## National Unit Specification: general information

**UNIT** Aircraft Hydraulic and Pneumatic Systems (SCQF level 6)

**CODE** F5GW 12

### SUMMARY

This Unit may form part of a National Qualification Group Award but may also be offered on a free-standing basis.

This Unit is designed to provide candidates with basic knowledge and understanding of hydraulic and pneumatic systems as found on modern aircraft. During the delivery of the Unit candidates will learn to describe the principles involved in generating power using hydraulic and pneumatic systems. They will also develop the knowledge and understanding to describe the operation of an aircraft hydraulic and pneumatic system. Candidates will also construct and test a fluid power circuit relevant to an aircraft application.

This Unit is suitable for candidates who:

- are undertaking the study of this subject for the first time
- wish to gain a basic knowledge and understanding of aircraft hydraulic and pneumatic systems
- are considering a career in the aviation industry and wish to gain a basic knowledge and understanding of aircraft hydraulic and pneumatic systems

### OUTCOMES

1 Describe the principles of generating hydraulic and pneumatic power.
2 Describe the operation of a given aircraft hydraulic system.
3 Describe the operation of a given aircraft pneumatic system.
4 Construct and test a fluid power circuit related to an aircraft application.

**Administrative Information**

**Superclass:** XP

**Publication date:** March 2009

**Source:** Scottish Qualifications Authority

**Version:** 01

## National Unit Specification: general information (cont)

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, it would be beneficial if candidates had attained one of the following, or equivalent:

- Standard Grade Physics (Credit level)
- Intermediate 2 Physics
- *Aeronautical Fundamentals (SCQF level 6)*

### CREDIT VALUE

1 credit at SCQF level 6 (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.*

### CORE SKILLS

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

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

Problem Solving (SCQF level 6)

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

## National Unit Specification: statement of standards

## UNIT Aircraft Hydraulic and Pneumatic Systems (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 SQA.

### OUTCOME 1

Describe the principles of generating hydraulic and pneumatic power.

### Performance Criteria

(a) Compare correctly the principle of hydraulic operation to that of a mechanical lever.
(b) Explain correctly how force, pressure and area affect the generation of hydraulic power.
(c) Explain correctly the characteristics and behaviour of compressed air.

### OUTCOME 2

Describe the operation of a given aircraft hydraulic system.

### Performance Criteria

(a) Identify correctly the major components in a given aircraft hydraulic system.
(b) Describe correctly how the main components of the given aircraft hydraulic system interrelate.
(c) Describe correctly how the given hydraulic system operates.
(d) State correctly the types of fluid used in the generation of hydraulic power.
(e) State correctly the advantages and disadvantages of aircraft hydraulic systems.

### OUTCOME 3

Describe the operation of a given aircraft pneumatic system.

### Performance Criteria

(a) Identify correctly the major components in a given aircraft pneumatic system.
(b) Describe correctly how the main components of a given aircraft pneumatic system interrelate.
(c) Describe correctly how a given aircraft pneumatic system operates.
(d) State correctly the sources of supply to the given aircraft pneumatic system.
(e) State correctly the advantages and disadvantages of aircraft pneumatics systems.

### OUTCOME 4

Construct and test a fluid power circuit related to an aircraft application.

(a) Interpret correctly fluid power component symbols.
(b) Construct correctly a fluid power circuit.
(c) Test the fluid power circuit to ensure its functionality.
(d) Perform the construction and testing of the fluid power circuit in a safe manner.

## National Unit Specification: statement of standards (cont)

## UNIT Aircraft Hydraulic and Pneumatic Systems (SCQF level 6)

### EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Candidate evidence should be in the form of written and/or recorded oral and performance evidence supplemented with an assessor observation checklist should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

**Outcomes 1, 2 and 3 (Written and Oral Evidence)**

Outcomes 1 to 3 may be assessed by a single, holistic assessment or as a combination of assessments or on an individual basis. Assessment of the three Outcomes must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment. The total time set aside for assessment of Outcomes 1, 2 and 3 must not exceed 2 hours and 15 minutes.

**With regard to Outcome 2**

- Candidates must use a block diagram to illustrate how the main components of the given aircraft hydraulic system interrelate
- Candidates must state two advantages and two disadvantages of aircraft hydraulic systems

**With regard to Outcome 3**

- Candidates must use a block diagram to illustrate how the main components of the given aircraft pneumatic system interrelate
- Candidates must state two advantages and two disadvantages of aircraft pneumatics systems

**Outcome 4 (Performance Evidence)**

Outcome 4 must be assessed by a single, holistic practical assessment which must be designed to ensure that candidates can generate sufficient evidence to satisfy the Outcome and Performance Criteria.

It is essential that candidates are inducted into current Health and Safety practices and procedures at the start of delivering of the Unit and that these are reinforced throughout Unit delivery.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

# National Unit Specification: support notes

## UNIT Aircraft Hydraulic and Pneumatic Systems (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

This Unit forms part of the National Qualification Group Award in Aeronautical Engineering at SCQF level 6, but may also be offered on a free-standing basis.

This Unit is designed to provide candidates with basic knowledge and understanding of hydraulic and pneumatic systems as found on modern aircraft. On successful completion of the Unit candidates will be able to describe the principles involved in generating power using hydraulic and pneumatic systems. They will also have the knowledge and understanding to describe the operation of an aircraft hydraulic and pneumatic system. Candidates will also be capable of constructing and testing a simple fluid power circuit relevant to an aircraft application.

It is strongly recommended that the Unit *Aeronautical Engineering: Fundamentals* at SCQF level 6 be delivered to candidates before this Unit.

This Unit may also provide part of the knowledge elements required to meet other awarding body specialist qualifications.

The following paragraphs show details of a suggested range of topics which may be delivered to candidates to support and underpin the requirements set out in the Outcomes, Performance Criteria and Evidence Requirements.

1 The comparison between the inputs and outputs of a simple lever to that of a hydraulic system in generating a force. The use of the pressure formula in conjunction with a diagram of a Bramah's press to explain how pressure in a hydraulic system is altered by either changes in the input force or area of piston. Explanation of the relationship between pressure, volume and temperature along with the energy and power requirements in the use of compressed air. Calculations involving of practical applications compressed air using the gas laws and energy and power formula.

2 Identification of the major components used in an aircraft's hydraulic systems and explanation of how a aircraft hydraulic system operates by sketching a simple system using block diagrams to identify the arrangement of components, demonstrating how they interrelate with each other. Explanation of the advantages and disadvantages of using a hydraulic system in an aircraft and description of the different types of hydraulic fluid that can be used in a hydraulic system.

3 Identification of the major components used in an aircraft's pneumatic system and explanation of how a pneumatic system operates by sketching a simple system using block diagrams to identify the arrangement of components, demonstrating how the components interrelate with each other. Explanation of the advantages and disadvantages of using a pneumatic system in an aircraft and the different sources of supply to a pneumatic system ie APU, main engine or ground cart.

## National Unit Specification: support notes (cont)

**UNIT** Aircraft Hydraulic and Pneumatic Systems (SCQF level 6)

4 Interpretation of component symbols used in both hydraulic and pneumatic system. Construction of simple fluid circuits using hydraulic or pneumatic components and carry out a functional check of the circuit constructed, ensuring that all relevant safety precaution are taken in both the construction and testing of the circuit.

### GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. A range of approaches can be used in the delivery of the Unit. Outcomes 1, 2 and 3 may be delivered mainly in a classroom, although practical experimental work to illustrate the principles behind the generation of hydraulic and pneumatic power and hangar visits to see practical examples of aircraft hydraulic and pneumatic systems would help to reinforce the theory taught in the classroom. Delivery of the three Outcomes may involve a combination of lectures, group discussion, tutorial work, experimental work and hangar visits. Outcome 4 may be delivered in a practical engineering or aviation environment where candidates have access to a suitable range of pneumatic and/or hydraulic equipment and components. It is essential that candidates are inducted into current Health and Safety practices and procedures when first entering practical areas and that these practices and procedures are reinforced while candidates are constructing and testing fluid power circuits.

Videos, DVDs etc. on aspects of Health and Safety, such as dangers in engineering workshops and aviation areas, may also support learning.

Wall charts and boards displaying examples of hydraulic and pneumatic components and systems would greatly assist candidate learning.

Candidates may be provided with appropriate notes, handouts and tutorials during Unit delivery to support their learning.

### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Aspects of the Core Skill of *Problem Solving*, that is, critical thinking, planning, organising, reviewing and evaluating, will be naturally developed in this Unit. Candidates apply knowledge and demonstrate understanding of the operation of hydraulic and pneumatic systems on modern aircraft. They have to identify and interpret fluid power component symbols and consider a range of relevant factors to construct and test a fluid power circuit. Adherence to health and safety requirements will underpin approaches to practical work. Discussion of technical issues and assessor feedback during formative work will reinforce the ability to evaluate decision making.

## National Unit Specification: support notes (cont)

## UNIT Aircraft Hydraulic and Pneumatic Systems (SCQF level 6)

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

**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 communications 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).*

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop sound knowledge, understanding and skills in the principles behind the generation of power using pneumatics or hydraulics, the operation of aircraft hydraulic and pneumatic circuits and while constructing and testing hydraulic and/or pneumatic circuits.

Where summative assessment of Outcomes 1, 2 and 3 is carried out on an individual Outcome basis the assessment papers may consist of short answer and restricted-response questions, or objective questions (eg multi-choice questions), or a mixture of both. Individual assessment events may last no longer than 30 minutes. It is recommended that each assessment event is carried out after the completion of the delivery of the corresponding Outcome. Assessment papers may be suitable for on-line delivery.

Where Outcomes 1, 2 and 3 are assessed using a single, holistic assessment the assessment paper may consist of short answer and restricted response questions, or objective questions or a combination of both. The assessment paper may be suitable for on-line delivery.

Outcome 4 must be assessed by a practical exercise involving candidates in constructing and testing a simple hydraulic or pneumatic circuit. An observation checklist(s) should be used to record candidate evidence.

### 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**