Higher National Unit Specification

General information for centres

Unit title: Aircraft Landing Gear

Unit code: F0M8 35

Unit purpose: This Unit is designed to explain the operation and requirements of aircraft landing gear systems. The candidate will gain a knowledge and understanding of aircraft landing gear, braking and tyre configurations and requirements. This Unit also provides partial coverage of EASA 66 Module 11.

On completion of this Unit the candidate will be able to:

1 Describe the operation of aircraft shock absorbing and steering systems.
2 Analyse the requirements and operation of aircraft landing gear.
3 Analyse the requirements and operation of aircraft brakes.
4 Analyse the requirements for aircraft wheels, tyres and tubes.

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

Core Skills: There are opportunities to develop the Core Skill of Communication (Reading) 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.

Assessment: Candidates can be assessed either by four 45-minute assessments or by a single three hour assessment. If four 45-minute assessments are used, the first assessment covers Outcome 1, the second assessment covers Outcome 2, the third assessment covers Outcome 3, and the fourth assessment covers Outcome 4. If a single three hour assessment is used, the assessment will cover all four Outcomes.

General information for centres (cont)

The assessment paper/s can be carried out on a sampling basis composed of a number of short answers, restricted response and/or multi-choice questions under supervised, closed-book, controlled conditions.

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 candidates' achievements should be kept. These records will be available for external verification.

Higher National Unit specification: statement of standards

Unit title: Aircraft Landing Gear

Unit code: F0M8 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.

Outcome 1

Describe the operation of aircraft shock absorbing and steering systems

Knowledge and/or skills

- Shock absorber types
- Oleo-pneumatic shock absorber design
- Nose wheel steering
- Shimmy dampers

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 1 should be provided on a sample basis. The evidence may be presented in response to specific questions. Each candidate will need evidence to show that she/he can describe the operation of aircraft shock absorbing and steering systems based on a sample of the four knowledge items above.

To ensure that candidates will not be able to foresee which items they will be questioned about, a different sample of two of the four knowledge and/or skills items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items. Where an item is sampled, a candidate's response can be judged satisfactory where the evidence shows that the candidate can:

- evaluate the various shock absorber types — to include solid and fluid spring design
- explain the oleo-pneumatic shock absorber design - to include components, operation, and servicing
- explain nose wheel steering — to include the operation, components and wheel alignment
- explain shimmy dampers - to include the operation, components, and necessity

The assessment for this Outcome is by a closed-book assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Landing Gear

Outcome 2

Analyse the requirements and operation of aircraft landing gear

Knowledge and/or skills

- Landing gear configurations
- Landing gear requirements
- Landing gear extension and retraction system
- Indication and warning systems used

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 2 should be provided on a sample basis. The evidence may be presented in response to specific questions. Each candidate will need evidence to show that she/he can describe the operation of aircraft shock absorbing and steering systems based on a sample of the four knowledge items above.

To ensure that candidates will not be able to foresee which items they will be questioned about, a different sample of two of the four knowledge and/or skills items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items. Where an item is sampled, a candidate's response can be judged satisfactory where the evidence shows that the candidate can:

- identify the various landing gear configurations — to include tailwheel, tricycle, bicycle gear, single main gear, quadricycle gear, and/or multi-bogey gear
- analyse the design requirements for landing gear — to include shock absorbing, tyres, brakes, steering, extension and retraction, and/or strength
- explain the operation of a landing gear extension and retraction system — to include the typical hydraulic system layout, components, and emergency system
- explain the landing gear indication, warning, and safety systems — to include the cockpit requirements, safety switches, gear indicators, and ground locks

The assessment for this Outcome is by a closed-book assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Landing Gear

Outcome 3

Analyse the requirements and operation of aircraft brakes

Knowledge and/or skills

- Various aircraft brakes types
- Aircraft brake actuating systems
- Anti-skid brake operation and construction

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 3 should be provided on a sample basis. The evidence may be presented in response to specific questions. Each candidate will need evidence to show that she/he can analyse the requirements and operation of aircraft brakes based on a sample of the three knowledge items above.

To ensure that candidates will not be able to foresee which items they will be questioned about, a different sample of two of the three knowledge and/or skills items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items. Where an item is sampled, a candidate's response can be judged satisfactory where the evidence shows that the candidate can:

- evaluate and identify various types of brakes — to include single and multiple disc brakes
- analyse the operation and construction of aircraft brake actuating systems — to include master cylinders, boosted, and power brakes
- analyse the necessity and operation of anti-skid brake control systems — to include system operation, layout, and components

The assessment for this Outcome is by a closed-book assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Landing Gear

Outcome 4

Analyse the requirements for aircraft wheels, tyres and tubes

Knowledge and/or skills

- Aircraft wheel requirements.
- Aircraft tyre construction.
- Aircraft tube construction.

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 4 should be provided on a sample basis. The evidence may be presented in response to specific questions. Each candidate will need evidence to show that she/he can analyse the requirements for aircraft wheels, tyres and/or tubes based on a sample of the three knowledge items above.

To ensure that candidates will not be able to foresee which items they will be questioned about, a different sample of two of the three knowledge and/or skills items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items. Where an item is sampled, a candidate's response can be judged satisfactory where the evidence shows that the candidate can:

- analyse the requirement for aircraft wheel types — to include one-piece, two-piece, and removable flange
- analyse the requirement for aircraft tyres and construction — to include tyre types, construction, inspection and repair
- analyse the requirement for aircraft tube construction and selection — to include construction, selection and inspection

The assessment for this Outcome is by a closed-book assessment.

Assessment guidelines for the Unit

Evidence for this Unit can be generated through assessment events. Candidates will be assessed either by four 45-minute assessments or by a single three hour assessment. If four 45-minute assessments are used, the first assessment covers Outcome 1, the second assessment covers Outcome 2, the third assessment covers Outcome 3, and the fourth assessment covers Outcome 4. If a single three hour assessment is used, the assessment will cover all four Outcomes.

The assessments should logically follow the instruction for each Outcome or after all Outcomes have been delivered. The number of assessments is at the discretion of the centre.

The assessment/s will cover all Outcomes and be carried out on a sampling basis of the knowledge and/or skills requirements of each Outcome, all of which the must be taught and available for assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Landing Gear

The assessment/s should be composed of short answers, restricted response and/or multi-choice questions. Candidates 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, candidates will need to demonstrate that they can achieve the minimum requirements for this Unit.

Administrative Information

Unit code: F0M8 35

Unit title: Aircraft Landing Gear

Superclass category: XP

Original date of publication: August 2006

Version: 01

History of Changes:

Version	Description of change	Date

Source: SQA

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: Aircraft Landing Gear

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 provide candidates with professional knowledge and skills for the specific occupational area of aircraft engineering. It is logical to deliver this Unit sequentially by outcome, with assignments following each outcome. The number of assessments is at the discretion of the centre.

Assessment of this Unit is to be carried out by centres using the assessment instruments they consider most appropriate, although assessment instruments used should follow the general guidelines offered by the Scottish Qualification Authority (SQA). For assessments that are carried out under controlled condition, candidates should not be allowed to bring into assessment events textbooks, handouts or other prepared material.

This Unit is designed to explain the operation and necessity of aircraft landing gear. The candidate will gain a knowledge and understanding of aircraft landing gear, braking and tyre configurations, components and requirements.

The Unit will also provide partial knowledge requirement to meet EASA IR Part 66 Aircraft Maintenance License (Module 11) Landing Gear.

Content/context corresponding to Outcomes

This Unit has been written in order to allow candidates to develop knowledge, understanding and appreciation of aircraft landing gear systems.

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

Outcome 1:

Describe the operation of aircraft shock absorbing and steering systems.

- Evaluate the various shock absorber types.
  - Rigid Gear
  - Bungee cord
  - Spring steel
  - Liquid spring design

- Explain the oleo-pneumatic shock absorber design:
  - Components
  - Operation
  - Servicing

- Explain nose wheel steering:
  - Operation of a typical nose wheel steering system
  - Nose wheel steering system components
  - Wheel alignment

- Shimmy dampers:
  - The operation of shimmy dampers
  - System components
  - Necessity

Outcome 2:

Analyse the requirements and operation of aircraft landing gear.

- Identify the various landing gear configurations:
  - Tailwheel
  - Tricycle
  - Bicycle gear
  - Single main gear
  - Quadricycle gear
  - Multi-bogey gear

- Analyse the various landing gear requirements:
  - Shock absorbing
  - Tyres
  - Brakes
  - Steering
  - Extension and retraction
  - Strength.

- Explain the operation of a landing gear extension and retraction system:
  - Operation of a typical hydraulic system layout and emergency system
  - Components used in the hydraulic system

- Explain the indication, warning, and safety systems:
  - Cockpit requirements
  - Safety switches
  - Gear indicators
  - Ground locks

Outcome 3:

Analyse the requirements and operation of aircraft brakes.

- Evaluate and identify various types of brakes:
  - Single and multiple disc brakes

- Analyse the operation and construction of aircraft brake actuating systems:
  - Master cylinders
  - Boosted brakes
  - Power brakes
  - Brake actuating system operation, inspection, and service

- Analyse the necessity and operation of anti-skid brake control systems:
  - System operation
  - Layout
  - Components

Outcome 4:

Analyse the requirements for aircraft wheels, tyres and tubes.

- Analyse the requirement for aircraft wheel types:
  - One-piece
  - Two-piece
  - Removable flange

- Analyse the requirement for aircraft tyres and construction:
  - Tyre types
  - Tyre construction
  - Inspection and repair

- Analyse the requirement for aircraft tube construction and selection:
  - Construction
  - Selection
  - Inspection

Guidance on the delivery and assessment of this Unit

It is logical to deliver this Unit sequentially by Outcome, with assignments following each Outcome. The number of assessments is at the discretion of the centre.

Assessment of this Unit is to be carried out by centres using the assessment instruments they consider most appropriate, although assessment instruments used should follow the general guidelines offered by the Scottish Qualification Authority (SQA). For assessments that are carried out under controlled condition, candidates should not be allowed to bring into assessment events textbooks, handouts or other prepared material.

Opportunities for developing Core Skills

Candidates will have opportunities to develop the Core Skill component of Communication (Reading) throughout all Outcomes. This could be achieved through an accurate account of the important ideas or significant information from the aircraft maintenance manuals or schematics then making a basic evaluation of the communication supported by evidence.

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Landing Gear

Open learning

As most of this Unit is verified with performance evidence open learning would be difficult. However, the assessments could be made available on demand for a suitably experienced candidate.

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. 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 SQA's website: **www.sqa.org.uk**.

General information for candidates

Unit title: Aircraft Landing Gear

This Unit is designed to explain the operation and requirements of aircraft landing gear systems. The candidate will gain the knowledge and understanding of aircraft landing gear, braking and tyre configurations and requirements. This Unit also provides partial coverage of EASA 66 Module 11.

On completion of this Unit the candidate will be able to:

1 Describe the operation of aircraft shock absorbing and steering systems.
2 Analyse the requirements and operation of aircraft landing gear.
3 Analyse the requirements and operation of aircraft brakes.
4 Analyse the requirements for aircraft wheels, tyres and tubes.

You will be assessed on a sampling basis where two-thirds of each Outcome will be assessed under closed-book supervised conditions. In order to gain an assessment pass, candidates will need to demonstrate that they can achieve the minimum requirements for this Unit.

The Unit may be of particular interest to candidates who are interested in pursuing a career in aircraft maintenance engineering as it partially covers the knowledge requirements for module 11 (Aircraft Landing Gear) of EASA IR part 66 aircraft licensing requirements for both mechanical and avionics engineers.