Describe the principle of combustion heating
- ◆ Describe a pressurised aircraft air conditioning system:
 - Air supply or charge air
 - System components
 - The use of ram air
 - Temperature control and air cycling
 - Humidity control
 - Filtration
 - Distribution and zones

Higher National Unit Support Notes (cont)

Unit title: Aircraft Environmental Systems: Cabin Conditioning and Pressurisation (SCQF level 8)

- ◆ Describe a no-bleed aircraft air conditioning system:
 - Air supply
 - System components
 - The use of ram air
 - Temperature control and air cycling
 - Humidity control
 - Filtration
 - Distribution and zones

Outcome 1 considers the necessity for aircraft air conditioning systems in relation to the aircraft operating environment, human physiological needs and current certification regulations. These necessities lead to the control of ventilation, temperature and humidity and these are demonstrated for a variety of aircraft types utilising principles commonly found in un-pressurised, pressurised and 'no-bleed' aircraft. Whilst the 'no-bleed' system is currently utilised on a pressurised aircraft it is separated from the pressurised aircraft system air conditioning system 'Knowledge and/or Skills' of Outcome 1 due to its significantly different architecture and modus operandi.

Outcome 2

- ◆ Analyse the requirement for cabin pressurisation:
 - Explain the physiological effects of altitude
 - Explain differential altitude and aircraft structural limitations
 - Identify standards of pressurisation
- ◆ Explain how aircraft pressure is controlled:
 - Mechanical
 - Electrical
 - Computer controlled
- ◆ Explain various methods of cabin sealing and pressure testing:
 - Doors
 - Windows
 - Assembly/repair of structural items affecting cabin pressurisation
 - Aircraft systems introducing breaks in the pressurised structural envelope
 - Functional tests and leak rate tests

Outcome 2 considers the necessity for aircraft cabin pressurisation in relation to the aircraft operating environment, human physiological needs, aircraft structural limitations and current certification regulations. The methods of control are demonstrated for a variety of aircraft utilising a range of approaches including mechanical, electrical and computer control to meet the previously identified requirements. This Outcome concludes with the means to control the loss of cabin pressure through doors, windows, structural items (skins, stringers, frames, bulkheads etc), structural breaks introduced by other aircraft systems eg flight controls and the testing undertaken to ensure that air leak rates are within design limits.

Higher National Unit Support Notes (cont)

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Outcome 3

- ◆ Evaluate the requirement for aircraft oxygen systems
- ◆ Evaluate the various methods of oxygen supply:
 - Continuous flow oxygen system
 - Pressure demand oxygen system
 - Minimum mass flow supplemental oxygen system
 - Gaseous
 - Chemical
 - Liquid
 - Sieve
- ◆ Testing, servicing, and safety of oxygen systems:
 - Pressure and leak testing
 - Charging of oxygen systems
- ◆ Identify safety precautions during servicing of oxygen systems:
 - Fire Prevention
 - System contamination

Outcome 3 relates the requirement for aircraft oxygen system with the various designs currently employed to meet them. Each of the main methods employed is analysed from a system architecture and operational perspective allowing comparison between them to be made and advantages and disadvantages to be explored. This Outcome concludes with the analysis of the testing, servicing and safety precautions associated with an aircraft oxygen system.

Guidance on approaches to delivery of this Unit

It is logical to deliver this Unit sequentially by Outcome as the requirements for cabin ventilation and pressurisation introduced in Outcome 1 provide the foundation for the subsequent Outcomes.

Whilst the mode of delivery is at the discretion of the centre it is anticipated that traditional lectures will be supplemented by a range of media for example videos, simulations and actual aircraft components. Although the nature of this aircraft system will provide less opportunity for this than other similar Units/aircraft systems these strategies should be explored wherever possible in a bid to enhance the learning experience. In addition having access to relevant publications including Aircraft Maintenance Manuals (AMM), and Illustrated Parts Catalogues (IPC) for a range of aircraft is recommended.

Higher National Unit Support Notes (cont)

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The Knowledge and/or Skills are written in a manner which should allow them to be delivered in the sequence presented as the subsequent concepts increase in complexity. In addition to the general advice for the Unit, it should be noted that the 'no-bleed' system Knowledge and/or Skills final bullet point in Outcome 1, whilst utilised on a pressurised aircraft, is written discretely from the pressurised system intentionally as a result of the significantly different architecture associated with it and it is envisaged that it should be delivered following the delivery of traditional pressurised aircraft air-conditioning systems.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Holistic assessment is encouraged and learners could be assessed by a single one and half hour closed-book assessment covering all three Outcomes after completion of the teaching of the Unit. The assessment could be comprised of a number of multiple-choice and extended response questions enabling Unit Evidence Requirements to be met and breadth and depth of learner knowledge to be demonstrated. This assessment approach should reduce the frequency of assessment/re-assessment events and ensure more time is afforded for teaching and learning whilst meeting the Evidence Requirements of the Unit.

Accurate records should be made of the assessment instruments used showing how evidence is generated for each assessment/examination, giving marking schemes and/or checklists, etc. Records of learners' achievements should be kept. These records will be available for external verification.

Learners should not know in advance the questions on which they will be assessed and different questions should be set on each assessment occasion. This assessment must be carried out under closed-book supervised conditions. In order to gain an assessment pass, learners will need to demonstrate that they can achieve the minimum requirements for this Unit.

Opportunities for 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 social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Higher National Unit Support Notes (cont)

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Opportunities for developing Core and other essential skills

Learners will have opportunities to develop the Core Skill component of *Communication* Written Communication at SCQF level 5 in this Unit throughout all Outcomes. This could be achieved through accurate written answers to formative and summative assessment questions.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Aircraft Environmental Systems: Cabin Conditioning and Pressurisation (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is designed to teach you about the operation and necessity of aircraft environmental systems. You will also gain knowledge of the relationship between cabin pressurisation and cabin air conditioning. In addition you will gain knowledge of oxygen systems found on aircraft.

On completion of this Unit you will be able to:

- 1 Describe how the air conditioning system maintains and distributes suitable cabin air.
- 2 Analyse the function of cabin pressurisation control systems.
- 3 Evaluate the requirement for and operation of various oxygen systems.

You will be assessed under closed-book supervised conditions on all of the Knowledge and/or Skills contained in the three Outcomes and to complete the Unit successfully you will have to achieve a satisfactory level of performance in the assessment event/s.

The Unit may be of particular interest if you are interested in pursuing a career in aircraft engineering either in a practical maintenance role or if you intend to look to undertake an engineering function such as design.

You will have opportunities to develop the Core Skill component of *Communication* (Written Communication) at SCQF level 5 in this Unit throughout all Outcomes, although there is no automatic certification of Core Skills or Core Skills components. This could be achieved through accurate written answers to formative and summative assessment extended response questions.