City & Guilds Level 3 Diploma for On-Aircraft Maintenance Category A (2675-04)

Version 5.0 (September 2024)

Qualification Handbook

Qualification at a glance

Subject area	Engineering
City & Guilds number	2675
Age group approved	Learners aged 16 or above
Entry requirements	City & Guilds does not set a minimum requirement for entry to this qualification. As a guide, the Engineering Manufacturing framework for this qualification is suitable for applicants who have five GCSEs grades C and above in English, Maths and Science.
Assessment	Multiple Choice Examination, Written Examination
Grading	Pass/Fail
Approvals	Automatic approval/Full approval required
Support materials	Centre handbook
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Regulatory reference number	GLH	TQT
City & Guilds Level 3 Diploma for On-Aircraft Maintenance Category A	2675-04	600/1927/X	595	720

Version and date	Change detail	Section
3.1 July 2013	Amended unit 006, 007 and 009	Units
3.2 January 2014	Inserted notes to centres	Assessment
3.3 September 2017	Added TQT details Deleted reference to QCF	Qualification at a glance and Structure Throughout
4.0 July 2018	Amended range to unit 006 to insert updated regulation references in the range TQT section updated with an additional explanation paragraph	Units Structure
5.0 September 2024	Handbook reviewed and updated to new template. Update on the Civil Aviation Authority (CAA) replacing all European Union Aviation Safety Agency (EASA) regulations	Throughout Throughout

Contents

1 Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	This qualification is for candidates who work or want to work in the aeronautical engineering sector across a range of roles and career routes.
What does the qualification cover?	This qualification allows candidates to learn, develop and practise the skills required for employment and/or career progression in the aeronautical engineering sector.
What opportunities for progression are there?	Further opportunities for candidates include: • Level 2 NVQ Diploma in Aeronautical Engineering (City & Guilds 1789) * • Level 3 Diploma in Aircraft Engineering (City & Guilds 2675) • Level 3 Certificate/Diploma in Aircraft Manufacturing (City & Guilds 4597) * Level 3 Diploma in Survival Equipment (City & Guilds 5412) *
Is it part of an apprenticeship framework or initiative?	This qualification is recognised as a technical certificate in the Engineering Manufacture apprenticeship framework.

* This qualification has been withdrawn and is no longer available for new candidate registrations. However, candidates who have already enrolled on the qualification will be granted a period of time to complete the qualification and achieve certification.

Structure

To achieve the City & Guilds Level 3 Diploma for On-Aircraft Maintenance Category A, learners must achieve 47 credits from the mandatory units, **plus** the required minimum from one of the following pathways: 31 credits from Category A1, **or** 31 credits from Category A2 **or** 25 credits from Category A3 **or** 25 credits from Category A4:

City & Guilds unit number	Unit title	Credit value	GLH
Mandatory units:			
Learners must achieve all **seven** mandatory units.			
2675-001	Fundamentals of aviation mathematics and science	5	40
2675-002	Fundamentals of aircraft electric, digital techniques and electronic instrument systems	5	40
2675-003	Fundamentals of aircraft materials and hardware	11	90
2675-004	Fundamentals of aircraft maintenance practices	11	90
2675-005	Fundamentals of aerodynamics	5	40
2675-006	Fundamentals of civil aviation legislation	5	30
2675-035	Human factors in aviation	5	40
Category A1 – Aeroplanes (Turbine)			
Learners must achieve all **three** pathway units.			
2675-007	Fundamentals of aircraft aerodynamics, structures and systems for turbine engines	12	115
2675-010	Fundamentals of aircraft gas turbine engines	13	115
2675-012	Fundamentals of aircraft propellers	6	50
Category A2 – Aeroplanes (Piston)			
Learners must achieve all **three** pathway units.			
2675-008	Fundamentals of aircraft aerodynamics, structures and systems for piston engines	12	100
2675-011	Fundamentals of aircraft piston engines	13	115

2675-012	Fundamentals of aircraft propellers	6	50
Category A4 – Helicopters (Piston)			
Learners must achieve all **two** pathway units.			
2675-009	Fundamentals of helicopter aerodynamics, structures and systems	12	115
2675-010	Fundamentals of aircraft gas turbine engines	13	115
Category A4 – Helicopters (Piston)			
Learners must achieve all **two** pathway units.			
2675-009	Fundamentals of helicopter aerodynamics, structures and systems	12	115
2675-011	Fundamentals of aircraft piston engines	13	115

Total Qualification Time (TQT)

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT comprises of the following two elements:

1) the number of hours that an awarding organisation has assigned to a qualification for guided learning
2) an estimate of the number of hours a learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by – but, unlike guided learning, not under the immediate guidance or supervision of – a lecturer, supervisor, tutor or other appropriate provider of education or training.

Title and level	GLH	TQT
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2 Centre requirements

Approval

Full approval

To offer this qualification, new centres will need to gain both centre and qualification approval. Please refer to the document **Centre Approval Process: Quality Assurance Standards** for further information

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Automatic approval

If your centre is approved to offer the Level 2 Certificate in Aeronautical Engineering (2597) will be automatically approved to run the Level 2 routes in this qualification.

If your centre is approved to offer the City & Guilds Certificate in Aeronautical Engineering (2661) you will be automatically approved to offer the new 2675-04. Please refer to the document **Centre Approval Process: Quality Assurance Standards** for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Resource requirements

Physical resources and site agreements

Centres can use specially designated areas within a centre to assess, for example, the installation of specialised electrical systems, alignment and setting up of electric motors and driven devices (pumps, compressors, and generators). The equipment, systems and machinery must meet industrial standards and be capable of being used under normal working conditions, for example electric motors must have a method of applying sufficient power and not be connected up to show movement.

Please note that to gather the requisite evidence, access to flight worthy aircraft is required on a regular basis.

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training (this knowledge must be to the same level as the training being delivered)
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and quality assurance, and that it takes account of any national or legislative developments.

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City and Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

Standards and rigorous quality assurance are maintained by the use of:

- Internal quality assurance
- City & Guilds external quality assurance.

In order to carry out the quality assurance role, Internal Quality Assurers must

- have appropriate teaching and vocational knowledge and expertise
- have experience in quality management/internal quality assurance
- hold or be working towards an appropriate teaching/training/assessing qualification
- be familiar with the occupation and technical content covered within the qualification.

External quality assurance for the qualification will be provided by City & Guilds EQA process. EQAs are appointed by City & Guilds to approve centres, and to monitor the assessment and internal quality assurance carried out by centres. External quality assurance is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres.

The role of the EQA is to:

- provide advice and support to centre staff
- ensure the quality and consistency of assessments and marking/grading within and between centres by the use of systematic sampling
- provide feedback to centres and to City & Guilds.

Learner entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

The SEMTA Engineering Manufacture apprenticeship framework suggests that:

Employers would be interested in candidates that:

- Are keen and motivated to work in an engineering environment
- Are willing to undertake a course of training both on-the-job and off-the-job and apply this learning in the workplace

- Have previous work experience or employment in the sector
- Have completed a 14 to 19 Diploma in Engineering or Manufacturing
- Have completed a Young Apprenticeship in Engineering or other related area
- Have GCSEs in English, Maths and Science
- Have completed tests in basic numeracy, literacy and communication skills and have spatial awareness.

As a guide, the Engineering Manufacturing framework is suitable for applicants who have five GCSEs grades A to C in English, Maths and Science. The selection process on behalf of employers may include initial assessment where applicants will be asked if they have any qualifications or experience that can be accredited against the requirements of the apprenticeship. They may also be required to take tests in basic numeracy and literacy, communications skills and spatial awareness. There may also be an interview to ensure applicants have selected the right occupational sector and are motivated to become an apprentice, as undertaking an apprenticeship is a major commitment for both the individual and the employer.

Age restrictions

There is no age restriction for this qualification unless this is a legal requirement of the process or the environment.

Access arrangements and reasonable adjustments

City & Guilds has considered the design of this qualification and its assessments in order to best support accessibility and inclusion for all learners. We understand however that individuals have diverse learning needs and may require reasonable adjustments to fully participate. Reasonable adjustments, such as additional time or alternative formats, may be provided to accommodate learners with disabilities and support fair access to assessment.

Access arrangements are adjustments that allow candidates with disabilities, special educational needs, and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

Equality legislation requires City & Guilds to make reasonable adjustments where a disabled person would be at a substantial disadvantage in undertaking an assessment.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Please refer to the Joint Council for Qualifications (JCQ) access arrangements and reasonable adjustments and access arrangements - when and how applications need to be made to City & Guilds. For more information documents are available on the City & Guilds website.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific training needs
- support and guidance they may need when working towards their qualification
- any units they have already completed or credit they have accumulated which is relevant to the qualification
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the learner fully understands the requirements of the qualification, their responsibilities as a learner and the responsibilities of the centre. This information can be recorded on a learning contract.

Inclusion and diversity

City & Guilds is committed to improving inclusion and diversity within the way we work and how we deliver our purpose which is to help people and organisations develop the skills they need for growth.

More information and guidance to support centres in supporting inclusion and diversity through the delivery of City & Guilds qualifications can be found here:

Inclusion and diversity | City & Guilds (cityandguilds.com)

Sustainability

City & Guilds are committed to net zero. Our ambition is to reduce our carbon emissions by at least 50% before 2030 and develop environmentally responsible operations to achieve net zero by 2040 or sooner if we can. City & Guilds is committed to supporting qualifications that support our customers to consider sustainability and their environmental footprint.

More information and guidance to support centres in developing sustainable practices through the delivery of City & Guilds qualifications can be found here:

Our Pathway to Net Zero | City & Guilds (cityandguilds.com)

Centres should consider their own carbon footprint when delivering this qualification and consider reasonable and practical ways of delivering this qualification with sustainability in mind. This could include:

- reviewing purchasing and procurement processes (such as buying in bulk to reduce the amount of travel time and energy, considering and investing in the use of components that can be reused, instead of the use of disposable or single use consumables)

- reusing components wherever possible
- waste procedures (ensuring that waste is minimised, recycling of components is in place wherever possible)
- minimising water use and considering options for reuse/salvage as part of plumbing activities wherever possible.

Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments	www.cityandguilds.com

4 Assessment

Assessment of the qualification

This qualification is assessed by a combination of e-assessments (multiple choice tests) and centre devised assignments covering practical skills and underpinning knowledge. The table below provides details on the assessment methods for each unit.

Please note: A note to Centres regarding CAA exams with a pass mark of 75% ('A' licence grade). Where a Learner has achieved a mark of between 65% and 74% on any of these exams, the centre can still claim the City & Guilds equivalent unit.
Centres as normal, should complete the results entry process using the equivalent City & Guilds units from 2675-04 via the Walled Garden. For external quality assurance purposes a record of the CAA exam results must be kept within the Learner's portfolio.

Assessment types			
Unit	**Title**	**Assessment method**	**Where to obtain assessment materials**
2675-001	Fundamentals of aviation mathematics and science	**Multiple choice exam**	**www.cityandguilds.com**
2675-002	Fundamentals of aircraft electric, digital techniques and electronic instrument systems	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-003	Fundamentals of aircraft materials and hardware	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-004	Fundamentals of aircraft maintenance practices	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-005	Fundamentals of aerodynamics	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2575-006	Fundamentals of civil aviation legislation	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-007	Fundamentals of aircraft aerodynamics, structures and systems for turbine engines	**External Examination**	**www.caa.co.uk www.cityandguilds.com**

Assessment types			
Unit	**Title**	**Assessment method**	**Where to obtain assessment materials**
2675-008	Fundamentals of aircraft aerodynamics, structures and systems for piston engines	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-009	Fundamentals of helicopter aerodynamics, structures and systems	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-010	Fundamentals of aircraft gas turbine engines	**External Examination / Short answer question paper**	**www.caa.co.uk www.cityandguilds.com**
2675-011	Fundamentals of aircraft piston engines	**External Examination**	**www.caa.co.uk www.cityandguilds.com**
2675-012	Fundamentals of aircraft propellers	**External Examination / Short answer question paper**	**www.caa.co.uk www.cityandguilds.com**
2675-035	Human factors in aviation	**Multiple choice exam**	**www.cityandguilds.com**

Assessment strategy

City & Guilds has written the following assessments to use with this qualification:

- live assignments that can be downloaded from the City & Guilds website
- sample assignments that can be downloaded from the City & Guilds website.

The following units are assessed via the Civil Aviation Authority (CAA):

2675-002	Fundamentals of aircraft electric, digital techniques and electronic instrument systems
2675-003	Fundamentals of aircraft materials and hardware
2675-004	Fundamentals of aircraft maintenance practices
2675-005	Fundamentals of aerodynamics
2575-006	Fundamentals of civil aviation legislation
2675-007	Fundamentals of aircraft aerodynamics, structures and systems for turbine engines
2675-008	Fundamentals of aircraft aerodynamics, structures and systems for piston engines
2675-009	Fundamentals of helicopter aerodynamics, structures and systems
2675-010	Fundamentals of aircraft gas turbine engines
2675-011	Fundamentals of aircraft piston engines
2675-012	Fundamentals of aircraft propellers

Online multiple-choice assessments

The online multiple-choice assessments for this qualification will be in the form of a question with three options to choose from (a, b, c) and calculators are not permitted. This is to bring it in line with the CAA exams and the expectation from industry that candidates can do basic mathematics (including long division) without a calculator. Please refer to the 2675-001 sample questions to understand the level of maths required of candidates – this will be available to download from the City & Guilds website.

Online multiple-choice tests are externally set, automatically marked exams, scheduled and delivered by the centre under invigilated conditions

Short answer questions

Short answer question tests are externally set by City & Guilds, scheduled and delivered by the centre under invigilated conditions. Assessments are marked by the centre using the marking guide provided in the relevant assessment materials which are available to download from www.cityandguilds.com. All assessment materials must be held securely by centres and not made available to candidates.

Assessments should be scheduled when the candidate is prepared and ready to be assessed and invigilated in line with City & Guild's invigilation policy. At the end of an assessment, candidates should not be permitted to take any materials away with them. Centres must have arrangements in place to store and handle assessment and marking materials securely at all times.

Time constraints

Timings for e-assessments are indicated in the test specifications. The centre set and marked assignments will need to have some limits to the time available. The time available may be based on practicalities such as scheduling marking during the required period, but the time available must always be sufficient for candidates to tackle the task fairly, and candidates will be able to negotiate extra time in appropriate circumstances.

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification.

Without evidence of formal qualifications, candidates must demonstrate adequate prior knowledge and experience to ensure they have the potential to gain the qualification. It is recognised that learners come from a wealth of applicable backgrounds and in these cases it is recommended that the centre assess learner competence against their claims.

Test specifications

The way the knowledge is covered by each test is laid out in the tables below:

Test 1: 2675-001	Duration: 70 minutes		
Unit	**Outcome**	**Number of questions**	**Percentage %**
001	01 Be able to use arithmetic and algebra to solve problems	7	15
	02 Be able to use simple graphs	3	6
	03 Know Imperial, SI and US Customary units used in aeronautical engineering	4	9
	04 Know the nature of matter	3	7
	05 Know the principles of statics	8	18
	06 Know the principles of kinetics	4	9
	07 Know the principles of dynamics	7	16
	08 Know the principles of fluid dynamics	4	9
	09 Know the properties of the earth's atmosphere	5	11
	Total	**45**	**100%**

Test 2: 2675-010	Duration: 60 minutes		
Unit	**Outcome**	**Number of questions**	**Percentage %**
010	01 Understand the fundamental principles of aircraft gas turbine engines	4	14
	02 Understand the operation of gas turbine engines	5	20
	03 Understand gas turbine fuels, lubricants and associated systems	4	16

Test 2: 2675-010	Duration: 60 minutes		
	04 Understand gas turbine starting, ignition and air system	2	8
	05 Understand gas turbine engine indication systems	3	12
	06 Understand auxiliary power units and power-plant installations	2	8
	07 Understand gas turbine engine monitoring, fire protection and ground operation	5	20
	Total	25	100%

Test 3: 2675-012	Duration: 60 minutes		
Unit	**Outcome**	**Number of questions**	**Percentage %**
012	01 Understand propellor theory	7	33
	02 Understand propellor construction	3	15
	03 Understand propellor pitch control	3	15
	04 Understand propellor ice and rain protection systems	2	10
	05 Understand propellor maintenance, storage and preservation	5	27
	Total	20	100%

Test 4: 2675-035	Duration: 60 minutes		
Unit	**Outcome**	**Number of questions**	**Percentage %**
035	01 Understand why human factors are important in aviation	2	5
	02 Know features of human performance	6	15
	03 Know aspects of social psychology	6	15
	04 Know personal factors that affect human performance	6	15
	05 Know physical aspects of working environments that affect human performance	5	12.5
	06 Know categories of task that can affect human performance	5	12.5
	07 Understand communication in the workplace	3	7.5
	08 Understand how human error occurs	3	7.5
	09 Know hazards and risks in aeronautical engineering environments	4	10
	Total	40	100%

5 Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- title
- level
- guided learning hours (GLH)
- assessment type
- credit value
- unit aim
- learning outcomes, which are comprised of a number of assessment criteria
- range statements
- supporting information
- relationship to NOS/mapping to occupational/apprenticeship standards.

Guidance for delivery of the units

This qualification comprises a number of **units**. A unit describes what is expected of a competent person in particular aspects of their job.

Each **unit** is divided into **learning outcomes** which describe in further detail the skills and knowledge that a candidate should possess.

Each **learning outcome** has a set of **assessment criteria** (performance and knowledge and understanding) which specify the desired criteria that must be satisfied before an individual can be said to have performed to the agreed standard.

Range statements define the breadth or scope of a learning outcome and its assessment criteria by setting out the various circumstances in which they are to be applied.

Supporting information provides guidance of the evidence requirement for the unit and specific guidance on delivery and range statements. Centres are advised to review this information carefully before delivering the unit.

Unit 001 Fundamentals of aviation mathematics and science

UAN:	H/503/0806
Level:	2
Credit value:	5
GLH:	40
Assessment type:	Multiple choice exam
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 2 NOS Units 002, 014 etc.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	The aim of this unit is to give learners a solid grounding in basic mathematics and science to enable further aeronautical engineering studies.

Learning outcome

The learner will:

LO1 Be able to use arithmetic and algebra to solve problems

Assessment criteria

The learner can:

AC1.1 perform arithmetical calculations using whole numbers
AC1.2 prioritise basic functions within arithmetical calculations
AC1.3 manipulate fractions and decimals to solve problems
AC1.4 manipulate ratios, proportions, averages and percentages to solve problems
AC1.5 calculate areas and volumes
AC1.6 calculate simple powers of numbers
AC1.7 manipulate simple algebraic expressions.

Range

AC1.1

Add
Subtract
Multiply
Divide
Positive and negative whole numbers

AC1.2
Using BODMAS

AC1.3
Simplify and solve problems
Understand numerator, denominator
Reduce fractions
Convert between mixed numbers and improper fractions
Add, subtract, multiply, divide fractions
Define ‘decimal’
Express values to given number of decimal places
Add, subtract, multiply, divide decimals
Convert between decimals and fractions
Make calculations using simple decimals and fractions

AC1.4
Simplify and solve problems
Explain percentages
Convert percentages to decimals and fractions and vice versa
Explain ‘ratio’ and ‘proportion’
Make simple engineering calculations involving ratios and proportion

AC1.5
Importance of units
State and use formulae for areas of:
- Triangle
- Rectangle
- Circle

State and use formulae for volumes of:
- Triangular prisms
- Rectangular boxes
- Cylinders

AC1.6
Squares
Square roots
Cubes
Cube roots
In conjunction with areas and volumes

AC1.7
Simplify, change the form of and evaluate first order algebraic expressions:
Add, subtract, multiply, divide

Use of brackets
Simple algebraic fractions.

Learning outcome

The learner will:

LO2 Be able to use simple graphs

Assessment criteria

The learner can:

AC2.1 describe the basic principles of graphical representation
AC2.2 identify graphs of simple equations and common functions
AC2.3 extract data from graphs used in aeronautical engineering.

Range

AC2.1
Axes
Grid lines
Origin
Scales
Calculating key values
Plotting graphs

AC2.2
Eg:
y =mx + c
sine wave
square wave

AC2.3
Eg:
ICAO temp/altitude
Fuel data
Engine performance

Learning outcome

The learner will:

LO3 Know Imperial, SI and US Customary units used in aeronautical engineering

Assessment criteria

The learner can:

AC3.1 state base and derived SI units and representative symbols

AC3.2 state the meaning of prefixes used with SI units
AC3.3 state Imperial units and representative symbols
AC3.4 state US customary units used in aviation
AC3.5 convert between Imperial, US customary and SI units.

Range

AC3.1
Explain:
Base
Derived
State base units and symbols:
Time
Length
Mass
Temperature
Current
State derived units and symbols:
Area
Volume
Density
Acceleration
Force
Pressure
Inertia
Impulse
Momentum
Torque
Energy (work)
Power
Voltage
Resistance
Frequency
Explain the relationship between Kelvin and degrees Celsius
Specific gravity as a ratio

AC3.2
State meaning of prefixes and identify symbols:
Micro
Milli
Kilo
Mega
Convert between prefixes

AC3.3
Including US gallons and US (short) ton
Length
Mass
Velocity

Temperature (Centigrade, Kelvin, Fahrenheit)
Pressure
Volume
Torque

AC3.4
Convert between:
Centimetres and inches
Kilograms to pounds
Litres to gallons (Imperial and US)
US to UK gallons
Litres to kilograms
lbf to Nm.

Learning outcome

The learner will:

LO4 Know the nature of matter

Assessment criteria

The learner can:

AC4.1 describe the structure of atoms
AC4.2 explain concepts of chemical elements
AC4.3 explain concepts of chemical compounds
AC4.4 define the three 'classical' states of matter
AC4.5 explain how matter changes between states.

Range

AC4.1
Simple explanation of:
Proton
Neutron
Electron
Nucleus
Atom

AC4.2
Simple explanations:
Define 'element'
How elements are different from one another
Basic element structure

AC4.3
Simple explanations:
Define compound, mixture
Chemical bonds

Explain ‘molecule’

AC4.4
Solid
Liquid
Gas

AC4.5
Eg:
Constant temperature
Volume changes (especially expansion of water when frozen)
Physical behaviour of molecules
Latent heat.

Learning outcome

The learner will:

LO5 Know principles of statics

Assessment criteria

The learner can:

AC5.1 explain forces, moments and couples
AC5.2 make simple calculations involving forces, moments and couples
AC5.3 explain equilibrium and centre of gravity
AC5.4 make calculations involving equilibrium and centre of gravity
AC5.5 explain stress, strain and elasticity, compression, shear and torsion
AC5.6 describe properties of solids, liquids and gases
AC5.7 explain pressure and buoyancy in liquids
AC5.8 solve problems involving pressure in liquids.

Range

AC5.1
Define:
Force
Moment
Couple
Vector
How forces, moments and couples can be represented as vectors using simple diagrams

AC5.2
Using SI units only
Force
Perpendicular distance
Simple calculations for: force, moments, couples

AC5.3

Using two forces

AC5.4
Simple calculations involving two forces

AC5.5
Define and explain the basics of: stress, strain, elasticity, compression, shear, torsion

AC5.6
Basic properties eg: shape, viscosity, volume, compressibility

AC5.7
Define:
Buoyancy
Explain the relationship between density, mass and volume
Specific gravity
Explain how barometers work
Upward thrust on a body in a fluid

AC5.8
Including measurement of pressure using a simple barometer
Pressure at depth in a fluid.

Learning outcome

The learner will:

LO6 Know principles of Kinetics

Assessment criteria

The learner can:

AC6.1 explain basic principles of linear motion
AC6.2 explain basic principles of rotational movement
AC6.3 explain basic principles of periodic motion
AC6.4 explain properties of simple mechanical systems.

Range

AC6.1
Explain and use basic principles:
Uniform motion in a straight line
Velocity
Momentum
Linear motion under constant acceleration (eg: gravity)
Make simple calculations involving linear motion

AC6.2
Explain and use basic principles:
Uniform circular movement
Centrifugal/centripetal forces

Make simple calculations involving rotational motion

AC6.3
Explain and use basic principles:

- Define pendular movement

Simple theory of:

- Vibration
- Harmonics
- Resonance

AC6.4
Explain and use basic principles:
Define:
Velocity ratio
Mechanical advantage
Efficiency
Make simple calculations involving simple mechanical systems.

Learning outcome

The learner will:

LO7 Know principles of dynamics

Assessment criteria

The learner can:

AC7.1 explain principles of dynamics involving mass, force and inertia
AC7.2 explain principles of dynamics involving energy, work and power
AC7.3 explain principles of dynamics involving heat
AC7.4 explain principles of dynamics involving efficiency
AC7.5 explain principles of dynamics involving momentum and impulse
AC7.6 explain gyroscopic principles
AC7.7 explain basic principles of dynamics involving friction.

Range

AC7.1
Explain and use the basic principles:
Units
Make simple calculations for mass and force only

AC7.2
Explain and use the basic principles:
Units
Make simple calculations

AC7.3
Explain and use the basic principles:

Units
Conduction
Radiation

AC7.4
Explain and use the basic principles:

AC7.5
Explain and use the basic principles:
Units
Make simple calculations involving momentum

AC7.6
Explain:
The purpose of a gyroscope
Application in aircraft
Component parts of a basic gyroscope: spinning mass, gimbals etc
Precession
Safety precautions for working with gyroscopic equipment

AC7.7
Basic principles
Units
Make simple calculations.
Static Friction
Dynamic Friction
Co-efficient of Friction

Learning outcome

The learner will:

LO8 Know principles of fluid dynamics

Assessment criteria

The learner can:

AC8.1 make calculations using the specific gravity and density of a fluid
AC8.2 explain principles of viscosity, fluid resistance and the effects of streamlining
AC8.3 explain principles and effects of compressibility in a fluid
AC8.4 explain principles of types of fluid pressure
AC8.5 explain the principles of a venturi.

Range

AC8.1
Explain basic principles
Units/lack of units
Simple calculations involving aircraft fuel and other fluids

AC8.2
Explain basic principles
Units

AC8.3
Explain basic principles
Units
Include qualitative effects of contaminants such as water in hydraulic oil

AC8.4
Explain basic principles of:
Static
Dynamic
Total
Units

AC8.5
Basic principles
Including an explanation of the simplified form of Bernoulli's Theorem

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Learning outcome

The learner will:

LO9 Know properties of the Earth's atmosphere

Assessment criteria

The learner can:

AC9.1 describe the relationship between the three main temperature scales
AC9.2 define the term 'heat' and how it relates to temperature
AC9.3 describe the composition and structure of the Earth's atmosphere
AC9.4 explain how pressure, density and temperature vary with altitude
AC9.5 explain pressure terms
AC9.6 explain the need for a standard atmosphere.

Range

AC9.1
Fahrenheit
Centigrade
Kelvin
Absolute zero

AC9.2
Using simple illustrations

AC9.3
Percentages of gases

Layers of the atmosphere

AC9.4
Including the effects at the Tropopause
ISA graphs

AC9.5
Explain and illustrate their relationship using simple examples
Atmospheric pressure
Absolute pressure
Differential pressure

AC9.6
Eg:
Standard measurements, particularly of altitude
Standardisation of instruments/displays
Engine performance

Unit 001 Fundamentals of aviation mathematics and science

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers the basic knowledge requirements – for Maths and Science for category ‘A’ licences.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise technical details

Unit 002 Fundamentals of aircraft electricals, digital techniques and electronic instrument systems

UAN:	A/503/0813
Level:	3
Credit value:	5
GLH:	40
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 120, 134 etc.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner an understanding of the fundamental principles of aircraft electrical systems. It contains the complete syllabi of CAA Part-66 Modules 3 and 5 for category A licences.

Learning outcome

The learner will:

LO1 Understand basic electron theory, static electricity and conduction

Assessment criteria

The learner can:

AC1.1 describe the structure and distribution of electrical charges in particles of matter
AC1.2 describe the molecular structure of electrical materials
AC1.3 explain the nature of static electricity
AC1.4 explain the electrostatic laws of attraction and repulsion
AC1.5 explain how static electricity can be quantified
AC1.6 describe electrostatic build-up on aircraft surfaces
AC1.7 explain how electricity flows through various media

Range

AC1.1
Overview of structure and distribution of electrical charges in: atoms, molecules, ions and compounds, sufficient to allow understanding of the concepts in the remaining outcomes

AC1.2
Overview of the molecular structure of: conductors, semiconductors and insulators

AC1.3
Overview of:
How static electricity is created
The structure and distribution of electrostatic charges
The levels of voltage involved in a static discharge
Potential damage in and around aircraft in flight and on the ground

AC1.4
Qualitative explanation

AC1.5
Simple explanation of: units of charge, Coulomb's Law

AC1.6
How static charge builds up and where
Measures to prevent it doing harm eg:

- Bonding
- Wick dischargers
- Conductive tyres
- Special paints etc.

AC1.7
Simple explanation of conduction in solids, liquids, gases and vacuum.

Learning outcome

The learner will:

LO2 Understand common electrical terminology

Assessment criteria

The learner can:

AC2.1 explain terminology associated with voltage
AC2.2 explain terminology associated with current
AC2.3 explain terminology associated with resistance
AC2.4 explain terminology associated with electrical charge.

Range

AC2.1
Basic definition, units and factors affecting: potential difference, electromotive force

AC2.2
Basic definition, units and factors affecting: current, conventional current flow, electron flow

AC2.3
Basic definition, units and factors affecting: resistance, conductance

AC2.4
Basic definition, units and factors affecting electrical charge.

Learning outcome

The learner will:

LO3 Understand how electricity can be generated

Assessment criteria

The learner can:

AC3.1 describe in simple terms common methods of electricity generation
AC3.2 describe basic principles how electricity is generated in aircraft.

Range

AC3.1
Basic explanation of:
Light
Heat
Friction
Pressure
Chemical action
Magnetism and motion

AC3.2
Basic explanation of principles:
Light eg: photo-electric cell to control lighting levels
Heat eg: thermocouples, fire wires etc.
Friction eg: Static
Pressure eg: Piezo-electricity
Chemical action eg: aircraft battery
Magnetism and motion eg: aircraft generator.

Learning outcome

The learner will:

LO4 Understand DC sources of electricity in aircraft

Assessment criteria

The learner can:

AC4.1 describe the basic construction of battery cells
AC4.2 describe how battery cells can be connected in a system
AC4.3 explain what internal resistance is and how it affects the performance of the battery
AC4.4 describe the construction and operation of a thermocouple
AC4.5 describe the construction and operation of a photocell.

Range

AC4.1
Construction and basic chemical action of:
Primary cells
Secondary cells
Lead acid cells liquid and gel
Nickel cadmium cells
Other alkaline cells (eg: re-chargeable dry cells)

AC4.2
Methods and reasons for connecting in:
Series
Parallel

AC4.3
Qualitative explanation only

AC4.4
Basic explanation of:
Materials
Construction
Operation

AC4.5
Basic explanation of:
Materials
Construction
Operation.

Learning outcome

The learner will:

LO5 Understand fundamental AC theory

Assessment criteria

The learner can:

AC5.1 describe the main features of sinusoidal waveforms
AC5.2 explain how voltage, current and power values are calculated
AC5.3 describe the main features of triangular and square waveforms
AC5.4 explain the qualitative principles of single and 3-phase supplies.

Range

AC5.1
Phase
Period
Frequency
Cycle

AC5.2
Simple explanation and calculations
Instantaneous
Average
Root mean square
Peak
Peak to peak

AC5.3
Phase
Period
Frequency
Cycle

AC5.4
Using simple waveform diagrams
Standard 3-phase aircraft supply voltages and frequencies
Derived single phase supply values

Learning outcome

The learner will:

LO6 Understand aircraft electronic instrument systems

Assessment criteria

The learner can:

AC6.1 explain reasons for the ergonomic layout of typical aircraft flight decks or cockpits
AC6.2 describe the system arrangement for typical primary flight displays (PFD)
AC6.3 describe system arrangements for typical multi-function displays (MFD)
AC6.4 describe system arrangements for typical engine indicating and crew alerting systems (EICAS).

Range

AC6.1
Eg: information priorities, ease of access, minimum distraction, positioning of information sources

AC6.2
Block diagram level of: information sources, major components, cockpit layout, alerting methods

AC6.3
Block diagram level of: information sources, major components, cockpit layout, alerting methods

AC6.4
Block diagram level of: information sources, major components, cockpit layout, alerting methods.

Learning outcome

The learner will:

LO7 Understand computer terminology and aircraft computer technology

Assessment criteria

The learner can:

AC7.1 explain common computer technology
AC7.2 describe computer technology used in aircraft systems.

Range

AC7.1
Including: bit, byte, software, hardware, CPU, IC, RAM, ROM, PROM, EPROM, flash memory, CD/DVD, storage, input, output

AC7.2
Basic knowledge of eg: data bus, multiplexer, encoder, decoder, redundancy, duplex, triplex, quadruplex, navigation computer, air data computer, controller, ARINC data bus standards

Learning outcome

The learner will:

LO8 Know the special handling techniques associated with Electrostatic Sensitive Devices

Assessment criteria

The learner can:

AC8.1 describe what is meant by an electrostatic sensitive device

AC8.2 describe the damage that could be caused to an SSD by static discharge

AC8.3 describe the protection that can be applied to devices and precautions that can be taken by personnel to prevent static damage.

Range

AC8.1

Basic description

AC8.2

Eg: size of voltage generated in a discharge, types of discharge,
immediate complete failure, delayed failure, intermittent failure, reduced performance

AC8.3

Eg: in-built protection by design, external in-circuit protection, shielding
Handling precautions, earthing straps, grounded mats and work surfaces.

Unit 002 Fundamentals of aircraft electricals, digital techniques and electronic instrument systems

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers the basic knowledge requirements for Electrical Fundamentals and digital techniques electronic instrument systems for the Category A Licences.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise technical details.

Unit 003 Fundamentals of aircraft materials and hardware

UAN:	R/503/0817
Level:	2
Credit value:	11
GLH:	90
Type of assessment:	External examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 013, 144 etc
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	The aim of the Unit is to provide learners with a detailed understanding of aircraft materials and hardware. The Unit covers the complete knowledge requirement for CAA Part-66 Module 6 for A Category licences.

Learning outcome

The learner will:

LO1 Know the properties of aircraft ferrous materials

Assessment criteria

The learner can:

AC1.1 describe the basic characteristics, properties and identification of ferrous materials
AC1.2 describe heat treatment and applications of alloy steels.

Range

AC1.1

Eg: Alloying elements, including: carbon, chromium, nickel, vanadium, molybdenum, manganese, silicon

Properties eg: density, strength, elasticity, ductility, malleability, toughness, hardness, brittleness, creep and fatigue resistance, work hardening, corrosion resistance, hot and cold performance

Identification markings on stock material

AC1.2
Annealing
Tempering
Quench Hardening
Normalising
Surface hardening
Including: Carburising, Nitriding, flame hardening, induction hardening

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Learning outcome

The learner will:

LO2 Know the properties of aircraft non-ferrous materials

Assessment criteria

The learner can:

AC2.1 describe characteristics, properties and identification of nonferrous metals used in aircraft
AC2.2 describe heat treatment and applications of non-ferrous materials.

Range

AC2.1
Eg:
Common alloying elements – all of: copper, magnesium silicon, zinc
Properties eg: density, strength, elasticity, ductility, malleability, toughness, hardness, brittleness, creep and fatigue resistance, work hardening, corrosion resistance, hot and cold performance
Advanced alloys eg: titanium and aluminium/lithium alloys
Identification marks on stock material

AC2.2
Annealing
Solution treatment
Precipitation hardening

Learning outcome

The learner will:

LO3 Know the properties of composite and other non-metallic materials

Assessment criteria

The learner can:

AC3.1 describe characteristics, properties and identification of composite and other non-metallic materials
AC3.2 describe characteristics, properties and identification of sealants and bonding agents
AC3.3 describe detection of typical defects/deterioration in composite material
AC3.4 explain typical repair techniques for composite materials
AC3.5 explain the preservation and maintenance of non-metallic materials.

Range

AC3.1
Fibres (eg: glass, carbon, boron, aramid)
Typical resins
Sandwich structures
Plastics
Polymers (eg thermoplastics, thermosetting, elastomers)
Sandwich construction
Adhesives and glues

AC3.2
Eg:
Polyurethane
Silicones
Thread locking compound
Resins
Glues

AC3.3
Eg: cracking, warping, splitting, de-bonding, delamination, Barely Visible Impact Damage (BVID)

AC3.4
Pre-impregnated layup (Prepreg)
Wet layup
Fibre orientation
Autoclave
Vacuum bag
Typical repair tools
Safety precautions

AC3.5
Protective treatments
Inspection

Learning outcome

The learner will:

LO4 Know wood and fabric airframe construction

Assessment criteria

The learner can:

AC4.1 describe construction methods for wooden airframe structures
AC4.2 describe characteristics and properties of the types of wood and glue used in aeroplanes
AC4.3 describe methods of detecting defects in wooden structures
AC4.4 describe methods of repairing wooden structures
AC4.5 describe characteristics, properties and types of fabric used in aeroplanes
AC4.6 describe inspection methods for fabrics
AC4.7 describe the common defects found in fabrics
AC4.8 describe common methods of repairing fabric coverings.

Range

AC4.1
Eg: structural members, fabric or plywood skin, type of joints, general direction of grain, reinforcement, use of glues, screws and other fasteners.

AC4.2
Wood: type of wood used eg: spruce

AC4.3
Eg: visual inspection joint testing, measurement

AC4.4
Eg: splicing, scarf joint, reinforcement, replacement, patching (scarf, splayed, oval, plug)

AC4.5
Eg: cotton, linen, Dacron, fibre glass
Classification of fabrics, stitching and lacing, anti-tear tape

AC4.6
Eg: visual inspection, fabric punch tester; tensile testing, slackness, peeling of re-enforcing fabric from ply wood panels,

AC4.7
Tears, deterioration of fabric due to: humidity, extremes of temperature, chemical action, fungal growth, erosion, brittleness

AC4.8
Eg: small tears – sew together and dope a pinked patch on top; larger tear – sewn in patch repairs; un-sewn doped-on patch repairs; panel replacement

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Learning outcome

The learner will:

LO5 Understand corrosion in aircraft materials

Assessment criteria

The learner can:

AC5.1 describe the chemical fundamentals of corrosion
AC5.2 describe the causes and formation of corrosion
AC5.3 describe the types of corrosion and their identification
AC5.4 explain which materials are susceptible to corrosion.

Range

AC5.1
Direct chemical action
Galvanic action process

AC5.2
Environment
Wear
Stress
Microbiological action

AC5.3
Surface, pitting, stress, fatigue, Intergranular, fretting, crevice, exfoliation, filiform

AC5.4
Steels
Aluminium alloys
Magnesium alloys
Copper
Silver

Learning outcome

The learner will:

LO6 Understand aircraft fasteners

Assessment criteria

The learner can:

AC6.1 explain the nomenclature of screw threads
AC6.2 explain thread systems
AC6.3 explain the specification of aircraft bolts
AC6.4 describe typical nuts, screws, studs and locking devices used on aircraft
AC6.5 describe typical rivet systems.

Range

AC6.1
Crest, form, root, thread angle, pitch, lead, major and minor diameters, depth, threads per inch single and multi-start threads, right- and left-hand threads

AC6.2
Eg: ACME. square, buttress, vee threads, BSF, BSW, BA, Unified, ISO metric

AC6.3
Eg:
Hexagon head
Cap bolts
Slotted head
High shear bolts
Twelve-point head

AC6.4
Machine screws, studs, washers, plain nuts, thin nuts, slotted nuts, castellated nuts, self-locking nuts, washers, typical thread locking devices, locking wire, tab and spring washers
Locking plates, quick release fasteners, keys, circlips, cotter pins

AC6.5
Overview of: solid and blind rivets, countersunk and snap head rivets
Describe heat treatment
Typical riveting tools

Learning outcome

The learner will:

LO7 Know aircraft pipes, unions and fittings

Assessment criteria

The learner can:

AC7.1 describe aircraft pipes and connectors
AC7.2 describe unions for hydraulic, fuel, pneumatic and oxygen systems

Range

AC7.1
ICAO pipeline symbols
Pipeline construction
Pipe material
Eg – Aluminium alloy, stainless steel, Tungum (bronze copper alloy)
Hose material

Eg: – Plastic, metal, rubber

AC7.2
Flared couplings
Flareless couplings
British metric swaged pipe couplings
American Flareless couplings
Arsaero pipe couplings
Swaged end couplings
Cryogenic pipe couplings
Gamah couplings
Sliding couplings
Quick release connectors
V-flange couplings
Typical pipeline clamping

Learning outcome

The learner will:

LO8 know aircraft bearings

Assessment criteria

The learner can:

AC8.1 describe the purpose of bearings
AC8.2 describe types of bearing and their construction
AC8.3 describe bearing loads and their application.

Range

AC8.1
Reduce friction and wear
Component alignment

AC8.2
Including: plain, roller, taper roller, needle roller, ball, thrust
Materials
Lubrication
Construction

AC8.3
Eg:
Axial
Radial
Bending (perpendicular to axis)

Pre-loading
Typical aircraft applications

Learning outcome

The learner will:

LO9 Know aircraft transmission systems and control cable mechanisms

Assessment criteria

The learner can:

AC9.1 describe gears systems, ratios and their application
AC9.2 describe belts and pulleys, chains and sprockets
AC9.3 describe types of control cable and mechanisms
AC9.4 describe pulleys and cable system components
AC9.5 describe bowden cables
AC9.6 describe flexible control systems.

Range

AC9.1
Eg:
Spur gears
Helical gears
Bevel gears
Worm gears
Rack and pinion
Application of gears
Driver gear
Driven gear
Idler gears
Gear ratio
Shaft drives
Spline drives

AC9.2
Overview of:
Drive belts and pulleys
Screw jacks
Sprockets
Typical applications
Chains

AC9.3
Overview of:

Cable materials
Typical cable end fittings
Typical turnbuckles
Control stops
Typical rigging and maintenance procedures

AC9.4
Pulleys
Cable tensioning
Tensiometer

AC9.5
Overview of:
Cable material
Conduit
Typical end fittings
Adjustment
Pull system only

AC9.6
Overview of:
Teleflex
Conduit
Core cable
Adjustment
Push/Pull systems

Learning outcome

The learner will:

LO10 know aircraft electrical cables and connectors

Assessment criteria

The learner can:

AC10.1 describe cable types, construction and characteristics
AC10.2 describe high tension and co-axial cables
AC10.3 explain the process of crimping
AC10.4 describe aircraft connector types.

Range

AC10.1
Overview of eg: signal cable, power cable, data cable, screened, shielded fibre optic

AC10.2
Overview of eg: purpose, construction, connectors

AC10.3
Eg: security and reliability of connection, ease of fitment
Process eg: types of tool, pre-use inspection, go/no-go gauges, preparation of cable, selection of termination, crimping action, postcrimp inspection.

AC10.4
Overview of: pins, plugs, sockets, insulators, current and voltage rating, coupling, identification codes

Unit 003 Fundamentals of aircraft materials and hardware

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers CAA Module 6: Aircraft Materials and Hardware within the UK Part-M licensing framework.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise details.

Unit 004 Fundamentals of aircraft maintenance practices

UAN:	K/503/0824
Level:	3
Credit value:	11
GLH:	90
Assessment type:	External examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 303, 304 etc.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	The aim of this unit is to provide learners with a detailed understanding of aircraft structures and maintenance practices. It covers the complete syllabus of CAA Part-66 Module 7 for category A licenses.

Learning outcome

The learner will:

LO1 Understand the safety and environmental precautions required when working on aircraft and in workshops

Assessment criteria

The learner can:

AC1.1 explain legislation required whilst working on aircraft and in workshops
AC1.2 explain safe working practices used on aircraft and in workshops
AC1.3 explain actions to be taken in the event of fire or other accident.

Range

AC1.1
Health and Safety legislation
Environmental protection legislation
Hazardous substance legislation

AC1.2
Including detailed knowledge of safe working practices associated with:
Aircraft engine intakes, exhausts and propellers
Hazards eg noise, working at height, manual handling, slips, trips falls
Electricity
High pressure gases including oxygen
Oils
Fuels
Hydraulic fluid
Chemicals (including cleaning agents, solvents, resins)
Radio wave radiation

AC1.3
Including detailed knowledge of:
First aid fire appliances (extinguishing agents, types of fire, how and when to use)
Applicable first aid procedures
Mains power supplies (including emergency stop switches)
Emergency evacuation from work areas

Learning outcome

The learner will:

LO2 Understand the working practices and equipment used on aircraft and in workshops

Assessment criteria

The learner can:

AC2.1 explain the care and control of tools and workshop materials
AC2.2 explain dimensions, allowances and tolerances, standards of workmanship
AC2.3 explain the calibration of tools and equipment
AC2.4 describe common hand and power tools used
AC2.5 describe the operation of precision measuring tools and equipment
AC2.6 explain lubrication equipment and methods used
AC2.7 explain the use of electrical general test equipment.

Range

AC2.1
Detailed knowledge of:
Tool storage facilities
Tool control systems
Storage of oils and chemicals
Safe storage of workshop materials eg: cleaning materials, metal and non-metal sheet, oils, lubricants, paint, fasteners

AC2.2

Detailed knowledge of the required for aircraft maintenance tasks including: dimensions, allowances and tolerances, standards of workmanship

AC2.3
Detailed knowledge of:
Requirement for calibration
Calibration standards
Torque loading and torque calibration tools
Precision termination tools
Micrometers
Vernier callipers
Dial test indicators
Plug gauges
Feeler gauges
Pressure gauges

AC2.4
Detailed knowledge of the care and use of common hand and power tools eg:
Spanners
Sockets
Wrenches
Screwdrivers
Air tools
Electrical equipment

AC2.5
Detailed knowledge of measuring equipment including:
Micrometers
Vernier callipers
Dial test indicators
Plug gauges
Feeler gauges
Pressure gauges

AC2.6
Detailed knowledge of the care and use of:
Oil replenishment equipment
Grease guns
Types of lubricant, grades and applications

AC2.7
Detailed knowledge of function and use of test equipment such as: multimeters, voltmeters, power and phase meters

Learning outcome

The learner will:

LO3 Understand engineering drawings, diagrams and standards of fits and clearances used on aircraft

Assessment criteria

The learner can:

AC3.1 explain typical engineering drawings
AS3.2 identify information contained drawing title blocks
AC3.3 explain alternative methods of presenting technical information
AC3.4 describe Specification 100 of the Air transport Association (ATA) of America
AC3.5 describe alternative aeronautical standards
AC3.6 describe main features and purpose of typical wiring and schematic diagrams
AC3.7 explain drill sizes for bolts and the classes of fits
AC3.8 explain the common system of fits and clearances
AC3.9 explain the schedule of fits and clearances for aircraft and engines
AC3.10 explain limits of bow, twist and wear
AC3.11 explain the standard methods for checking shafts, bearings, and other associated parts

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Range

AC3.1
Overview of:
Type of projection (First angle, third angle)
Orthographic
Isometric
ISO, AN, MS, NAS, MIL

AC3.2
Eg: units and dimensions, scale, title, author, issue number, date

AC3.3
Eg: microfilm, microfiche, computerised presentation

AC3.4
Overview of eg:
Organisation of chapters
Titles of chapters
Relationship to aircraft maintenance and repair manuals
How to find specific information

AC3.5
Overview, including: ISO, An, MS, NAS, Mil

AC3.6
Nil

AC3.7
Overview of eg: pilot drill, tapping drill, clearance drill, classes of thread fit

AC3.8
Basic principles of eg: ISO hole-basis fits, shaft-basis fits

AC3.9
Eg:
Interference, driving, push, running fits
Applications of each

AC3.10
Definitions of bow, twist, wear
Methods of measurement
Acceptable limits

AC3.11
Overview of:
Including: types of defect found in shafts, bearings etc.
Methods of checking eg: visual, static measurement using jigs, vee blocks etc.; dynamic measurement
Acceptable limits

Learning outcome

The learner will:

LO4 Understand the components and maintenance of an aircraft electrical wiring interconnection system (EWIS)

Assessment criteria

The learner can:

AC4.1 describe techniques used to test continuity, insulation and bonding
AC4.2 describe use of hand and hydraulic operated crimp tools
AC4.3 describe how crimp joints are tested
AC4.4 describe the process of connector pin removal and insertion
AC4.5 describe the process of installing and testing co-axial cables
AC4.6 explain how types of aircraft wire are identified
AC4.7 explain the inspection criteria and damage tolerance of aircraft cable types
AC4.8 describe aircraft wiring protection techniques
AC4.9 describe wiring husbandry in EWIS installations.

Range

AC4.1
Eg: continuity tester, bonding tester, automatic installation tester

AC4.2
Overview of:
Types of crimp end, types of tool, colour coding, ratchet devices, jaws and chucks, testing, go/no-go gauges
Preparation of cable, stripping lengths, insertion of connector into tool, correct orientation, insertion of cable, operation of tool, release of connector
Precautions for crimping aluminium cable

AC4.3
Eg: visual inspection, pull test, millivolt drop test

AC4.4
Including: selection and use of correct insertion/extraction tool, direction of insertion/extraction

AC4.5
Eg: selection and fitting of connectors, minimum bend radius, cable support, high and low tension

AC4.6
Including: solid and stranded conductors, wire size, types of insulation
Marking methods and identification codes

AC4.7
Types of damage (eg: cut, scuff, overheated, corrosion, chemical contamination, water ingress, broken strands etc)
Allowable damage for typical cables

AC4.8
Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding

AC4.9
Inspection, repair, maintenance and cleanliness standards.

Learning outcome

The learner will:

LO5 Know the use of pipes and hoses, springs and bearings in aircraft applications

Assessment criteria

The learner can:

AC5.1 describe techniques for forming and fitting aircraft rigid pipes
AC5.2 describe inspection and testing of aircraft rigid pipes and flexible hoses
AC5.3 describe installation and clamping of aircraft rigid pipes
AC5.4 describe inspection and testing aircraft springs
AC5.5 describe testing, cleaning and inspection of bearings
AC5.6 describe lubrication requirements of bearings
AC5.7 describe common defects found in bearings and their causes.

Range

AC5.1
Heat treatment before and after bending
Lubrication, loading and unloading filler for bending on a compression bending machine
Use of a spring instead of filler
Use of mandrel type bending machine

Radius limits
Belling/flaring process (heat treatment, preparation, use of the flaring tool, inspection for cracks, distortion etc.)
Types of flared coupling eg: AGS, AS

AC5.2
Eg:
Typical defects in pipe bends and flares (eg: cracks, ripples, asymmetry, splits)
Typical defects in flexible hoses eg: kinks, corrosion, damaged braiding, damaged and worn couplings and seals
Visual inspection – tell-tale signs of defects
Flaring check eg: use a coned adaptor test fitting, measurements
Bore tests eg: ball bearing, flow test
Pressure tests for hydraulic, pneumatic, oxygen: test media, test pressures and durations
Bedding-in flared couplings
Post-test cleaning, inspection and blanking

AC5.3
Types of coupling eg: flared, flareless, Avimo, brazed nipple, high and low pressure
Pre-installation checks
Cleanliness
Care in manoeuvring into position
Positioning in clamps to ensure correct mating and zero strain
Clamp packing
Electrical bonding
'P' clips
Clearances from surrounding structure
Connection and post-installation leak checks
Protection from accidental impact damage eg: in a cargo hold or high traffic area

AC5.4
Types, materials, applications, limitations, inspection and testing methods

AC5.5
Overview of:
Types of bearing eg: plain, roller, taper, ball, needle, self – aligning, air
Testing methods and typical limits
Cleaning methods, equipment and materials
Inspection methods

AC5.6
Lubrication requirements of typical bearing types and applications – installation and in-service
Lubricant type, quantity, application

AC5.7
Typical defects and causes

Learning outcome

The learner will:

LO6 Understand transmissions and control cables used in aircraft

Assessment criteria

The learner can:

AC6.1 explain the inspection of gears
AC6.2 explain the inspection of belts and pulleys, chains and sprockets
AC6.3 explain the inspection of screw jacks
AC6.4 explain the inspection of lever devices and push-pull rod systems
AC6.5 explain the process of swaging control cable end fittings
AC6.6 explain the inspection and testing of control cables
AC6.7 describe Bowden cables and aircraft flexible control systems.

Range

AC6.1
Overview of:
Types of gear eg: helical, spur, bevel, hypoid
Method of inspection eg: visual inspection, measurement of backlash and key dimensions of the gear
Typical defects

AC6.2
Overview of:
Types of belt, pulley, chain, sprocket
Inspection methods: visual, mechanical, measurement
Typical defects

AC6.3
Overview of:
Typical types of screw jack
Inspection methods: visual, mechanical, measurement
Typical defects

AC6.4
Overview of:
Typical types of lever, bellcrank and pushrod systems
Main components eg: rods, turnbuckles, torque arms and tubes, universal joints
Inspection methods: visual, mechanical, measurement
Typical defects

AC6.5
Overview of:
Cable construction
Handling precautions
Cutting using eg: heavy duty cable cutters, hammer and sharp chisel, pre-cut binding
Selection of swaged end fittings eg: screwed and tapped turnbarrel parts, Talurit splice

Use of portable swaging machines – swaging process including cleaning and anti-corrosion treatment
Inspection of the swaged joint – use of inspection holes, typical process defects

AC6.6
Overview of:
Typical defects in cables and fittings eg: corrosion, fraying, slippage
Visual inspection, signs of defects
Proof loading: use of proof-loading rig, painting of cable and swaged fittings, test load (eg: UK – 50%, US – 60% of minimum breaking strength), length of test, measurement of cable length

AC6.7
Overview of:
Bowden cable, construction and application
Types of flexible control system
Major components eg: flexible shafts, couplings, guides
Operation
Lubrication
Inspection methods: visual, mechanical, measurement
Typical defects

Learning outcome

The learner will:

LO7 Know procedures for aircraft ground handling, maintenance and storage

Assessment criteria

The learner can:

AC7.1 describe procedures for moving aircraft on the ground
AC7.2 describe aircraft jacking and security procedures
AC7.3 describe aircraft storage methods
AC7.4 describe aircraft refuelling/defuelling procedures
AC7.5 describe aircraft de-icing and anti-icing procedures
AC7.6 describe the use of electrical, hydraulic and pneumatic ground supplies
AC7.7 describe the effects of environmental conditions on aircraft handling and operation.

Range

AC7.1
Aircraft taxiing including: safety checks, marshalling signals, communication, day/night
Towing including: safety precautions, personnel requirements, towing vehicles, towing arms, weak links, weight limits, turning angle limits, brake control day/night towing, communication during the tow

AC7.2
Principles of aircraft jacking
Types of aircraft jack

Jacking points
Balance and weight limits
Safety precautions
Jacking techniques
Levelling
Structural integrity while jacking eg: fitting structural panels, positioning flight control surfaces, undercarriage precautions, overhead clearance
Use of aircraft chocks – how many, where
Security of aircraft – doors, windows, hatches

AC7.3
Short-term storage procedures including: picketing, control and undercarriage locks, blanks and bungs, levelling, protection of canopy/windows, security of panels, doors
Long-term storage procedures including: draining of fluids; preservation treatments for engines, airframes, electrical/electronic equipment, wheels and tyres, undercarriage etc.; environmental control, elimination of vermin, periodic anti-deterioration maintenance

AC7.4
Including:
Description of pressure and open-line fuelling/de-fuelling – bowser and ring-main supplies
Safety: bonding, security of couplings, vapour during open-line operations, control of use of electrical power and equipment
Sampling of fuel, draining of water and sediment
Use of tank contents indicators
Balancing fuel contents/use of cross-feed pumps
Metering and recording of fuel delivered/removed including location of remaining fuel
Venting of tanks

AC7.5
Difference between de-icing and anti-icing
Reasons for preventing ice from forming on airframes, engines etc
Basic explanation of ice types and how they form
Removal of frost, ice and snow:
De-icing procedures including substances and methods of delivery, timing of process
Anti-icing equipment – mechanical, electrical, chemical, positioning

AC7.6
Types of electrical ground power supply eg: DC battery trolley, diesel or petrol electric set, electric/electric set, hangar power supplies
Types of hydraulic supply eg: mobile powered hydraulic rig, hangar ring main
Types of pneumatic supply eg: portable, hangar ring main

AC7.7
Environmental conditions eg: extreme heat, cold, high winds, heavy rain, standing water, snow
Describe precautions and measures to be taken when working on aircraft in the above conditions

Learning outcome

The learner will:

LO8 Understand disassembly, inspection, repair and assembly techniques

Assessment criteria

The learner can:

AC8.1 explain visual inspection techniques and describe typical defects
AC8.2 describe corrosion removal, assessment and re-protection methods
AC8.3 explain disassembly and re-assembly techniques for typical airframe components
AC8.4 describe the riveted joints used in aircraft
AC8.5 describe the operation of tools used for riveting and dimpling
AC8.6 describe procedures for inspecting riveted joints.

Range

AC8.1
Classification of damage
Visual inspection tools and equipment

AC8.2
Types of corrosion
Removal methods eg abrasion, chemical
Temporary protective methods
Plating
Excluders
Paint
Primers
Sealants

AC8.3
Eg: hydraulic components, mechanical components, structural assemblies, wheels and brakes, control surface attachments, engine components etc
Cleanliness, tools and techniques

AC8.4
Explain basics of eg: how riveted joints work, basic features, how rivets are classified, types and sizes, materials, how rivets are formed, heat treatment of rivets and materials, heating and freezing of rivets, finished dimensions of correctly formed rivet
Rivet layout: spacing and pitch

AC8.5
Tools used for dimpling and riveting eg: bucking bars, hand rivet and draw sets, countersinks, dimpling dies, pneumatic rivet guns

AC8.6
Inspection of riveted joints: appearance of a perfectly formed riveted joint, typical defects (eg: Shank joggling, shear failure, bearing failure, head failure), allowable deviations

Learning outcome

The learner will:

LO9 Know actions after abnormal aircraft events

Assessment criteria

The learner can:

AC9.1 describe inspection techniques used following lightning strikes and HIRF penetration
AC9.2 describe inspection techniques used following abnormal events.

Range

AC9.1
Avionic/electrical systems
Aerials
Static discharge wick
Skin inspection
Structural inspection

AC9.2
Eg:
Heavy landing
Bird strike
Hail damage
Tyre burst
Brake fire
Flight through turbulence
Atmospheric contamination.

Learning outcome

The learner will:

LO10 Understand maintenance procedures for safe and effective operation of aircraft

Assessment criteria

The learner can:

AC10.1 describe the operation maintenance planning departments and its interface with aircraft operations
AC10.2 explain the need for modification programmes and procedure for implementation
AC10.3 explain the process for certification and release of aircraft
AC10.4 explain the quality assurance procedures for aircraft maintenance
AC10.5 explain the procedures for carrying out additional maintenance procedures
AC10.6 explain the need for the control of life-limited components.

Range

AC10.1
IRAN (Inspect and repair As Necessary)
Scheduled maintenance
Preventative maintenance
Anti-deterioration maintenance
Aircraft log books, documentation etc

AC10.2
Designer modification
Service/Operator modification
Modification leaflets
Technical instructions

AC10.3
Documentation
Authorities to sign off maintenance work

AC10.4
Overview of procedures for:
Maintenance Inspection
Quality Control
Quality Assurance

AC10.5
Eg: Emergency Airworthiness Directives (EAD)

AC10.6
Typical life limited components
Procedures for tracking and monitoring the life of lifed components
Documentation**.**

Unit 004 Fundamentals of aircraft maintenance practices

Supporting information

Unit guidance

As of January 1, 2023, the UK Civil Aviation Authority (CAA) replaced European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers CAA Module 6: Aircraft Materials and Hardware within the UK Part-M licensing framework.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise details.

Unit 005 Fundamentals of aerodynamics

UAN:	T/503/0857
Level:	2
Credit value:	5
GLH:	40
Type of assessment:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 2 NOS Units 006, 007
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit aims to give the learner a working knowledge of aircraft aerodynamics and control to as a basis for further study. It covers the complete syllabus for the CAA Part-66 Module 8 for the category A licences.

Learning outcome

The learner will:

LO1 Know the basic properties of the Earth's atmosphere

Assessment criteria

The learner can:

AC1.1 describe the basic nature and composition of the Earth's atmosphere
AC1.2 describe the main layers of the Earth's atmosphere
AC1.3 use the basic gas laws make calculations
AC1.4 describe the use of the International Standard Atmosphere (ISA) in aviation.

Range

AC1.1
Air composition
Temperature
Pressure
Density

Position on the Earth's surface
Climatic conditions

AC1.2
Including the region of constant temperature (with altitude)

AC1.3
Quoting values at sea level in SI and Imperial units:
Pressure: psi, N m^{-2}, bar, millibar, hectopascal
Density: kg m^{-2}
Temperature: °C, Kelvin, °F

Learning outcome

The learner will:

LO2 Understand the nature of airflow around aerodynamic bodies

Assessment criteria

The learner can:

AC2.1 describe the main properties of airflow
AC2.2 describe how air flows around an aerodynamic body
AC2.3 explain how an aerofoil stalls and the effect a stall has on an aircraft in flight
AC2.4 describe the main characteristics of symmetrical and cambered aerofoils
AC2.5 describe how the airflow around aerofoils changes with angle of attack and velocity
AC2.6 explain how lift and drag affect aircraft performance
AC2.7 explain qualitatively how lift and drag can vary
AC2.8 explain how a high lift device alters the flow characteristics of an aerofoil
AC2.9 explain how the total drag of an aircraft is generated
AC2.10 describe common methods of drag reduction.

Range

AC2.1
Eg:
Compressible
Viscosity
Changed by temperature, solid objects etc

AC2.2
Related to different types of flow including:
Laminar, turbulent (boundary layer)
Free stream flow
Up and down wash
Vortices
Features including:
Stagnation point/region

Transition and separation points

AC2.3
Mechanism in terms of airflow
Effect in terms of passage through the air and degree of control available

AC2.4
Related to AC2.2 and including:
Camber
Chord
Mean aerodynamic chord
Mean camber line
Angle of attack
Angle of incidence
Fineness ratio
Thickness to chord ratio (percentage)

AC2.5
Basic qualitative explanation:
With reference to Bernoulli's principle
Including resulting static pressure changes resulting from:
Changes in angle of attack, including around the stall
Velocity changes
Effects including changes in:
Lift
Drag

AC2.6
Simple explanation

AC2.7
Simple explanation:
Including, for both cambered and symmetrical aerofoils:
How the following change with angle of attack:
Lift coefficient
Drag coefficient
Lift/drag ratio

AC2.8
Eg:
Airflow separation
Changes in lift and drag coefficients

AC2.9
Including simple explanations of:
Induced drag
Pressure or form drag
Skin friction
Interference drag
Parasite drag

AC2.10
Eg:
Polished surfaces
Fairings
Special materials
Aerodynamic shape

Learning outcome

The learner will:

LO3 Know the characteristics of the basic wing planforms

Assessment criteria

The learner can:

AC3.1 describe the basic wing planforms and their typical applications
AC3.2 calculate dimensions for each basic wing planform
AC3.3 describe the airflow over each basic wing planform
AC3.4 describe the effect of ice, snow and frost build-up on the performance of aerofoils.

Range

AC3.1
Rectangular
Tapered
Swept
Delta

AC3.2
Span
Aspect ratio
Taper ratio
Gross wing area
Wash in
Wash out

AC3.3
Using simple diagrams:
In normal flight
At or near the stall

AC3.4
Eg:
Change of shape
Increase in weight
Variation in thickness

Learning outcome

The learner will:

LO4 Understand basic aircraft control using primary control surfaces

Assessment criteria

The learner can:

AC4.1 explain the relationship between the four main forces acting on an aircraft
AC4.2 explain the meaning of 'aircraft control'
AC4.3 describe the operation and effect of the primary aircraft control surfaces
AC4.4 explain the term 'flight envelope'
AC4.5 describe typical aircraft performance in different phases of flight
AC4.6 describe how turning flight is related to the stall
AC4.7 describe how turning flight changes the loading on an airframe
AC4.8 explain the influence of load factor on aerodynamic performance.

Range

AC4.1
Lift
Drag
Thrust
Weight
Balancing effect of the tailplane

AC4.2
Any accepted definition

AC4.3
Elevator
Aileron
Rudder

AC4.4
Define the term flight envelope
Simple qualitative explanation of the limits and their dependency on values such as Mach number
Simple qualitative explanation why an aircraft may be unable to recover from a stall at Mach numbers close to 1 at high operating altitude (the so-called 'coffin corner')

AC4.5
Straight and level flight
Climb
Descent
Glide
Turn

AC4.6
Simple aerodynamic explanation
Spins

AC4.7
Simple explanation including the effect on structural defects

AC4.8.
Define Load Factor
Simple qualitative explanation of its effect on lift generated and how changes alter the aircraft's flight characteristics

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Learning outcome

The learner will:

LO5 Understand the nature of aircraft stability

Assessment criteria

The learner can:

AC5.1 explain the nature of aircraft flight stability
AC5.2 relate the three aircraft axes to different types of stability
AC5.3 explain the differences between statically stable, unstable and neutral aircraft
AC5.4 describe major components on an aircraft that affect stability in flight
AC5.5 describe typical methods of enhancing stability.

Range

AC5.1
Eg:
Active stability
Passive stability

AC5.2
Eg:
Pitch stability eg:
Short period pitch oscillation
Long period pitch oscillations (Phugoid)
Lateral stability eg: Dutch roll
Directional stability eg: Weathercocking

AC5.3
Definitions and examples of:
Static or positive stability
Negative stability (unstable)
Zero stability (neutral)

AC5.4

Eg:
Position and size of vertical stabiliser(s)
Shape and mounting of the wings (eg: anhedral/dihedral, aspect ratio etc.)
Design of the tailplane

AC5.5
Eg:
Adjusting the centre of gravity
Design of lifting and control surfaces (eg: wings, canards, tailplane etc.)

Learning outcome

The learner will:

LO6 Know the purpose and operation of a range of secondary control surfaces

Assessment criteria

The learner can:

AC6.1 describe the secondary effects of roll and yaw and methods of overcoming them
AC6.2 describe the arrangement and operation of alternative and combined flying controls
AC6.3 describe the general flow characteristics of high-lift devices
AC6.4 compare the performance of trailing edge high-lift devices
AC6.5 describe the aerodynamic problems caused by asymmetric flap operation
AC6.6 compare the performance of leading edge high-lift devices
AC6.7describe the purpose and operation of stall strips/wedges
AC6.8 describe common methods of boundary layer control
AC6.9 compare the operation of high drag devices.

Range

AC6.1
Simple description in terms of airflow over control surfaces:
Main issue is adverse yaw
Explain the effect of adverse yaw on roll rate
Ways of counteracting averse yaw eg:
Differential ailerons
Frise ailerons
Roll spoilers
Explain the secondary roll effect of applying rudder
Explain this is worse in V-tailed aircraft
Co-ordinated use of rudder and aileron
Rudder limiters

AC6.2
Simple explanation of: arrangement, operation and reasons for:
Spoilers
All-moving tailplane (slab/stabilator)

Tailerons
Canards
Elevons
Ruddervators
Flaperons

AC6.3
Using the example of eg: a trailing edge flap
Simple explanation to centre on:
Airflow changes on deployment eg:
Change in lift and drag coefficients
Airflow separation

AC6.4
Simple explanation of advantages, disadvantages with respect to aerodynamic effectiveness and operation:
Plain flap
Split flap
Slotted flap
Fowler flap

AC6.5
Explanation of asymmetric flap and how it happens
Description of the effect on aircraft attitude

AC6.6
Simple explanation of advantages, disadvantages with respect to aerodynamic effectiveness and operation:
Krueger flap
Leading edge droop
Slots
Slats

AC6.7
Reason
Position
How they operate

AC6.8
Eg:
Blown air
Suction

AC6.9
Including limitations in flight and on the ground
Spoilers
Lift dumpers
Speed brakes.

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Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers part 66 Basic Knowledge Requirements Module 8 – Basic Aerodynamics for A Category licenses.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise details.

Unit 006 Fundamentals of civil aviation legislation

UAN:	A/503/0858
Level:	3
Credit value:	4
GLH:	30
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Unit 305, 306 etc
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner a working knowledge of aviation legislation to enable maintenance work to be done within the requirements of the Law. It contains the complete syllabus of CAA Part-66 Module 10 for category A licences).

Learning outcome

The learner will:

LO1 Know the roles of UK, European and international organisations in aviation safety regulation

Assessment criteria

The learner can:

AC1.1 describe the role of the International Civil Aviation Organisation (ICAO)
AC1.2 describe the role of the European Aviation Safety Agency (EASA)
AC1.3 describe the role of the Civil Aviation Authority (CAA)
AC1.4 describe the role of the EU Member States and National Aviation Authorities
AC1.5 describe the relationships between key elements of the Internation Civil Aviation Safety Regulations.

Range

AC1.1
Overview

AC1.2
Overview

AC1.3
Overview, with respect to CAA aviation

AC1.4
Overview of obligations and responsibilities for aviation safety

AC1.5
UK Regulation (EC) No 216/2008 and its implementing rules UK Regulations, (EU) No748/2012 and UK (EU) No 1321/2014
Part-21, Part-M, Part-145, Part-66, Part-147 and UK Regulation (EU) No 965/2012.

Learning outcome

The learner will:

LO2 Understand how civil aviation legislation relates to the maintenance of airworthiness

Assessment criteria

The learner can:

AC2.1 explain the certification requirements for Maintenance Certifying Staff
AC2.2 explain the requirements for Approved Maintenance organisations
AC2.3 explain the requirements of UK Regulation on Air Operations for Commercial Air Transportation.

Range

AC2.1
Detailed understanding of Part-66 including:
Details of the requirements for the issue of licences to maintenance personnel
The approved basic training course
Examinations
Practical experience
Log books
Privileges of a Licensed Aircraft Maintenance Engineer in each category

AC2.2
Detailed understanding of: Part-145 and Part-M Subpart F,
including:
Approval
Maintenance Organisation Manual
Facilities
Personnel requirements
Certifying staff
Components, equipment and tools
Maintenance data, work orders and standards

Release-to-service certification of aircraft and components
Maintenance records
Privileges of the organisation
Organisational changes
Review of the organisation
Continuing approval and 'findings'

AC2.3
Overview of:
General understanding of Regulation (EU) No 965/2012
Air Operators Certificates
Operators Responsibilities – particularly continuing airworthiness and maintenance
Aircraft Maintenance Programme
Minimum Equipment Lists (MEL)
Configuration Deviation List (CDL)
Documents to be carried on board
Aircraft placarding (markings)

Learning outcome

The learner will:

LO3 Understand the contents of Part-M and other National and International requirements

Assessment criteria

The learner can:

AC3.1 explain the purpose of the sub-parts and annexes of Part-M
AC3.2 explain additional National and International documentation and procedures.

Range

AC3.1
A detailed understanding of:
Subparts A-I
Appendices I - VIII

AC3.2
Detailed understanding of Part-21 provisions related to continuing airworthiness
Overview of:
Maintenance Programmes, Maintenance checks and inspections
Airworthiness Directives
Service Bulletins, manufacturers service information
Modifications and repairs
Maintenance documentation including: maintenance manuals, structural repair manual, illustrated parts catalogue
Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists

Learning outcome

The learner will:

LO4 Be able to carry out practical procedures related to aviation legislation

Assessment criteria

The learner can:

AC4.1 demonstrate how to examine maintenance documentation to determine its validity
AC4.2 apply procedures related to the supply of aircraft equipment and spares
AC4.3 perform the procedures to document the replacement of a time-expired aircraft component.

Range

AC4.1
Including:
Aircraft Type Certificate (authority, registration, date)
Aircraft Operator's Certificate (authority, company and address, currency)
Engineer's Licence (aircraft type, validity, authority)

AC4.2
Process aircraft equipment/spares from supplier to aircraft fitment

AC4.3
A rotatable component
Aircraft above 5700 kg MTWA (Maximum Total Weight Authorised)
Within a Part 145 Maintenance Organisation

Unit 006 Fundamentals of civil aviation legislation

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module 10 – Aviation Legislation for the Category A Licences.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise technical details.

Unit 007 Fundamentals of aircraft aerodynamics, structures and systems for turbine engines

UAN:	J/503/1091
Level:	3
Credit value:	12
GLH:	115
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 322, 339 etc
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner a broad understanding of the aircraft systems and structures they will encounter when working in the aircraft maintenance field. It covers the complete syllabus for the CAA Part-66 Module 11A for the category A1 Licence.

Learning outcome

The learner will:

LO1 Know aspects of the theory of flight

Assessment criteria

The learner can:

AC1.1 describe the operation and effect of primary flying controls in all three axes
AC1.2 describe the operation and effect of high lift and drag-inducing devices
AC1.3 describe the effects of stall control devices
AC1.4 describe boundary layer control
AC1.5 describe the operation and effect of trim and balance devices
AC1.6 describe terms relating to high speed flight
AC1.7 describe the aerodynamic effects of high speed flight
AC1.8 describe the effects of engine intake and swept wing design on high speed performance.

Range

AC1.1
Overview of:
Operation and effect of:
Roll control: ailerons and spoilers
Pitch control: elevators, stabilators, variable incidence stabilisers and canards
Yaw control: rudder limiters
Control using elevons, ruddervators

AC1.2
Overview of:
High lift devices: slots, slats, flaps, flaperons
Drag inducing devices: spoilers, lift dumpers, speed brakes

AC1.3
Overview of:
Effects of wing fences, saw tooth leading edges

AC1.4
Overview of:
Using: vortex generators, stall wedges and leading edge devices

AC1.5
Overview of:
Trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels

AC1.6
Overview of:
Speed of sound, subsonic flight, transonic flight, supersonic flight

AC1.7
Overview of:
Mach number, critical Mach number, compressibility
Buffet, shock wave, aerodynamic heating, area rule

AC1.8
Overview of:
Factors affecting airflow in engine intakes of high speed aircraft
Effects of sweepback on critical Mach number.

Learning outcome

The learner will:

LO2 Understand the general concepts of airframe structure

Assessment criteria

The learner can:

AC2.1 explain the airworthiness requirements for structural strength
AC2.2 explain the classification of aircraft structure
AC2.3 explain the concept of in-built safety
AC2.4. explain how locations on the airframe are defined
AC2.5 explain the physical effects of flying on aircraft structures
AC2.6 explain how moisture build-up in airframe structures is minimised
AC2.7 explain how airframe design allows for the installation of aircraft systems
AC2.8 explain how the aircraft is protected from lightning strikes and other static discharges
AC2.9 describe construction methods for various airframe components
AC2.10 describe structural assembly techniques
AC2.11 describe methods of surface protection
AC2.12 describe methods of surface cleaning
AC2.13 describe measurements performed on airframes.

Range

AC2.1
Eg: structural strength, strength-to-weight ratio, rigidity and flexibility

AC2.2
Primary, secondary and tertiary

AC2.3
Fail safe, safe life, damage tolerance concepts

AC2.4
Zonal and station identification systems

AC2.5
Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue

AC2.6
Drains and ventilation provisions

AC2.7
Eg: electrical system, engines (wing hard points, nacelles, fuel tanks etc), pipework, reservoirs, tanks, attachment points for undercarriage etc

AC2.8
Lightning strike protection provision, aircraft bonding

AC2.9
Overview of:
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement
Methods of: skinning, anti-corrosive protection, wing, empennage and engine attachments

AC2.10
Overview of: structure assembly techniques: riveting, bolting, bonding

AC2.11
Overview of eg: chromating, anodising, painting

AC2.12
Overview of eg: polishing, use of solvents and detergents

AC2.13
Overview of airframe symmetry: methods of alignment and symmetry checks.

Learning outcome

The learner will:

LO3 Know fixed wing aircraft structures

Assessment criteria

The learner can:

AC3.1 describe fuselage construction and pressurisation sealing
AC3.2 describe fuselage attachment points
AC3.3 describe seat installation and cargo loading systems
AC3.4 describe doors and emergency exits
AC3.5 describe windows and windscreens
AC3.6 describe wing construction
AC3.7 describe wing fuel storage
AC3.8 describe attachment points
AC3.9 describe the construction of stabilisers
AC3.10 describe flight control surfaces
AC3.11 describe methods of balancing flight control surfaces
AC3.12 describe the construction of nacelles and pylons.

Range

AC3.1
Overview of
(ATA 52/53/56) including:
Design principles such as load transfer, load path continuity and reducing stress-raisers; minimising or eliminating the loads and stresses experienced by a pressurised fuselage in flight (eg: tension, hoop stress, shear stress) and to minimise crack propagation and the effects of bursting and fatigue stress
Methods used to prevent doors and other large cut-outs from opening under pressurisation loads
Methods to ensure protection from rapid decompression

AC3.2
Overview of
(ATA 52/53/56) including: wing, stabiliser, pylon and undercarriage attachments

AC3.3
Overview of
(ATA 52/53/56) including: floor strong points, seat attachment methods, seat pitch, cargo positioning and restraint

AC3.4
Overview of
(ATA 52/53/56) including: construction, mechanisms, operation and safety devices

AC3.5
Overview of
(ATA 52/53/56) including: construction and mechanisms

AC3.6
Overview of
(ATA 57) including: spars, ribs, skin, wing root attachments, fairings, nacelles, wing profiles

AC3.7
Overview of
(ATA 57) including the siting and installation in/on the wing structure of: integral tanks, bag tanks, tip tanks, access, refuelling points, externally mounted tanks

AC3.8
Overview of
(ATA 57) including: landing gear, pylon, control surface and high lift/drag attachments

AC3.9
Overview of
(ATA 55) including for horizontal and vertical: structure, attachment to fuselage, attachment of control surfaces

AC3.10
Overview of
(ATA 55/57): construction and attachment

AC3.11
(ATA 55/57): mass and aerodynamic

AC3.12
Overview of
(ATA 54): construction, firewalls, engine mounts.

Learning outcome

The learner will:

LO4 Know equipment air, cabin conditioning, pressurisation and oxygen systems

Assessment criteria

The learner can:

AC4.1 describe sources of aircraft air supply
AC4.2 describe aircraft air conditioning systems
AC4.3 describe aircraft pressurisation systems
AC4.4 describe cabin conditioning protection and warning devices

AC4.5 describe aircraft oxygen systems
AC4.6 describe aircraft pneumatic/vacuum systems.

Range

AC4.1
Overview of
(ATA 21) including: engine bleed, APU and ground cart

AC4.2
Overview of
(ATA 21):
Air cycle and vapour cycle machines: components, layout, operation
Distribution systems
Flow, temperature and humidity control system

AC4.3
Overview of
(ATA 21) including:
Control and indication including components, layout, operation, control and safety valves
Cabin pressure controllers

AC4.4
Overview of
(ATA 21) including:
Eg: pressure relief valve, over-temperature warning

AC4.5
Overview of
(ATA 35):
System lay-out: cockpit, cabin
Sources, storage, charging and distribution
Supply regulation
Indications and warnings

AC4.6
Overview of
(ATA 36) including:
System lay-out
Sources: engine/APU, compressors, reservoirs, ground supply
Pressure control
Distribution
Indications and warnings
Interfaces with other systems.

Learning outcome

The learner will:

LO5 Know aircraft instrument, avionic and on-board maintenance systems

Assessment criteria

The learner can:

AC5.1 describe pitot static flight instruments
AC5.2 describe gyroscopic flight instruments
AC5.3 describe aircraft compasses
AC5.4 describe angle of attack and stall warning systems
AC5.5 describe indications provided for other aircraft systems
AC5.6 describe on-board maintenance systems (OMS)
AC5.7 describe the layout and operating fundamentals of auto flight control systems
AC5.8 describe the layout and operating fundamentals of communication systems
AC5.9 describe the layout and operating fundamentals of navigation systems.

Range

AC5.1
Overview including:
(ATA 31):
Altimeter, air speed indicator, vertical speed indicator
Single instrument displays, glass cockpit: construction, function, aircraft installation

AC5.2
Overview including:
(ATA 31):
Artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator
Single instrument displays, glass cockpit: construction, function, aircraft installation

AC5.3
Overview including:
(ATA 31):
Direct reading, remote reading
Construction, function, aircraft installation, adjustment

AC5.4
Overview including:
(ATA 31):
Angle of attack: probe, indication
Stall warning sensors, indicators, warning systems – horns, visual alarms, stick-shakers

AC5.5
Overview including:
(ATA 31) including indications for: engines, electrical power, fuel system, hydraulics, undercarriage, flying controls, environmental
Including temperature, current, voltage, mass air flow, contents, fluid flow, pressure, position

Integrated Modular Avionics (ATA 42) – overview of modules such as:
Bleed management, air pressure control, air ventilation and control, avionics and cockpit ventilation control, temperature control, air traffic communication, avionics communication

router, electrical load management, circuit breaker monitoring, electrical system bite, fuel management, braking control, steering control, landing gear extension and retraction, tyre pressure indication, oleo pressure indication, brake temperature monitoring, etc.
Overview of Core System Network Components.

AC5.6
Overview including (ATA 45):
Central maintenance computers: Function, data inputs, data outputs, data up/downlinks, outputs to alerting systems (eg: EICAS)
Interfaces with aircraft systems: aircraft (general), airframe, structures, propellers, power plant
Data loading system: via data links, memory devices (CD/DVD, flash drive), direct from sensors and systems
Electronic library system: storage, updating, access
Printing: on board, in-flight, remote
Structure monitoring (damage tolerance monitoring): sensors, data logs, remote monitoring and alerts

AC5.7
Overview including:
Auto Flight (ATA 22): Auto-trim, yaw damping, autopilot, autothrottle, autoland
Layout and fundamentals of operation of including:
Sensors and inputs
Servomotors and actuators
Computers and interfaces with other systems
Controllers and indicators
Safety cut outs

AC5.8
Overview including:
Communications (ATA 23): HF, VHF, UHV, Satcom, data links, audio systems (Interphone, intercom), audio integration
Layout and fundamentals of operation of including:
Controllers, transmitter/receivers, antennae

Overview of Cabin Systems (ATA 44):
Interface between cockpit/cabin crew and cabin systems
Functions such as: access to pre-departure/departure reports, email/intranet/Internet access, passenger database;
Server
Cabin Core System; server interfacing with:
Flight attendant panels
In-flight Entertainment System;
External Communication System;
Cabin Mass Memory System;
Cabin Monitoring System;
Miscellaneous Cabin Systems

Information Systems (ATA46)
Note: Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display

Overview of, for example:
Air Traffic and Information Management Systems and Network Server Systems
Electronic library mass storage and controller
Aircraft General Information System
Flight Deck Information System
Maintenance Information System
Passenger Cabin Information System
Miscellaneous Information System

AC5.9
Overview including:
Navigation Systems (ATA 34):
Flight environmental data (eg: pitot-statics, temperature, rate of climb, central air data computer)
Attitude and direction (eg: compasses, attitude director, vertical and direction references)
Landing and taxiing (eg: Localiser, glide slope, ILS markers, ground guidance)
Independent position finding (eg: inertial navigation, star tracker, anti-collision, weather radar),
Dependent position finding (eg: DME, VOR, ADF, GPS)
Flight management computers (eg: performance data, course, display, warnings)

Learning outcome

The learner will:

LO6 Know electrical power, lighting, and ice and rain protection systems

Assessment criteria

The learner can:

AC6.1 describe aircraft battery installations and their operation
AC6.2 describe aircraft DC power generation systems
AC6.3 describe aircraft AC power generation systems
AC6.4 describe aircraft emergency power generation
5AC6.5 describe aircraft power distribution
AC6.6 describe inverters, transformers, and rectifiers
AC6.7 describe aircraft external and ground power systems
AC6.8 describe aircraft lighting systems
AC6.9 describe ice formation and classification, and ice detection systems
AC6.10 describe aircraft anti-icing systems
AC611 describe aircraft de-icing systems
AC6.12 describe aircraft rain removal systems.

Range

AC6.1
Overview of

(ATA 24): batteries and battery installations, safety when charging, handling and operating batteries, care and maintenance of batteries, battery performance and testing, aircraft battery installations

AC6.2
Overview of
(ATA 24) eg: generators, alternators, installation, drive systems, indication

AC6.3
Overview of
(ATA 24): constant speed drive (oil system, connecting devices, indicating and warning systems), alternators, generators, installations

AC6.4
Overview of
(ATA 24): air driven turbines, ram air turbines, auxiliary airborne power units

AC6.5
Overview of
(ATA 24): bus bars, load sharing, paralleling, real load, reactive load, bus tie contactors, voltage regulation, circuit protection

AC6.6
Overview of
(ATA 24): rotary and static invertors, power and current transformers, rectifiers (single and 3 phase, full and half-wave), transformer-rectifier units

AC6.7
Overview of
(ATA 24): AC and DC ground power units, DC battery cart, rectifiers, invertors, gas turbine APU, connectors (number, purpose and length of pins, compatibility) connection and disconnection procedures, power on/off procedures, earthing, safety precautions

AC6.8
(ATA 33): external lighting - navigation, anti-collision, landing, taxiing, ice
Internal lighting: cabin, cockpit, cargo
Emergency lighting

AC6.9
Overview of
(ATA 30): eg: glaze ice, rime ice, mixed (cloudy) ice, super-cooled large droplets, runback ice, intercycle ice. From eg: supercooled moisture, freezing rain/drizzle, snow
Detection systems eg: optical, ultrasonic, cold soak

AC6.10
Overview of
(ATA 30): electrical, hot air and chemical
Aerofoils, air intakes, pitot and static, windows, windshields and doors, antennas and radomes, propellers, probe and drain heating

AC6.11
Overview of

(ATA 30): Rain repellent, wiper systems.

Learning outcome

The learner will:

LO7 Know equipment and furnishings, water and waste, and fire protection systems

Assessment criteria

The learner can:

AC7.1 describe aircraft emergency equipment requirements
AC7.2 describe aircraft seats, harnesses and belts
AC7.3 describe lay-outs of aircraft cabin equipment
AC7.4 describe aircraft cabin furnishing installations
AC7.5 describe aircraft cabin entertainment equipment
AC7.6 describe aircraft galley installations
AC7.7 describe aircraft cargo handling and retention equipment
AC7.8 describe aircraft air-stairs
AC7.9 describe the lay-out of aircraft water systems
AC7.10 describe the layout of aircraft toilet systems
AC7.11 describe aircraft fire and smoke detection and warning systems
AC7.12 describe aircraft fire extinguishing systems.

Range

AC7.1
(ATA 25) including: life rafts and jackets, emergency locator beacons (surface and underwater), first aid kit, flares, evacuation equipment

AC7.2
(ATA 25) including: passenger seats, seat belts and extensions, other special restraints, first class sleeping berths
Crew seats, seat belts and harnesses

AC7.3
Overview of
(ATA 25) including: cabin seating configuration (eg: first, club, economy), movable partitions positions, overhead storage, galley positions, lavatories, emergency exits, entertainment equipment, cabin monitoring display
Awareness of corrosion potential in the area of lavatory and galley installations

AC7.4
Overview of
(ATA 25) including fitting of: seats, insulation, carpets, partitions, curtains, cockpit door security, wardrobes, cupboards, other storage

AC7.5
Overview of

(ATA 25) including: individual multimedia screens (seat), bulkhead multimedia screens, individual entertainment controller, DVD and tape players, overhead loudspeakers

AC7.6
Overview of
(ATA 25) including: removable and fixed cabinets, ovens, refrigerators, waste storage and disposal, dish racks, coffee maker, water dispenser, service trolleys, electrical and water supplies.
Explain the importance of maintaining serviceability and integrity of water drains and their heaters

AC7.7
Overview of
(ATA 50) including: Cargo hold – nets, containers, lashing and latching points, floor rollers
Main cabin in cargo or passenger/cargo role – floor fitments, rollers, tracks, hard points for nets and straps

AC7.8
Overview of
(ATA 60) including: structure, actuating mechanisms, controls, handrails

AC7.9
(ATA 38) including: supply, distribution, servicing and draining, operation of pumps, waste water extraction and storage, anti-icing measures
Describe corrosion potential around water pipes and drains and in the bilges; corrosion prevention measures

AC7.10
(ATA 38) including: flushing and servicing, operation of flushing system, gate valves, storage tanks, service points
Describe corrosion potential around water pipes and drains, and in the bilges; corrosion prevention measures
Explain the potential for ice to form and break off in-flight around insecure and leaking service points

AC7.11
(ATA 26) including:
Fire detection: continuous element or pressure type sensor responder, fire wire, thermal switch, thermocouple, infra-red
Smoke detection: carbon monoxide, photoelectric, visual, infra-red
Central warning systems: operation and indications, inputs, outputs, priority philosophy
System inspection, maintenance and test

AC7.12
(ATA 26) including: extinguishing agents, positioning of fire extinguisher units, method of initiating
System inspection, maintenance and test
Portable fire extinguishers: labelling, extinguishing agents, stowage, use, inspection.

Learning outcome

The learner will:

LO8 Know aircraft flight controls

Assessment criteria

The learner can:

AC8.1 describe the function and operation of aircraft primary controls
AC8.2 describe trim when related to control surfaces
AC8.3 describe active load control
AC8.4 describe high lift devices
AC8.5 describe speed brakes and lift dump devices
AC8.6 describe the operation of various types of flight control system
AC8.7 describe active methods of adjusting flying controls to suit flight conditions
AC8.8 describe the function and operation of gust locks systems
AC8.9 describe the process of balancing and rigging an aircraft
AC8.10 describe aircraft stall protection/warning systems.

Range

AC8.1
Overview of
(ATA 27) including: control wheels, cables, rods, linkages, chains, pulleys, control surface etc
For: aileron, elevator, rudder, spoiler

AC8.2
Overview of
(ATA 27) including: manual trim, servo and anti-servo tabs,

AC8.3
Overview of
(ATA 27) including: reasons for active load control, system components, layout, system operation

AC8.4
Overview of
(ATA 27) including:
Control handles, cables, actuators, warning systems, linkages, control surfaces, position indicators for high lift devices including:
Trailing edge flaps
Leading edge flaps
Slats
Slots
Boundary layer control

AC8.5
Overview of
(ATA 27) including:

Control handles, cables, warning systems, linkages, position indicators, limiters for devices including:
Speed brakes
Variable aerodynamic fairings
Spoilers
Other drag and lift dumping devices

AC8.6
Overview of
(ATA 27) including: manual, hydraulic, pneumatic, electrical and fly-by-wire systems

AC8.7
Overview of
(ATA 27): Reasons for each system, system components, input, output, operation
Artificial feel via a spring strut or 'q' system
Yaw damper
Mach trim
Rudder limiter

AC8.8
Overview of
(ATA 27) including: reasons for using gust locks, type of gust lock,
Methods of operation

AC8.9
Overview of
(ATA 27) including: Reasons for balancing control surfaces, equipment, tools and methods of balancing a control surface
Reasons for checking control surface rigging, equipment, tools and methods of measuring and rigging control surfaces

AC8.10
Overview of
Stick shakers, stall warning audible and visual devices, automatic stall recovery devices.

Learning outcome

The learner will:

LO9 Know aircraft fuel systems

Assessment criteria

The learner can:

AC9.1 describe aircraft fuel system layouts
AC9.2 describe aircraft fuel tanks
AC9.3 describe aircraft fuel supply systems
AC9.4 describe fuel dumping, venting and draining systems
AC9.5 describe fuel cross-feed and transfer systems

AC9.6 describe fuel indications and warnings
AC9.7 describe aircraft refuelling and defuelling systems
AC9.8 describe aircraft longitudinal balance fuel systems.

Range

AC9.1
Overview of
(ATA 28) including: components of the fuel system, positioning and purpose of tanks, pumps, refuelling points, interconnection of system components, power supplies

AC9.2
Overview of
(ATA 28) including: integral tanks, tip tanks, bladder cells, baffles, ventilation, cell and tank interconnectors, over-wing filler necks and caps, reservoir feed pumping system, in-tank reservoirs, leak detection and classification, tank sealing and repair, pressurisation, fire and explosion suppression

AC9.3
Overview of
(ATA 28) including: pipework, pumps (including booster, ejector and backing), valves, strainers, emergency devices such as power plant fuel quick disconnect

AC9.4
Overview of
(ATA 28) including: pipework, jettison chutes and valves, venting system, tank drain points

AC9.5
Overview of
(ATA 28) including: pipework, cross-feed pumps, transfer valves, fuel manifold

AC9.6
Overview of
(ATA 28) including: fuel quantity, system pressure, temperature and flow; valve positions, warnings for tank pump pressure

AC9.7
Detailed knowledge of (ATA 28) including: over-wing and pressure refuelling, bonding, distribution to and from tanks during re-fuel/de-fuel

AC9.8
Overview of
(ATA 28) including: trim tanks (eg: in horizontal/vertical stabiliser), transfer pumps, valves, trim warnings.

Learning outcome

The learner will:

LO10 Know hydraulic and landing gear systems

Assessment criteria

The learner can:

AC10.1 describe aircraft system lay-outs
AC10.2 describe hydraulic filters and the types and properties of hydraulic fluids in use
AC10.3 describe hydraulic reservoirs and accumulators
AC10.4 describe hydraulic pressure generation
AC10.5 describe hydraulic pressure control and power distribution
AC10.6 describe hydraulic system indication and warning systems
AC10.7 describe how hydraulic power systems interface with other systems
AC10.8 describe the construction and shock-absorbing action of aircraft landing gear
AC10.9 describe landing gear extension and retraction systems
AC10.10 describe landing gear indications and warning devices
AC10.11 describe wheels, brakes, antiskid and autobraking
AC10.12 describe aircraft tyres, their design, classification and application
AC10.13 describe aircraft landing gear steering and shimmy damping systems

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Range

AC10.1

Overview of
(ATA 29) including: multiple system integration, functions and features of each system, components of a system, positioning and purpose of tanks, accumulators, valves, pumps, levers, switches, cables, pipework, seals, quick disconnection, wiring, and external connectors, up to but not including supply valves to individual systems

AC10.2

Overview of
(ATA 29) including: mineral, synthetic hydrocarbon and phosphate-ester based fluids, properties (eg: low compressibility, low temperature performance, resistance to combustion, resistance to moisture and gas absorption), shelf life, importance of cleanliness, contamination checks, particular health and safety issues (eg: Skydrol)
Hydraulic filters: construction, filtering operation, maintenance, alert systems, types of filter (eg: metal element, two-stage)

AC10.3

Overview of
(ATA 29) including: purpose, construction, operation of accumulators (diaphragm, bladder and piston type); reservoirs (reason for pressurisation, methods of pressurisation, control of pressure)

AC10.4

Overview of
(ATA 29) including construction, operation, location and function of:
Normal operation: electrical and mechanical pumps (engine gear driven, bleed air driven),
Emergency: hand operated double-acting and ram air turbine pumps, auxiliary tanks and accumulators, valves and pipework

AC10.5

Overview of
(ATA 29) including construction, operation, location and function of:
Pressure control: relief valves, regulators, reducers, thermal relief valves, de-boosters, cut-off valves, low-demand fluid circulation, protection from overpressure damage
Power distribution: manifolds, valves (eg: selector, in-line check, sequence, spool, rotary, priority, disconnect), hydraulic fuses

AC10.6
Overview of
(ATA 29) including: pressure, flow, contents, temperature, contamination/clogging, transmitters, indicators, interconnection, warning methods

AC10.7
Overview of
(ATA 29) including with: electrical and emergency systems

AC10.8
(ATA 32) including:
Arrangement: fixed, retractable tail wheel, tricycle, tandem, single wheel, double wheel, tandem wheel, bogie,
Construction: main and nose casting, torque link arms, pivot trunnion side braces, trunnion beam, drag brace/strut, shock strut cylinders, positioned, equaliser, pivot beam, pivot fork and shafts, up and down locks
Shock struts – construction and operation: types (metering pin, metering tube, separator piston), damping and snubbing devices, axles, mounting assemblies, glands, packing, seals and backing rings, charging and bleeding, ground locks, safety devices

AC10.9
(ATA 32) including:
Normal: electrical and hydraulic retraction and extension, locking methods, door mechanisms, extension and retraction sequencing
Emergency: pneumatic, hand pump and gravity, locking

AC10.10
(ATA 29) including: gear-located switches, cockpit indicators, air-ground sensing, warning devices (visual, mechanical, audible), typical retraction faults and associated cockpit indication

AC10.11
(ATA 29) including:
Types of wheel: material, detachable flange, split rim, wheel bearings, fusible plugs, inspection
Brake unit: construction, wear limits, maintenance/inspection
Hydraulic brake systems
Emergency brake systems
Parking brake systems
Mechanical/hydraulic anti-skid
Electro-hydraulic anti-skid
Auto-brake systems (landing, take-off, intensity settings, conditions for operation)

AC10.12
(ATA 29) including: bias (cross) ply, radial ply, tubed, tubeless, sidewall markings, tread patterns, wear limits, damage limits (eg: oil contamination, cuts, blisters)

AC10.13
(ATA 29) including: cockpit controls (wheel, tiller etc.), linkages (hydraulic, electrical, mechanical), pressurising assembly, power sources, metering valve, steering cylinders, compensator/accumulator, follow-up, safety valves, centring cam, differential assembly, main bogie steering
Nosewheel shimmy damping: types of damper (piston, steer, vane), causes of shimmy.

Unit 007 Fundamentals of aircraft aerodynamics, structures and systems for turbine engines

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module11A – Turbine Aeroplane Aerodynamics, Structures and Systems.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information, and for precise details.

Unit 008 Fundamentals of aircraft aerodynamics, structures and systems for piston engines

UAN:	M/503/1098
Level:	3
Credit value:	12
GLH:	100
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 313, 327 etc
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner a broad understanding of the aircraft systems and structures they will encounter when working in the aircraft maintenance field. It covers the complete syllabus for the CAA Part-66 Module 11B for the category A2 Licence.

Learning outcome

The learner will:

LO1 Know aspects of the theory of flight

Assessment criteria

The learner can:

AC1.1 describe the operation and effect of primary flying controls in all three axes
AC1.2 describe the operation and effect of high lift and drag-inducing devices
AC1.3 describe the effects of stall control devices
AC1.4 describe boundary layer control
AC1.5 describe the operation and effect of trim and balance devices
AC1.6 describe the aerodynamic effects of high speed flight
AC1.7 describe the effects of engine intake and swept wing design on high speed performance.

Range

AC1.1

Operation and effect of:
Roll control: ailerons and spoilers
Pitch control: elevators, stabilators, variable incidence stabilisers and canards
Yaw control: rudder limiters
Control using elevons, ruddervators

AC1.2

High lift devices: slots, slats, flaps, flaperons
Drag inducing devices: spoilers, lift dumpers, speed brakes

AC1.3

Effects of wing fences, saw tooth leading edges

AC1.4

Using: vortex generators, stall wedges and leading edge devices

AC1.5

Trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels

Learning outcome

The learner will:

LO2 Understand the general concepts of airframe structure

Assessment criteria

The learner can:

AC2.1 explain the airworthiness requirements for structural strength
AC2.2 explain the classification of aircraft structure
AC2.3 explain the concept of in-built safety
AC2.4 explain how locations on the airframe are defined
AC2.5 explain the physical effects of flying on aircraft structures
AC2.6 explain how moisture build-up in airframe structures is minimised
AC2.7 explain how airframe design allows for the installation of aircraft systems
AC2.8 explain how the aircraft is protected from lightning strikes and other static discharges
AC2.9 describe typical construction methods for various airframe components
AC2.10 describe typical structural assembly techniques
AC2.11 describe methods of surface protection
AC2.12 describe methods of surface cleaning
AC2.13 describe typical measurements performed on airframes.

Range

AC2.1

Eg: structural strength, strength-to-weight ratio, rigidity and flexibility

AC2.2
Primary, secondary and tertiary

AC2.3
Fail safe, safe life, damage tolerance concepts

AC2.4
Zonal and station identification systems

AC2.5
Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue

AC2.6
Drains and ventilation provisions

AC2.7
Eg: electrical system, engines (wing hard points, nacelles, fuel tanks etc), pipework, reservoirs, tanks, attachment points for undercarriage etc

AC2.8
Lightning strike protection provision, aircraft bonding

AC2.9
Overview of:
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement
Methods of: skinning, anti-corrosive protection, wing, empennage and engine attachments

AC2.10
Overview of: structure assembly techniques: riveting, bolting, bonding

AC2.11
Overview of eg: chromating, anodising, painting

AC2.12
Overview of eg: polishing, use of solvents and detergents

AC2.13
Overview of airframe symmetry: methods of alignment and symmetry checks.

Learning outcome

The learner will:

LO3 Know fixed wing aircraft structure

Assessment criteria

The learner can:

AC3.1 describe typical fuselage construction and pressurisation sealing

AC3.2 describe fuselage attachment points
AC3.3 describe typical seat installation and cargo loading systems
AC3.4 describe typical doors and emergency exits
AC3.5 describe typical windows and windscreens
AC3.6 describe typical wing construction
AC3.7 describe typical wing fuel storage
AC3.8 describe typical attachment points
AC3.9 describe the construction of typical stabilisers
AC3.10 describe typical flight control surfaces
AC3.11 describe methods of balancing flight control surfaces
AC3.12 describe the construction of typical nacelles and pylons.

Range

AC3.1
Overview of
(ATA 52/53/56) including:
Design principles such as load transfer, load path continuity and reducing stress-raisers; minimising or eliminating the loads and stresses experienced by a pressurised fuselage in flight (eg: tension, hoop stress, shear stress) and to minimise crack propagation and the effects of bursting and fatigue stress
Methods used to prevent doors and other large cut-outs from opening under pressurisation loads
Methods to ensure protection from rapid decompression

AC3.2
Overview of
(ATA 52/53/56) including: wing, stabiliser, pylon and undercarriage attachments

AC3.3
Overview of
(ATA 52/53/56) including: seat attachment methods (pilots, other cockpit seats, cabin crew and passenger), seat pitch

AC3.4
Overview of
(ATA 52/53/56) including: construction, mechanisms, operation and safety devices

AC3.5
Overview of
(ATA 52/53/56) including: construction and mechanisms

AC3.6
Overview of
(ATA 57) including: spars, ribs, skin, wing root attachments, fairings, nacelles, wing profiles

AC3.7
Overview of
(ATA 57) including the siting and installation in/on the wing structure of: integral tanks, bag tanks, tip tanks, access, refuelling points, externally mounted tanks

AC3.8
Overview of
(ATA 57) including: landing gear, pylon, control surface and high lift/drag attachments

AC3.9
Overview of
(ATA 55) including for horizontal and vertical: structure, attachment to fuselage, attachment of control surfaces

AC3.10
Overview of
(ATA 55/57): construction and attachment

AC3.11
(ATA 55/57): mass and aerodynamic

AC3.12
Overview of
(ATA 54): construction, firewalls, engine mounts.

Learning outcome

The learner will:

LO4 Know cabin conditioning, pressurisation and oxygen systems

Assessment criteria

The learner can:

AC4.1 describe typical aircraft air conditioning systems
AC4.2 describe typical aircraft pressurisation systems
AC4.3 describe typical cabin conditioning protection and warning devices
AC4.4 describe typical aircraft oxygen systems
AC4.5 describe typical aircraft pneumatic/vacuum systems.

Range

AC4.1
Overview of (ATA 21 including: cabin air scoops, superchargers, turbochargers, ducting, valves (eg: pressure relief, negative pressure, cabin pressure control, emergency depressurisation), controllers, regulators

AC4.2
Overview of (ATA 21) including: air inlets, air conditioning units, distribution systems (cabin, equipment conditioning), temperature and humidity control system

AC4.3
Overview of (ATA 21) including: sensors and transmitters, indicators, warning devices, safety valves and cut-offs

AC4.4
Overview of (ATA 35):
System lay-out: cockpit, cabin
Sources, storage, charging and distribution
Supply regulation
Indications and warnings

AC4.5
Overview of (ATA 36) including:
System lay-out
Sources: engine/APU, compressors, reservoirs, ground supply
Pressure control
Distribution
Indications and warnings
Interfaces with other systems.

Learning outcome

The learner will:

LO5 Know aircraft instrument and avionics systems

Assessment criteria

The learner can:

AC5.1 describe typical pitot static flight instruments
AC5.2 describe typical gyroscopic flight instruments
AC5.3 describe typical aircraft compasses
AC5.4 describe typical angle of attack and stall warning systems
AC5.5 describe indications provided for other aircraft systems
AC5.6 describe the layout and operating fundamentals of auto flight control systems
AC5.7 describe the layout and operating fundamentals of communication systems
AC5.8 describe the layout and operating fundamentals of navigation systems

Range

AC5.1
Overview including:
(ATA 31):
Altimeter, air speed indicator, vertical speed indicator
Construction, function, aircraft installation

AC5.2
Overview including:
(ATA 31):
Artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator
Construction, function, aircraft installation

AC5.3
Overview including:
(ATA 31):
Direct reading, remote reading
Construction, function, aircraft installation, adjustment

AC5.4
Overview including:
(ATA 31):
Angle of attack: probe, indication
Stall warning sensors, indicators, warning systems – horns, visual alarms, stick-shakers

AC5.5
Overview (ATA 31) including indications for: engines, electrical power, fuel system, hydraulics, undercarriage, flying controls, environmental
Including temperature, current, voltage, contents, fluid flow, pressure, position
Independent instruments such as clocks, inclinometers etc

AC5.6
Overview including:
Auto Flight (ATA 22): Auto-trim, yaw damping, autopilot, autothrottle, autoland
Layout and fundamentals of operation of including:
Sensors and inputs
Servomotors and actuators
Computers and interfaces with other systems
Controllers and indicators
Safety cut outs

AC5.7
Overview including:
Communications (ATA 23): HF, VHF, UHV, Satcom, data links, audio systems (Interphone, intercom), audio integration
Layout and fundamentals of operation of including:
Controllers, transmitter/receivers, antennae

AC5.8
Overview including:
Navigation Systems (ATA 34):
Flight environmental data (eg: pitot-statics, temperature, rate of climb, central air data computer)
Attitude and direction (eg: compasses, attitude director, vertical and direction references)
Landing and taxiing (eg: Localiser, glide slope, ILS markers, ground guidance)
Independent position finding (eg: inertial navigation, star tracker, anti-collision, weather radar),
Dependent position finding (eg: DME, VOR, ADF, GPS)
Flight management computers (eg: performance data, course, display, warnings)

Learning outcome

The learner will:

LO6 Know electrical power, lighting and ice and rain protection systems

Assessment criteria

The learner can:

AC6.1 describe typical aircraft battery installations and their operation
AC6.2 describe aircraft DC power generation systems
AC6.3 describe aircraft power distribution, voltage regulation and circuit protection
AC6.4 describe inverters, transformers, and rectifiers
AC6.5 describe aircraft external and ground power systems
AC6.6 describe aircraft lighting systems
AC6.7 describe ice formation and classification, and ice detection systems
AC6.8 describe aircraft de-icing systems
AC6.9 describe aircraft rain removal systems

Range

AC6.1
Overview of
(ATA 24): batteries and battery installations, safety when charging, handling and operating batteries, care and maintenance of batteries, battery performance and testing, aircraft battery installations

AC6.2
Overview of
(ATA 24) eg: generators, alternators, installation, drive systems, indication

AC6.3
Overview of
(ATA 24): bus bars, load sharing, paralleling, real load, reactive load, bus tie contactors, voltage regulation, circuit protection

AC6.4
Overview of
(ATA 24): rotary and static invertors, power and current transformers

AC6.5
Overview of
(ATA 24): ground power units, DC battery cart, rectifiers, invertors, APUs, connectors (number, purpose and length of pins, compatibility) connection and disconnection procedures, power on/off procedures, earthing, safety precautions

AC6.6
(ATA 33): external lighting – navigation, anti-collision, landing, taxiing, ice
Internal lighting: cabin, cockpit, cargo
Emergency lighting

AC6.7
Overview of
(ATA 30): eg: glaze ice, rime ice, mixed (cloudy) ice, super-cooled large droplets, runback ice, intercycle ice. From eg: supercooled moisture, freezing rain/drizzle, snow

Detection systems eg: optical, ultrasonic, cold soak

AC6.8
Overview of
(ATA 30): electrical, hot air, pneumatic and chemical
Aerofoils, air intakes, pitot and static, windows, windshields and doors, antennas and radomes, propellers, probe and drain heating

AC6.9
Overview of
(ATA 30): wiper systems.

Learning outcome

The learner will:

LO7 Know equipment and furnishings, water and waste and fire protection systems

Assessment criteria

The learner can:

AC7.1 describe aircraft emergency equipment requirements
AC7.2 describe aircraft seats, harnesses and belts
AC7.3 describe typical lay-outs of aircraft cabin equipment
AC7.4 describe typical aircraft cabin furnishing installations
AC7.5 describe aircraft cabin entertainment equipment
AC7.6 describe aircraft galley installations
AC7.7 describe aircraft cargo handling and retention equipment
AC7.8 describe aircraft airstairs
AC7.9 describe the lay-out of a typical aircraft water system
AC7.10 describe the layout of a typical aircraft toilet system
AC7.11 describe aircraft fire and smoke detection and warning systems
AC7.12 describe aircraft fire extinguishing systems.

Range

AC7.1
(ATA 25) including: life rafts and jackets, emergency locator beacons (surface and underwater), first aid kit, flares, evacuation equipment

AC7.2
(ATA 25) including: passenger seats, seat belts and extensions, other special restraints, first class sleeping berths
Crew seats, seat belts and harnesses

AC7.3
Overview of

(ATA 25) including: cabin seating configuration (eg: first, club, economy), movable partitions positions, overhead storage, galley positions, lavatories, emergency exits, entertainment equipment, cabin monitoring display
Awareness of corrosion potential in the area of lavatory and galley installations

AC7.4
Overview of
(ATA 25) including fitting of: seats, insulation, carpets, partitions, curtains, cockpit door security, wardrobes, cupboards, other storage

AC7.5
Overview of
(ATA 25) including: individual multimedia screens (seat), bulkhead multimedia screens, individual entertainment controller, DVD and tape players, overhead loudspeakers

AC7.6
Overview of
(ATA 25) including: removable and fixed cabinets, ovens, refrigerators, waste storage and disposal, dish racks, coffee maker, water dispenser, service trolleys, electrical and water supplies.
Explain the importance of maintaining serviceability and integrity of water drains and their heaters

AC7.7
(ATA 50) including: Cargo hold – nets, containers, lashing and latching points, floor rollers
Main cabin in cargo or passenger/cargo role – floor fitments, rollers, tracks, hard points for nets and straps

AC7.8
Overview of
(ATA 60) including: structure, actuating mechanisms, controls, handrails

AC7.9
(ATA 38) including: supply, distribution, servicing and draining, operation of pumps, waste water extraction and storage, anti-icing measures
Describe corrosion potential around water pipes and drains and in the bilges; corrosion prevention measures

AC7.10
(ATA 38) including: flushing and servicing, operation of flushing system, gate valves, storage tanks, service points
Describe corrosion potential around water pipes and drains, and in the bilges; corrosion prevention measures
Explain the potential for ice to form and break off in-flight around insecure and leaking service points

AC7.11
(ATA 26) including:
Fire detection: continuous element or pressure type sensor responder, fire wire, thermal switch, thermocouple, infra-red
Smoke detection: carbon monoxide, photoelectric, visual, infra-red

Central warning systems: operation and indications, inputs, outputs, priority philosophy
System inspection, maintenance and test

AC7.12
(ATA 26) including: extinguishing agents, positioning of fire extinguisher units, method of initiating
System inspection, maintenance and test
Portable fire extinguishers: labelling, extinguishing agents, stowage, use, inspection.

Learning outcome

The learner will:

LO8 Know aircraft flight controls

Assessment criteria

The learner can:

AC8.1 describe the function and operation of aircraft primary controls
AC8.2 describe the operation of trim tabs
AC8.3 describe high lift devices
AC8.4 describe speed brakes and lift dump devices
AC8.5 describe the operation of manual flight control systems
AC8.6 describe the function and operation of gust lock systems
AC8.7 describe the process of balancing and rigging an aircraft
AC8.8 describe aircraft stall warning systems.

Range

AC8.1
Overview of (ATA 27) including: control wheels, cables, rods, linkages, chains, pulleys, control surface etc
For: aileron, elevator, rudder, spoiler

AC8.2
Overview of (ATA 27) including: manual trim, servo and anti-servo tabs

AC8.3
Overview of (ATA 27) including: control handles, cables, warning systems, linkages, control surfaces, position indicators for high lift devices including:
Trailing edge flaps
Leading edge flaps
Slats
Slots

AC8.4
Overview of (ATA 27) including: control handles, cables, warning systems, linkages, position indicators
Limiters for devices including:

Speed brakes
Variable aerodynamic fairings
Spoilers
Other drag and lift dumping devices

AC8.5
Overview of (ATA 27) manual flight control system operation including: cables and pulleys, push/pull rods, chain and sprocket, torque tubes, trim and balance, linkages, adjustment, inspection, maintenance, location and layout, fairleads, position indication

AC8.6
Detailed knowledge of (ATA 27) including: reasons for using gust locks, type of gust lock, Methods of operation

AC8.7
Detailed knowledge of (ATA 27) including: reasons for balancing control surfaces, equipment, tools and methods of balancing a control surface
Reasons for checking control surface rigging, equipment, tools and methods of measuring and rigging control surfaces

AC8.8
Detailed knowledge of (ATA 27) including: sensors and detectors, stick shakers, stall warning audible and visual devices

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Learning outcome

The learner will:

LO9 Know aircraft fuel systems

Assessment criteria

The learner can:

AC9.1 describe typical aircraft fuel system layouts
AC9.2 describe typical aircraft fuel tanks
AC9.3 describe typical aircraft fuel supply systems
AC9.4 describe typical fuel cross-feed and transfer systems
AC9.5 describe typical fuel indications and warnings
AC9.6 describe typical aircraft refuelling and defuelling systems.

Range

AC9.1
Overview of (ATA 28) including: components of the fuel system, positioning and purpose of tanks, pumps, refuelling points, interconnection of system components, power supplies

AC9.2
Overview of (ATA 28) including: integral tanks, tip tanks, bladder cells, baffles, ventilation, cell and tank interconnectors, over-wing filler necks and caps, reservoir feed pumping system, in-

tank reservoirs, leak detection and classification, tank sealing and repair, pressurisation, fire and explosion suppression

AC9.3
Overview of (ATA 28) including: pipework, pumps (including booster, ejector and backing), valves, strainers, emergency devices such as power plant fuel quick disconnect

AC9.4
Overview of (ATA 28) including: pipework, cross-feed pumps, transfer valves, fuel manifold

AC9.5
Overview of (ATA 28) including: fuel quantity, system pressure, temperature and flow; valve positions, warnings for tank pump pressure

AC9.6
Overview of (ATA 28) including: methods of refuelling, location and access to refuelling points, bonding, distribution to and from tanks during re-fuel/de-fuel.

Learning outcome

The learner will:

LO10 Know hydraulic and landing gear systems

Assessment criteria

The learner can:

AC10.1 describe typical aircraft system lay-outs
AC10.2 describe hydraulic filters and the types and properties of hydraulic fluids in use
AC10.3 describe typical hydraulic reservoirs and accumulators
AC10.4 describe hydraulic pressure generation (electric and mechanical)
AC10.5 describe typical hydraulic pressure control and power distribution
AC10.6 describe typical hydraulic system indication and warning systems
AC10.7 describe the construction and shock-absorbing action of aircraft landing gear
AC10.8 describe typical landing gear extension and retraction systems
AC10.9 describe typical landing gear indications and warning devices
AC10.10 describe wheels, brakes, antiskid and autobraking
AC10.11 describe typical aircraft tyres, their design, classification and application
AC10.12 describe typical aircraft landing gear steering and shimmy damping systems.

Range

AC10.1
Overview of (ATA 29) including: components of a system, positioning and purpose of tanks, accumulators, valves, pumps, levers, switches, cables, pipework, seals, quick disconnection, wiring, and external connectors, up to but not including supply valves to individual systems

AC10.2

Overview of (ATA 29) including: mineral, synthetic hydrocarbon and phosphate-ester based fluids, properties (eg: low compressibility, low temperature performance, resistance to combustion, resistance to moisture and gas absorption), shelf life, importance of cleanliness, contamination checks, particular health and safety issues (eg: Skydrol)
Hydraulic filters: construction, filtering operation, maintenance, alert systems, types of filter (eg: metal element, two-stage)

AC10.3
Overview of (ATA 29) including: purpose, construction, operation of accumulators (diaphragm, bladder and piston type); reservoirs (reason for pressurisation, methods of pressurisation, control of pressure)

AC10.4
Overview of (ATA 29) including construction, operation, location and function of:
Electric and mechanical pumps (eg: constant and variable delivery, piston, gear, gerator, vane)

AC10.5
Overview of (ATA 29) including construction, operation, location and function of:
Pressure control: relief valves, regulators, reducers, thermal relief valves, de-boosters, cut-off valves, low-demand fluid circulation, protection from overpressure damage
Power distribution: manifolds, valves (eg: selector, in-line check, sequence, spool, rotary, priority, disconnect), hydraulic fuses

AC10.6
Overview of (ATA 29) including: pressure, flow, contents, temperature, contamination/clogging, transmitters, indicators, interconnection, warning methods

AC10.7
Overview of (ATA 32) including:
Arrangement: fixed, retractable tail wheel, tricycle, tandem, single wheel, double wheel, tandem wheel, bogie
Construction: main and nose casting, torque link arms, pivot trunnion side braces, trunnion beam, drag brace/strut, shock strut cylinders, positioned, equaliser, pivot beam, pivot fork and shafts, up and down locks
Shock struts – construction and operation: types (metering pin, metering tube, separator piston), damping and snubbing devices, axles, mounting assemblies, glands, packing, seals and backing rings, charging and bleeding, ground locks, safety devices

AC10.8
Overview of (ATA 32) including:
Normal: electrical and hydraulic retraction and extension, locking methods, door mechanisms, extension and retraction sequencing
Emergency: pneumatic, hand pump and gravity, locking

AC10.9
Overview of (ATA 29) including: gear-located switches, cockpit indicators, warning devices (visual, mechanical, audible), typical retraction faults and associated cockpit indication

AC10.10
Overview of (ATA 29) including:

Types of wheel: material, detachable flange, split rim, wheel bearings, fusible plugs, inspection
Brake unit: construction, wear limits, maintenance/inspection
Hydraulic brake systems
Emergency brake systems
Parking brake systems
Mechanical/hydraulic anti-skid
Electro-hydraulic anti-skid
Auto-brake systems (landing, take-off, intensity settings, conditions for operation)

AC10.11
Overview of (ATA 29) including: bias (cross) ply, radial ply, tubed, tubeless, sidewall markings, tread patterns, wear limits, damage limits (eg: oil contamination, cuts, blisters)

AC10.12
Overview of (ATA 29) including: cockpit controls (wheel, tiller etc.), linkages (hydraulic, electrical, mechanical), pressurising assembly, power sources, metering valve, steering cylinders, compensator/accumulator, follow-up, safety valves, centring cam, differential assembly
Nosewheel shimmy damping: types of damper (piston, steer, vane), causes of shimmy.

Unit 008 Fundamentals of aircraft aerodynamics, structures and systems for piston engines

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module11B – Turbine Aeroplane Aerodynamics, Structures and Systems

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information and precise technical details.

Unit 009 Fundamentals of helicopter aerodynamics, structures and systems

UAN:	H/503/1101
Level:	3
Credit value:	12
GLH:	115
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 310, 316 etc
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner a broad and detailed knowledge of helicopter systems as part of a comprehensive training programme for aircraft maintenance engineers. It covers the complete syllabus for the CAA Part-66 Module 12 for the category A3 and A4 licences. .

Learning outcome

The learner will:

LO1 Know aspects of rotary wing aerodynamics

Assessment criteria

The learner can:

AC1.1 describe terminology related to rotary wing aerodynamics
AC1.2 describe the effects of gyroscopic precession
AC1.3 describe torque reaction and directional control
AC1.4 describe dissymmetry of lift, blade tip stall
AC1.5 describe the translating tendency and its correction
AC1.6 describe the Coriolis Effect and its compensation
AC1.7 describe ground effect
AC1.8 describe vortex ring state, power settling, over-pitching
AC1.9 describe auto-rotation

Range

AC1.1

Overview

Including terminology to enable an understanding of the fundamentals of rotary wing flight in the following categories: rotor blade architecture, production of lift by rotor blades considered as a spinning disc, control of lift and conversion into motion in vertical and horizontal planes, control of helicopter attitude and motion by altering rotor blade, rotor blade behaviour (eg: flap up, flap down, coning, blade tip vortex)

Configurations of rotorcraft eg: autogyro, dual rotor, single rotor

AC1.2

Overview including:

Application of basic gyroscope theory to a rotary wing aircraft:

Definition of gyroscopic precession

Effect on a spinning mass eg: rotor blades

AC1.3

Overview including:

Explanation of how torque is generated on helicopter with a single turning main rotor

Explanation of how dual rotor systems cancel out the torque

Different types of antitorque system eg: variable pitch tail rotor, fenestron (fan-in-tail), low pressure air duct producing a ‘Coanda effect’ lift force

How directional control is achieved

AC1.4

Overview including:

Definition of lift dissymmetry

Cause eg: differential relative airflow across the main rotor disc in forward flight

Effect on the aircraft without correction

Designed-in corrective action (eg: flap up and flap down)

Effect of increasing forward speed leading to retreating blade tip stall

Limiting effect on top speed (VNE)

AC1.5

Overview including:

Definition of translation tendency (drift) in a hovering single rotor helicopter

Counteracting translation tendency eg: tilting the main rotor mast, adjustment of flight control rigging, bias on the cyclic pitch control

AC1.6

Overview including:

Definition of the Coriolis Effect (Law of conservation of Angular Momentum)

Effect on spinning rotor blades

Effect on flight

Counteraction measures eg: underslung rotor, dampers, blade twist

Explanation of why an underslung two bladed rotor is least effected

AC1.7

Overview including:

Define ground effect and illustrate airflow through the rotor and underneath the aircraft

AC1.8

Overview including:

Define vortex ring state (settling with power)

Conditions under which it happens: eg: Low forward speed with high upflow into the rotor, descending exit from a ground effect hover, autorotation recovery

Effects eg: loss of rotor efficiency, secondary vortex ring, uncommanded pitch and roll oscillations, little or no cyclic authority

Corrective action eg: increase forward speed and/or partially lower the collective

Definition of over-pitching

AC1.9

Overview including:

Principles of autorotation, freewheeling unit, use of controls

Autorotation with forward speed – blade regions

Vertical autorotation – blade regions

Effects of excessively high or low autorotation RPM

Learning outcome

The learner will:

LO2 Understand the operation of helicopter flight controls

Assessment criteria

The learner can:

AC2.1 explain the principles of cyclic control
AC2.2 explain the principles of collective control
AC2.3 explain the principles of operation of a swash plate
AC2.4 explain the principles of yaw control
AC2.5 explain the design and operational features of a main rotor head
AC2.6 explain the function and construction of blade dampers
AC2.7 explain the construction and attachment of rotor blades
AC2.8 explain the construction and operation of trim control, fixed and adjustable stabilisers
AC2.9 explain the operation of flight control systems
AC2.10 explain the principles and operation of artificial feel
AC2.11 explain the principles and processes of balancing and rigging.

Range

AC2.1

Detailed knowledge of: mechanical and electrical layout, control movement produced by each movement of the control, aerodynamic effect of each movement

Including grip mounted switches

Maintenance, typical faults, symptoms, causes, corrective measures

AC2.2

Detailed knowledge of: mechanical and electrical layout, control movement produced by each movement of the control, aerodynamic effect of each movement

Including throttle and the combined and separate effects of collective and throttle on rotor RPM and piston engine manifold pressure, function of a correlator/governor
Typical faults, symptoms, causes, corrective measures

AC2.3
Detailed knowledge of: purpose, design and mechanical layout, function, maintenance, typical faults, symptoms, causes, corrective measures

AC2.4
Detailed knowledge of: purpose, design and mechanical layout, function, maintenance, typical faults, symptoms, causes, corrective measures:
Anti-torque control
Tail rotor
Bleed air

AC2.5
Detailed knowledge of: types (fully articulated, semi-rigid, rigid); design and operation features purpose, mechanical layout, function, maintenance, typical faults, symptoms, causes, corrective measures

AC2.6
Detailed knowledge of: purpose, design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures

AC2.7
Detailed knowledge of: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures:
Main and tail rotor blade construction and attachment

AC2.8
Detailed knowledge of: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures

AC2.9
Detailed knowledge of: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures
System types: manual, hydraulic, electrical and fly-by-wire

AC2.10
Detailed knowledge of: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures

AC2.11
Detailed knowledge of main rotor control system including: rigging procedure including freedom of operation, range of movement, throttle-collective correlation, synchronised elevator operation, friction
Detailed knowledge of tail rotor control system including: pedal travel, pedal alignment, T/R range of movement, cable tension, control chain twist and sprocket engagement, rod/tube adjustment.

Learning outcome

The learner will:

LO3 Know blade tracking and the operation of helicopter transmission systems

Assessment criteria

The learner can:

AC3.1 describe the procedures for rotor alignment
AC3.2 describe the procedures for main and tail rotor tracking
AC3.3 describe the procedures for static and dynamic balancing
AC3.4 describe the common vibration types and vibration reduction methods
AC3.5 describe what is meant by ground resonance
AC3.6 describe the construction and operation of rotor gear boxes
AC3.7 describe the construction and operation of clutches, free wheel units and rotor brakes
AC3.8 describe the construction and installation of tail rotor power transmission components
AC3.9 describe the construction and function of vibration dampers and bearing hangers.

Range

AC3.1

Overview including:
Alignment and adjustment procedures including when they are required, measurements, limits and limits and possible adjustments

AC3.2

Overview including: tracking and adjustment procedures including when they are required, measurements, limits and possible adjustments
Main rotor blades
Tail rotor blades

AC3.3

Overview including: static and dynamic balancing procedures including when they are required, measurements, limits and possible adjustments

AC3.4

Overview including: vibration types, their causes and methods of reducing the vibration levels

AC3.5

Overview of the phenomenon for example: associated with fully articulated rotor systems and can occur if the helicopter is touched down hard on one wheel. The resulting shock is transmitted to the main rotor system causing a change in rotor blade alignment along the drag hinge. If not corrected immediately the helicopter can shake itself to pieces very quickly.

AC3.6

Overview including: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures for:
Main rotor gearbox
Tail rotor gearbox

AC3.7
Overview including: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures for:
Clutches
Free wheel units
Rotor brakes

AC3.8
Overview including: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures for:
Drive shafts
Flexible couplings
Bearings

AC3.9
Overview including: design and installation, function, maintenance, typical faults, symptoms, causes, corrective measures for:
Vibration dampers
Bearing hangers.

Learning outcome

The learner will:

LO4 Understand helicopter airframe structures

Assessment criteria

The learner can:

AC4.1 explain the airworthiness requirements for structural strength
AC4.2 explain the classification of aircraft structure
AC4.3 explain the concept of in-built safety
AC4.4 explain how locations on the airframe are defined
AC4.5 explain the physical effects of flying on aircraft structures
AC4.6 explain how moisture build-up in airframe structures is minimised
AC4.7 explain how airframe design allows for the installation of aircraft systems
AC4.8 explain how the aircraft is protected from lightning strikes and other static discharges
AC4.9 explain typical construction methods and techniques for the airframe structure
AC4.10 explain the construction and installation of typical pylons, stabilisers and undercarriage attachments
AC4.11 explain the construction and attachment of the seat installations
AC4.12 explain the construction and attachment of doors and windows
AC4.13 explain the construction and installation of fuel tanks
AC4.14 explain the construction and installation of engine firewalls
AC4.15 explain the construction and installation of engine mounts
AC4.16 explain how airframe symmetry is measured.

Range

AC4.1
Eg: structural strength, strength-to-weight ratio, rigidity and flexibility

AC4.2
Primary, secondary and tertiary

AC4.3
Fail safe, safe life, damage tolerance concepts

AC4.4
Zonal and station identification systems

AC4.5
Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue

AC4.6
Drains and ventilation provisions

AC4.7
Including types of fuselage construction eg: monocoque, semi-monocoque
Systems eg: electrical system, engines (fuselage mounting points, cowlings, fuel tanks etc), transmission and rotor pylons, transmission shafts, pipework, reservoirs, tanks, attachment points for undercarriage etc
Structural assembly techniques: riveting, bolting, bonding
Methods of surface protection eg: chromating, anodising, painting
Surface cleaning

AC4.8
Lightning strike protection provision, aircraft bonding

AC4.9
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning and anti-corrosive protection

AC4.10
Construction, function, installation and maintenance of:
Pylon and transmission mounts
Stabilisers: synchronised elevator/horizontal stabiliser, vertical stabiliser, fins
Undercarriage attachments

AC4.11
Construction, function, installation and maintenance of:
Seats, seat rails, operating and locking mechanisms

AC4.12
Construction, function, installation and maintenance of:
Doors: construction, mechanisms, operation and safety devices;
Windows and windscreen construction

AC4.13

Location, attachment, maintenance and inspection of
Integral tanks
Externally mounted tanks
Internally mounted (eg: ferry) tanks

AC4.14
Design, construction, materials, and installation of engine firewalls

AC4.15
Design, materials, construction location, attachment, maintenance and inspection of engine mounts for:
Piston engines
Gas turbine engines

AC4.16
Methods of alignment and symmetry checks including: datum points and lines, methods of measurement, preparation for measurement, recording data, calculations, tolerances, interpretation of data.

Learning outcome

The learner will:

LO5 Know helicopter air conditioning, pneumatics and vacuum systems

Assessment criteria

The learner can:

AC5.1 describe where air is sourced for air conditioning and heating
AC5.2 describe the function of air conditioning systems
AC5.3 describe helicopter air distribution systems
AC5.4 describe air flow and temperature control systems;
AC5.5 describe air conditioning protection and warning devices
AC5.6 describe the lay-out and function of a typical pneumatic and vacuum system.

Range

AC5.1
Overview (ATA21) including: gas turbine engine bleed, piston engine systems, ground cart

AC5.2
Overview (ATA21):
Types of system, equipment, function, installation and maintenance
Bleed air heating
Exhaust heat exchanger
Ram-air cooling

AC5.3
Overview of (ATA21) including: ducting (shape, material, size), attachment and routing, outlets

AC5.4
Overview of (ATA21) including: sensors, positioning, indication and control units

AC5.5
Overview of (ATA21) eg: over-temperature, noxious gas, flow rate

AC5.6
Overview of (ATA 36) including:
System lay-out
Sources: engine driven compressors, bleed air, air bottles, ground supply
Pressure control including manual and automatic control valves, pressure relief valves
Distribution - hardware including pipework, valves, manifolds, selectors, isolators
Indications and warnings
Interfaces with other systems.

Learning outcome

The learner will:

LO6 Know helicopter instrumentation and avionics systems

Assessment criteria

The learner can:

AC6.1 describe typical pitot static flight instruments
AC6.2 describe typical gyroscopic flight instruments
AC6.3 describe typical aircraft compasses
AC6.4 describe the function of vibration indicating systems – HUMS
AC6.5 describe indications provided for other aircraft systems
AC6.6 describe the layout and operating fundamentals of auto flight control systems
AC6.7 describe the layout and operating fundamentals of communication systems
AC6.8 describe the layout and operating fundamentals of navigation systems.

Range

AC6.1
Overview (ATA 31):
Altimeter, air speed indicator, vertical speed indicator
Construction, function, aircraft installation

AC6.2
Overview (ATA 31):
Artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator
Single instrument displays, glass cockpit: construction, function, aircraft installation

AC6.3
Overview (ATA 31):
Direct reading, remote reading

Single instrument displays, glass cockpit: construction, function, aircraft installation, adjustment

AC6.4
Overview of Vibration Health Monitoring (VHM)/HUMS sensors, parameters measured, alarms and alerts, information provided, pilot interface

AC6.5
Overview (ATA 31) including indications for: engines, electrical power, fuel system, hydraulics, undercarriage, flying controls, environmental
Including temperature, current, voltage, mass air flow, contents, fluid flow, pressure, position

Integrated Modular Avionics (ATA 42) – overview of modules such as:
Bleed management, air pressure control, air ventilation and control, avionics and cockpit ventilation control, temperature control, air traffic communication, avionics communication router, electrical load management, circuit breaker monitoring, electrical system bite, fuel management, braking control, steering control, landing gear extension and retraction, tyre pressure indication, oleo pressure indication, brake temperature monitoring, etc.
Overview of Core System, Network Components.

Overview of On Board Maintenance Systems (ATA45):
Central maintenance computers;
Data loading system;
Electronic library system;
Printing;
Structure monitoring (damage tolerance monitoring).

Overview of Cabin Systems (ATA 44):
Interface between cockpit/cabin crew and cabin systems
Functions such as: access to pre-departure/departure reports, email/intranet/Internet access, passenger database;
Server
Cabin Core System; server interfacing with:
Flight attendant panels
In-flight Entertainment System;
External Communication System;
Cabin Mass Memory System;
Cabin Monitoring System;
Miscellaneous Cabin Systems

Information Systems (ATA46)
Note: Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display

Overview of, for example:
Air Traffic and Information Management Systems and Network Server Systems
Electronic library mass storage and controller
Aircraft General Information System
Flight Deck Information System
Maintenance Information System
Passenger Cabin Information System
Miscellaneous Information System

AC6.6
Overview including:
Auto Flight (ATA 22): Stability Augmentation System (SAS), autopilot
Layout and fundamentals of operation of including:
Force trim system
Two-axis system
Three-axis system
Four-axis system
Sensors and inputs
Servomotors and actuators
Computers and interfaces with other systems
Controllers and indicators
Manual over-rides and safety cut outs

AC6.7
Overview including:
Communications (ATA 23): HF, VHF, UHV, Satcom, data links, audio systems (Interphone, intercom), audio integration
Layout and fundamentals of operation of including:
Controllers, transmitter/receivers, antennae,

AC6.8
Overview including:
Navigation Systems (ATA 34):
Flight environmental data (eg: pitot-statics, temperature, rate of climb, central air data computer)
Attitude and direction (eg: compasses, attitude director, vertical and direction references)
Landing and taxiing (eg: Localiser, glide slope, ILS markers, ground guidance)
Independent position finding (eg: anti-collision, weather radar),
Dependent position finding (eg: DME, VOR, ADF, GPS)
Flight management computers (eg: performance data, course, display, warnings).

Learning outcome

The learner will:

LO7 Know helicopter electrical power and lighting

Assessment criteria

The learner can:

AC7.1 describe typical helicopter battery installations and their operation
AC7.2 describe helicopter DC power generation systems
AC7.3 describe helicopter AC power generation systems
AC7.4 describe helicopter emergency power generation
AC7.5 describe helicopter power distribution
AC7.6 describe inverters, transformers, and rectifiers
AC7.7 describe helicopter external and ground power systems

AC7.8 describe helicopter lighting systems.

Range

AC7.1
Overview of including (ATA 24): batteries and battery installations, safety when charging, handling and operating batteries, care and maintenance of batteries, battery performance and testing, aircraft battery installations

AC7.2
Overview including:
(ATA 24) eg: starter/generators, alternators, installation, drive systems, indication

AC7.3
Overview of including (ATA 24): constant speed drive (oil system, connecting devices, indicating and warning systems), alternators, generators, installations

AC7.4
Overview of including (ATA 24): emergency battery power, air driven turbines

AC7.5
Overview of including (ATA 24): bus bars, load sharing, paralleling, real load, reactive load, bus tie contactors, voltage regulation, circuit protection

AC7.6
Overview of (ATA 24): rotary and static invertors, power and current transformers, rectifiers (single and 3 phase, full and half-wave), transformer-rectifier units

AC7.7
Overview of including (ATA 24): AC and DC ground power units, DC battery cart, rectifiers, invertors, connectors (number, purpose and length of pins, compatibility) connection and disconnection procedures, power on/off procedures, earthing, safety precautions

AC7.8
Overview of (ATA 33): external lighting - navigation, anti-collision, landing, taxiing, ice
Internal lighting: cabin, cockpit
Fitting of strobe lights to helicopters
Emergency lighting.

Learning outcome

The learner will:

LO8 Understand helicopter landing gear, equipment and furnishings

Assessment criteria

The learner can:

AC8.1 explain the construction and shock-absorbing action of helicopter landing gear
AC8.2 explain typical helicopter landing gear extension and retraction systems

AC8.3 explain typical helicopter landing gear indications and warning devices
AC8.4 explain helicopter wheels, brakes
AC8.5 explain typical helicopter tyres, their design, classification and application
AC.6 explain typical helicopter landing gear steering and shimmy damping systems
AC8.7 explain typical helicopter skids, floats and skis
AC8.8 explain the requirements for helicopter emergency equipment
AC8.9 explain helicopter seats, harnesses and belts
AC8.10 explain helicopter lifting systems
AC8.11 describe helicopter emergency flotation systems
AC8.12 describe helicopter cabin lay-out and cargo retention equipment
AC8.13 describe the typical layout of equipment in a helicopter
AC8.14 describe typical helicopter cabin furnishing installations.

Range

AC8.1
Detailed knowledge of (ATA 32) including: reasons for shock-absorbing (eg: avoidance of ground resonance caused by shocks transmitted to the main rotor head), design, attachment, maintenance, inspection of shock absorbing mechanisms on:
Skids
Floats
Skis
Wheels including: construction and configuration

AC8.2
Detailed knowledge of (ATA 32) including:
Normal: electrical and hydraulic retraction and extension, locking methods, door mechanisms, extension and retraction sequencing
Emergency: pneumatic, hand pump and gravity, locking

AC8.3
Detailed knowledge of (ATA 29) including: gear-located switches, cockpit indicators, warning devices (visual, mechanical, audible), typical retraction faults, associated cockpit indication and air-ground sensing

AC8.4
Detailed knowledge of (ATA 29) including:
Types of wheel: material, detachable flange, split rim, wheel bearings, fusible plugs, inspection
Brake unit: construction, wear limits, maintenance/inspection
Hydraulic brake systems
Emergency brake systems
Parking brake systems

AC8.5
Detailed knowledge of (ATA 29) including: bias (cross) ply, radial ply, tubed, tubeless, sidewall markings, tread patterns, wear limits, damage limits (eg: oil contamination, cuts, blisters)

AC8.6
Detailed knowledge of (ATA 29) including: cockpit controls (wheel, tiller etc.), linkages (hydraulic, electrical, mechanical), pressurising assembly, power sources, metering valve,

steering cylinders, compensator/accumulator, follow-up, safety valves, centring cam, differential assembly, main bogie steering
Nosewheel shimmy damping: types of damper (piston, steer, vane), causes of shimmy

AC8.7
Detailed knowledge of the design, construction, attachment, maintenance, and inspection of:
Skids
Floats
Skis

AC8.8
(ATA 25) including: life rafts and jackets, emergency locator beacons (surface and underwater), first aid kit, flares, evacuation equipment

AC8.9
(ATA 25) including: passenger seats, seat belts and extensions, other special restraints, first class sleeping berths
Crew seats, seat belts and harnesses

AC8.10
(ATA 25) design, construction, attachment, maintenance, and inspection of helicopter lifting gear above the point at which the load is released eg:
Hoists, attachment points, beams, load panels, load poles, cargo release units

AC8.11
Overview of:
(ATA 25) design, construction, attachment, maintenance, and inspection of helicopter emergency flotation systems

AC8.12
Overview of:
(ATA 25) design, construction, attachment, maintenance, and inspection of helicopter cargo restraint equipment
Typical cabin layouts

AC8.13
Overview of:
(ATA 25) typical helicopter equipment layouts including: electronic equipment bays, emergency equipment, mechanical linkages, controls, electrical panels etc

AC8.14
Overview of:
(ATA 25) typical helicopter furnishing layouts including: removable bulkheads, carpets, lavatories, galley equipment etc.

Learning outcome

The learner will:

LO9 Know helicopter fuel and hydraulic systems

Assessment criteria

The learner can:

AC9.1 describe the lay-out and functioning of a typical helicopter fuel system
AC9.2 describe typical fuel indications and warnings
AC9.3 describe helicopter refuelling and defuelling
AC9.4 describe typical helicopter system lay-outs
AC9.5 describe hydraulic filters and types and properties of hydraulic fluids in use in helicopters
AC9.6 describe typical helicopter hydraulic reservoirs and accumulators
AC9.7 describe helicopter hydraulic pressure generation
AC9.8 describe typical helicopter hydraulic pressure control and power distribution
AC9.9 describe typical helicopter hydraulic system indication and warning systems
AC9.10 describe how helicopter hydraulic power systems interface with other systems.

Range

AC9.1

Overview of including (ATA 28): layout, location and functioning of supply and fuel control systems for both gas turbine and piston engines including:
Piston engine, gravity feed: fuel tanks, pipework, supply pumps, transfer pump, priming pump, shut-off valves, fuel strainer, throttle control, carburettor, vents, drains, refuelling points
Pressurised supply systems – fuel injected piston engines and gas turbines: engine driven pumps, electric pumps, fuel manifold

AC9.2

Overview of including (ATA 28): fuel flow, contents and pressure sensors, indicators, warning lights and feeds to FADEC etc.

AC9.3

Overview of including (ATA 28):
Standard refuelling procedure ie: engine(s) off, rotors stationary – earthing, safety precautions, fuel sampling
Hot refuelling ie: engine(s) running/rotors turning – additional safety precautions

AC9.4

Overview of (ATA 29) including: multiple system integration, functions and features of each system, components of a system, positioning and purpose of tanks, accumulators, valves, pumps, levers, switches, cables, pipework, seals, quick disconnection, wiring, and external connectors, up to but not including supply valves to individual systems

AC9.5

Overview of (ATA 29) including: mineral, synthetic hydrocarbon and phosphate-ester based fluids, properties (eg: low compressibility, low temperature performance, resistance to combustion, resistance to moisture and gas absorption), shelf life, importance of cleanliness, contamination checks, particular health and safety issues (eg: Skydrol)
Hydraulic filters: construction, filtering operation, maintenance, alert systems, types of filter (eg: metal element, two-stage)

AC9.6

Overview of (ATA 29) including: purpose, construction, operation of accumulators (diaphragm, bladder and piston type); reservoirs (reason for pressurisation, methods of pressurisation, control of pressure)

AC9.7
Overview of (ATA 29) including: construction, operation, location and function of:
Normal operation: electrical and mechanical pumps (engine gear driven, bleed air driven),
Emergency: hand operated double-acting and ram air turbine pumps, auxiliary tanks and accumulators, valves and pipework

AC9.8
Overview of (ATA 29) including: construction, operation, location and function of:
Pressure control: relief valves, regulators, reducers, thermal relief valves, de-boosters, cut-off valves, low-demand fluid circulation, protection from overpressure damage
Power distribution: manifolds, valves (eg: selector, in-line check, sequence, spool, rotary, priority, disconnect), hydraulic fuses

AC9.9
Overview of (ATA 29) including: pressure, flow, contents, temperature, contamination/clogging, transmitters, indicators, interconnection, warning methods

AC9.10
Overview of (ATA 29) including with: electrical and emergency systems.

Learning outcome

The learner will:

LO10 Know helicopter ice, rain and fire protection systems

Assessment criteria

The learner can:

AC10.1 describe ice formation and classification, and ice detection systems
AC10.2 describe typical helicopter anti-icing systems
AC10.3 describe helicopter de-icing systems
AC10.4 describe helicopter rain removal systems
AC10.5 describe helicopter fire and smoke detection and warning systems
AC10.6 describe helicopter fire extinguishing systems.

Range

AC10.1
Overview of (ATA 30): eg: glaze ice, rime ice, mixed (cloudy) ice, super-cooled large droplets, runback ice, intercycle ice. From eg: supercooled moisture, freezing rain/drizzle, snow
Detection systems eg: optical, ultrasonic, cold soak

AC10.2
Overview of (ATA 30): electrical, hot air and chemical

Aerofoils, air intakes, pitot and static, windows, windshields and doors, antennas and radomes, propellers, probe and drain heating

AC10.3
Overview of:
(ATA 30): Rain repellent, wiper systems

AC10.4
Overview of (ATA 26) including:
Fire detection: continuous element or pressure type sensor responder, fire wire, thermal switch, thermocouple, infra-red
Smoke detection: carbon monoxide, photoelectric, visual, infra-red
Central warning systems: operation and indications, inputs, outputs, priority philosophy
System inspection, maintenance and test

AC10.5
Overview of (ATA 26) including: extinguishing agents, positioning of fire extinguisher units, method of initiating
System inspection, maintenance and test.

Unit 009 Fundamentals of helicopter aerodynamics, structures and systems

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replace the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module12 – Helicopter Aerodynamics, Structures and Systems

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information and precise technical details.

Unit 010 Fundamentals of aircraft gas turbine engines

UAN:	M/503/1103
Level:	2
Credit value:	13
GLH:	115
Assessment type:	Short answer question paper or External Examination
Relationship to NOS:	This unit is linked to the Level 2 Aeronautical Engineering NOS Unit 7
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to provide learners with a basic understanding of aircraft gas turbine engines and their associated systems. It covers the complete syllabus for CAA Part-66 Module 15 for Category A licenses.

Learning outcome

The learner will:

LO1 Understand the fundamental principles of aircraft gas turbine engines

Assessment criteria

The learner can:

AC1.1 explain the need for gas turbine propulsion
AC1.2 describe how the laws of motion and energy apply to the operation of gas turbine engines
AC1.3 describe shaped ducts
AC1.4 describe the constructional arrangement of turbojet, turbofan, turboshaft and turbo-prop engines.

Range

AC1.1

In simple terms:

Limitations of a piston engine
Requirement to fly high and fast
Fuel economy
Power

AC1.2
In simple terms:
Newton's Third Law of Motion
Force
Work
Power
Energy
Acceleration

AC1.3
In simple terms:
Inlet
Convergent and divergent ducts
Intake design eg:
Pod, side, bifurcated, wing root, bellmouth, variable geometry, chin intake, S-duct
The effect shaped ducts have on gas flows
Velocity
Temperature
Acceleration
Intake anti-icing

AC1.4
In simple terms:
Compressor
Combustion
Turbine
Exhaust
Engine spools
Gearboxes including output drives
Propellers and rotors

Learning outcome

The learner will:

LO2 Understand the operation of gas turbine engines

Assessment criteria

The learner can:

AC2.1 describe the operation of a compressor section
AC2.2 describe the operation of a combustion section
AC2.3 describe the operation of a turbine section
AC2.4 describe the operation of an exhaust section

AC2.5 describe the operation of the main gas turbine engine types.

Range

AC2.1
In simple terms:
Purpose
Axial flow compressor
Centrifugal compressor
Single, twin and multi spool compressors
Rotors
Stators
Airflow

AC2.2
In simple terms:
Purpose
Typical materials
Combustion chambers
Air/fuel ratio

AC2.3
In simple terms:
Purpose
Materials
LP and HP turbines

AC2.4
In simple terms:
Purpose
Jet pipe/exhaust unit/propelling nozzle
Noise suppression
Reverse thrust
Thrust augmentation

AC2.5
In simple terms:
Turbojet
Turbo-prop
Turbo-shaft
Bypass (fan) engine
Torque producing engines
Thrust producing engines.
Simple explanation of engine rating and factors affecting performance

Learning outcome

The learner will:

LO3 Understand gas turbine fuels, lubricants and associated systems

Assessment criteria

The learner can:

AC3.1 describe the properties and specifications required for gas turbine fuels and lubricants
AC3.2 describe safety precautions applicable to gas turbine fuels and lubricants
AC3.3 describe gas turbine lubrication systems
AC3.4 describe gas turbine fuel systems.

Range

AC3.1
In simple terms:
Specification
Viscosity
Calorific value
Synthetic oils
Additives eg anti-icing

AC3.2
Fire
Contamination
Specification
Water sediment
Bacterial growth

AC3.3
In simple terms:
Purpose
Loss and re-circulatory systems
Engine oil level checks
Pumps
Filters
Replenishment documentation

AC3.4
In simple terms:
Purpose
Safety issues
Fuel tanks
Fuel pumps
Main and emergency switches
Filters
Refuelling
Defuelling
Fuel jettison
Fuel contents
Engine control and fuel metering (eg: FADEC).

Learning outcome

The learner will:

LO4 Understand gas turbine starting, ignition and air systems

Assessment criteria

The learner can:

AC4.1 describe the operation of a gas turbine starting system
AC4.2 describe the operation of a gas turbine ignition system
AC4.3 describe the operation of a gas turbine air system.

Range

AC4.1
In simple terms:
Purpose
Types of starting systems eg: electric, air, gas turbine, hydraulic, cartridge

AC4.2
In simple terms:
Purpose
Typical ignition system components eg: high energy ignition units, igniter plug
Safety precautions

AC4.3
In simple terms:
Purpose
Anti-icing
Internal cooling
External air services.

Learning outcome

The learner will:

LO5 Understand gas turbine engine indication systems

Assessment criteria

The learner can:

AC5.1 describe gas turbine exhaust/turbine temperature indications/indicators
AC5.2 describe gas turbine oil pressure/temperature indications/indicators
AC5.3 describe gas turbine fuel pressure/flow indications/indicators
AC5.4 describe gas turbine engine speed indications/indicators
AC5.5 describe gas turbine vibration measurement and indication

AC5.6 describe gas turbine engine thrust/torque/power indications/indicators.

Range

AC5.1
In simple terms:
Gauges
Thermocouples
Warning panel/attention getters

AC5.2
In simple terms:
Temperature sensitive transmitter
Temperature indicator
Pressure switches/ transducers
Pressure gauge/indicator
Warning panel/attention getters

AC5.3
In simple terms:
Pressure switches/transducers
Pressure indicators/gauges
Fuel flow transmitters
Flow indicator
Warning panel/attention getters

AC5.4
In simple terms:
Engine speed indicator
Engine speed generator

AC5.5
In simple terms:
Vibration transmitter
Warning indicator

AC5.6
In simple terms:
Engine pressure transmitter
Engine pressure ratio
Engine turbine discharge pressure/jet pipe pressure systems
Torque transmitter
Torque indicator.

Learning outcome

The learner will:

LO6 Understand auxiliary power units and power-plant installations

Assessment criteria

The learner can:

AC6.1 describe the operation of a typical auxiliary power unit
AC6.2 describe a typical power plant installation.

Range

AC6.1

In simple terms:
Purpose
Operation including safety monitoring
Protection systems

AC6.2

In simple terms eg:
Intakes
Exhaust and jet pipe
Firewalls
Cowlings
Acoustic panels
Engine mounts
Anti-vibration mounts
Accessories
Hoses
Pipes
Connectors
Wiring looms
Control cables and rods
Lifting and slinging points
Drains.

Learning outcome

The learner will:

LO7 Understand gas turbine engine monitoring, fire protection and ground operation

Assessment criteria

The learner can:

AC7.1 describe the operation of fire detection and extinguishing systems
AC7.2 describe the procedure for starting and engine ground run-up
AC7.3 describe engine monitoring systems
AC7.4 describe compressor washing
AC7.5 describe foreign object damage (FOD).

Range

AC7.1

In simple terms:
Prevention of engine fire ignition
Engine cooling and ventilation
Fire detectors
Fire warning
Attention getters
Fire extinguishers and discharge nozzles

AC7.2

In simple terms:
Fire precautions
Performance checks
Mechanical integrity
Noise suppression
Safe running zones
Personal protective equipment

AC7.3

In simple terms:
Scheduled maintenance
Unscheduled maintenance
Oil sampling
Condition monitoring
Purpose
Equipment
Periodicity

AC7.4

In simple terms:
Reasons for washing compressors
Precautions when washing eg: blanking off electrics and air ducts to prevent ingress
Washing methods using water or detergent
Describe a typical compressor wash rig

AC7.5

Causes of foreign object damage eg:
Loose articles in or on the aircraft eg: loose panels, lost fasteners
Loose articles on taxiways, ramps etc
Types of foreign object damage to engines eg:
Impact damage to inlet components,
Damage by small, hard objects to compressor and turbine blades
Ways of preventing FOD eg
Strict cleaning and inspection of aircraft both inside and out
Following maintenance procedures and practices
Aircraft runway and taxiway cleaning.

Unit 010 Fundamentals of aircraft gas turbine engines

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module 15 – Gas Turbine Engine.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information and precise technical details.

Unit 011 Fundamentals of aircraft piston engines

UAN:	T/503/1104
Level:	2
Credit value:	13
GLH:	115
Assessment type:	External Examination (Written)
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 2 NOS Unit 007.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit aims to give the learner a comprehensive knowledge of aircraft piston engine principles. It covers the complete syllabus for CAA Part-66 Module 16 – Piston Engine, for Licence Categories A2 and A4.

Learning outcome

The learner will:

LO1 Know the fundamentals of aircraft piston engines and their performance

Assessment criteria

The learner can:

AC1.1 describe the ways in which the efficiency of a reciprocating engine is measured
AC1.2 describe the operating principles of different types of reciprocating engine
AC1.3 describe what is meant by piston displacement and compression ratio
AC1.4 describe various engine configurations and explain firing order
AC1.5 describe engine power calculation and measurement
AC1.6 describe the factors affecting engine power
AC1.7 describe fuel/air mixture and the effects of altering it.

Range

AC1.1

Overview of:

Explanation and simple calculations for the following efficiencies:

Thermal eg: the ratio of work done to fuel used, expressed in heat or work units

Mechanical eg: the ratio of power developed by expanding gas in the cylinders to the power delivered to the output shaft

Volumetric eg: the volume of fuel/air charge (temperature and pressure corrected) compared with the total piston displacement of the engine (expressed as a percentage)

AC1.2

Overview of including:

Define: top dead centre (TDC), bottom dead centre (BDC), clearance volume, bore, stroke, swept volume, firing order, ignition timing, valve timing, 'heat engine', 'reciprocating engine'

Methods of ignition (spark and compression), arrangement of

Description of the Otto cycle – events during induction, compression, power and exhaust strokes

Illustrate the Otto cycle using spark ignition with simple diagrams showing piston and bore, crank, inlet and exhaust valves and spark plug

Illustrate the Otto cycle using compression ignition with simple diagrams showing piston and bore, crank, inlet and exhaust valves and injector

Description of the 2-stroke cycle using simple diagrams of piston, bore, ports, crank and spark plug describing events during the up and down strokes

Requirements for an engine suitable for aircraft eg: reliability, durability, maintainability, compactness, high power/weight ratio, high specific power output, fuel economy, low vibration, flexibility, cost

Advantages and disadvantages of each engine type for aircraft use

AC1.3

Overview of:

Definition of piston displacement and compression ratio

AC1.4

Overview of:

Explain the basic layout of in-line, vee and opposed engines

Explain the importance of numbering cylinders and different manufacturer conventions for similar engines

Explain firing order in different engine configurations

Explain the effect of the number of cylinders on smoothness of running

AC1.5

Overview of:

The relationship between 'free' horsepower, 'friction' horsepower and 'brake' or 'shaft' horsepower, how they are calculated and how they are measured

Perform calculations for the power values given appropriate data, in Imperial and metric (kW)

AC1.6

Overview of:

Factors including: icing, altitude, temperature, ram air, barometric pressure, humidity, manifold pressure

Define brake specific fuel consumption (BSFC) and calculate from given data

AC1.7

Overview of:

Define, with approximate fuel/air ratios:
Rich best power mixture
Lean best power mixture
Cruise power mixture
'Stoichiometric' mixture
Effects of varying mixture at different power settings
Causes of pre-ignition, backfire etc.

Learning outcome

The learner will:

LO2 Know the construction of aircraft piston engines

Assessment criteria

The learner can:

AC2.1 describe the construction and assembly and function of the crank case and its contents
AC2.2 describe the construction, assembly and function of accessory gearboxes
AC2.3 describe the construction, assembly and function of cylinders, pistons and connecting rod assemblies
AC2.4 describe the construction, assembly and function of inlet and exhaust manifolds
AC2.5 describe the construction, assembly and function of valve mechanisms;
AC2.6 describe the construction, assembly and function of propeller reduction gearboxes.

Range

AC2.1

Overview of:

Constructional features, function, classification, materials of items including: crank shaft, cam shafts, sumps, counterweights, vibration dampers, ball bearings (including thrust bearings, representative plain and roller bearings), oil seals

Typical defects to be found in the above, with causes and corrective action

Inspection and replacement of seals, packing and gaskets

Inspection of crankshafts and measurement of run-out

Maintenance of magnesium castings

Torque loading of components

AC2.2

Overview of:

Purpose, typical design, components, lubrication, location, fitting, operation, maintenance, typical defects, causes and corrective action

AC2.3

Overview of:

Constructional features, function, classification, materials of: pistons, gudgeon pins (fixed and floating), piston rings, cylinders, cylinder heads and connecting rods

Typical defects associated with each of the above – detection, cause, corrective action

Types of cylinder bore surface – rough, smooth, reasons for each, precautions when working with each, types of piston ring for each
Maintenance of piston rings – gap measurement, adjustment
Piston ring stagger – reasons
Compression testing – equipment, methods, typical results, limits
Removing and fitting cylinder assemblies
Attachment of cylinder heads and bores

AC2.4
Overview of:
Constructional features, function and materials of exhaust and inlet manifolds
Attachment, gaskets and seals, inspection, typical defects, corrective action

AC2.5
Overview of:
Cam followers, push rods, inlet and exhaust valves sodium filled exhaust valves, seats, guides, springs, rocker assemblies, tappets (including hydraulic)
Valve springs, fitting, number on each valve, prevention of binding
Checking of valve for bowing of stems, pitting, glazing and chipping
Valve clearances: purpose, procedure for checking and adjustment on engines with camshafts, effects of excessive valve clearance on valve timing and engine performance
Typical defects, causes, corrective action associated with valves and their operating mechanisms

AC2.6
Overview of:
Purpose, construction, attachment to engine, propeller attachment, lubrication, typical faults, causes and corrective actions.

Learning outcome

The learner will:

LO3 Know aircraft piston engine fuel and lubrication systems

Assessment criteria

The learner can:

AC3.1 describe various carburettor types
AC3.2 describe fuel injection systems
AC3.3 describe electronic engine control
AC3.4 describe aviation fuels used in aircraft piston engines
AC3.5 describe lubricants used in aircraft piston engines
AC3.6 describe aircraft piston engine lubrication systems.

Range

AC3.1
Overview of:

Float type:
Principles including: down-draft and up-draft configurations;
Components:
Control systems
Typical faults, symptoms, causes and corrective action
Advantages and disadvantages
Icing: fuel evaporation ice, throttle ice, impact ice; carburettor heat (sources, application)

Pressure injection type:
Principles including differences and advantages over float type
Components
Control systems
Typical faults, symptoms, causes and corrective action
Advantages and disadvantages

AC3.2
Overview of:
Types, construction and principles of operation
Types eg: Bendix, Continental
Main components, Bendix, including: fuel injector, airflow section, regulator section, fuel metering section, flow divider, fuel discharge nozzles
Main components, Continental including: fuel injection pump, fuel/air control unit, fuel control unit, fuel manifold valve, fuel discharge nozzle
Typical faults, symptoms, causes and corrective action
Advantages and disadvantages

AC3.3
Overview of:
Operation of electronic engine control and fuel metering systems: EEC, ECU, FADEC
Types, construction and principles of operation – differences between EEC, ECU and FADEC, inputs, outputs, degrees of manual override, fault tolerant control, typical faults, symptoms, causes and corrective action
Systems lay-out and components

AC3.4
Overview of:
Properties and specifications (Avgas and jet fuel): fuel types, colour coding, grading, labelling
Fuel additives
Contamination – types, avoidance, sampling
Safety precautions: during engine maintenance (use for cleaning and preparing components), re-fuelling
Use of jet fuel in aircraft diesel engines
Use of automotive fuel in aircraft piston engines

AC3.5
Overview of:
Types, properties and specifications of lubrication oils including 2-stroke oil
Types, properties and specifications of grease used in aircraft engines
Safety precautions

AC3.6

Overview of:
Types of lubrication system (eg: pressure, splash, spray, combination) and application, components, system operation, system lay-out, typical faults, symptoms, causes and corrective action.

Learning outcome

The learner will:

LO4 Know aircraft piston engine starting and ignition systems

Assessment criteria

The learner can:

AC4.1 describe typical piston engine starting and pre-heat systems
AC4.2 describe the types of magneto used in aircraft piston engines
AC4.3 describe the construction of ignition harnesses
AC4.4 describe the operation of spark plugs
AC4.5 describe low and high tension ignition systems.

Range

AC4.1
Overview of:
Construction and principles of operation of starter system types including:
Direct –cranking electric (auto and manual engage), electric inertia; using external and internal power
Typical faults, symptoms, causes and corrective action

Pre-heat systems: purpose, construction, operation
Typical faults, symptoms, causes, and corrective action

AC4.2
Overview of:
Construction and principles of operation various magneto types eg: rotating coil, polar inductor, rotating magnet
Including mechanical and electrical layout, adjustment, typical faults, causes, symptoms and corrective actions (including purpose of and procedure for ‘mag drop’ testing pre-take-off

AC4.3
Overview of:
Ignition harnesses including: types of cable, connectors, suppression of radio interference, dual crossover system, maintenance, harness testing, typical faults, causes, symptoms and remedial actions

AC4.4
Overview of:
Spark plugs; importance of using plugs of the correct reach and temperature; operating life, maintenance, faults, causes, symptoms, corrective actions

AC4.5
Overview of:
High tension ignition systems: construction, installation and operation, faults, causes, symptoms and corrective actions, advantages and disadvantages

Low tension ignition systems: reasons for development, advantages over high tension systems, construction, installation and operation, faults, causes, symptoms and corrective actions.

Learning outcome

The learner will:

LO5 Know aircraft piston engine induction, exhaust, turbocharging, supercharging and cooling

Assessment criteria

The learner can:

AC5.1 describe the construction and operation of piston engine induction systems
AC5.2 describe the construction and operation of piston engine exhaust systems
AC5.3 describe the principles and purpose of supercharging
AC5.4 describe the construction and operation of supercharging/turbocharging systems
AC5.5 describe piston engine cooling systems.

Range

AC5.1
Overview of:
Non-supercharged (naturally aspirated) induction system: of: air scoop, ducting, carburettor, intake manifold, alternate air valve, temperature control unit, carburettor heat source, temperature sensor, fluid de-icing system
Inspection and maintenance, faults, causes, symptoms and corrective actions

AC5.2
Overview of:
Short stack and collector exhaust systems: construction and installation
Inspection and maintenance, faults, causes, symptoms and corrective actions

AC5.3
Overview of:
Principles of supercharging and its effects on engine parameters (eg: critical altitude, manifold air pressure

AC5.4
Overview of:
System terminology including: waste gate, compressor, turbine, intercooler, overboost
The difference between a supercharger and a turbocharger – advantages and disadvantages
Construction and installation of superchargers and turbochargers,

Control systems eg: automatic waste gate control, manual boost lever
System protection
Inspection and maintenance, faults, causes, symptoms and corrective actions

AC5.5
Overview of:
Air cooling systems: air inlet, baffles, cowl flaps (fixed and hinged), finned cylinders and cylinder heads, cylinder head temperature indication, augmenters
Inspection, maintenance and adjustment, faults, symptoms, corrective action
Liquid cooling systems: internal cooling by oil (oil cooler), other liquid cooling systems.

Learning outcome

The learner will:

LO6 Know engine indication systems

Assessment criteria

The learner can:

AC6.1 describe engine speed indication
AC6.2 describe cylinder head temperature indication
AC6.3 describe coolant temperature indication
AC6.4 describe oil pressure and temperature indication
AC6.5 describe exhaust gas temperature indication
AC6.6 describe fuel pressure and flow indication
AC6.7 describe manifold pressure indication.

Range

AC6.1
Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.2
Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.3
Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.4

Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.5
Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.6
Overview of:
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator

AC6.7
Reason for displaying the information
Sensing: types of sensors, location output
Indication: types of indicator.

Learning outcome

The learner will:

LO7 Know typical piston engine powerplant installation

Assessment criteria

The learner can:

AC7.1 describe the configuration of firewalls, cowlings and acoustic panels
AC7.2 describe the configuration of engine mounts and anti-vibration mounts
AC7.3 describe the configuration of feeders, connectors and wiring looms
AC7.4 describe the configuration of control cables and rods
AC7.5 describe the configuration of hoses, pipes and drains
AC7.6 describe the configuration of lifting points.

Range

AC7.1
Overview

AC7.2
Overview

AC7.3
Overview

AC7.4

Overview including the need for duplicate inspections of engine controls

AC7.5
Overview

AC7.6
Overview

Learning outcome

The learner will:

LO8 Know engine monitoring, ground operation, storage and preservation

Assessment criteria

The learner can:

AC8.1 describe procedures for starting and ground run-up of an aircraft piston engine
AC8.2 describe how to interpret engine power output and parameters
AC8.3 describe inspection of engine and components.

Range

AC8.1
Overview of of:
Pre-start arrangements eg; aircraft position, safety of ground personnel, chocks, external checks
Pre-start checks eg: brakes, fuel, fluids, battery power, magneto switches, prop clearance, pitch settings, permissions, security of panels etc
Start procedure eg: engine priming, switch settings, starter operation, hand swinging, control settings, engage starter
Post start checks eg: RPM, pitch, mag drop checks, temperatures and pressures, carb heat, mixture, checks and measurements including cold cylinder check

Shut down procedure eg: idle cut-off, mixture, carb heat, mag drop checks, throttle, pitch, magneto switches, main battery power, fuel switches

AC8.2
Overview of the use of graphs and tables

AC8.3
Overview of inspection and checking procedures to criteria, tolerances and data specified by the engine manufacturer

Unit 011 Fundamentals of aircraft piston engines

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Module 16 – Piston Engine.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information and precise technical details.

Unit 012 Fundamentals of aircraft propellers

UAN:	F/503/0859
Level:	3
Credit value:	6
GLH:	50
Assessment type:	Short answer question paper or External Examination
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 3 NOS Units 143, 331 etc.
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	This unit aims to provide learners with a detailed understanding of aircraft propellers, and associated systems. It contains the complete syllabus for CAA Part-66 Module 17 for A1 and A2 Categories.

Learning outcome

The learner will:

LO1 Understand propeller theory

Assessment criteria

The learner can:

AC1.1 explain blade element theory
AC1.2 explain the effects of varying blade angles, angle of attack and rotational speed
AC1.3 explain propeller slip
AC1.4 explain the aerodynamic, centrifugal and thrust forces on a propeller
AC1.5 explain the torque effect of a propeller
AC1.6 explain the effect of relative airflow on a blade's angle of attack
AC1.7 explain vibration and resonance produced by a propeller.

Range

AC1.1

In simple terms:

General configuration: fixed and variable pitch
Parts of the propeller, features of the blades
Division of the blades into an infinite number of thin elements used to calculate total forces on the blade

AC1.2
In simple terms
Coarse and fine pitch
Combinations of rotational speed, blade angle and angle of attack in different phases of flight
Reasons for each combination

AC1.3
Define: geometric pitch and effective pitch
Calculate propeller slip (geometric pitch – effective pitch)

AC1.4
In simple terms qualitative description using simple diagrams

AC1.5
Qualitative explanation

AC1.6
Qualitative explanation

AC1.7
Qualitative explanation.

Learning outcome

The learner will:

LO2 Understand propeller construction

Assessment criteria

The learner can:

AC2.1 describe materials and construction methods for propellers
AC2.2 explain basic propeller terminology
AC2.3 describe the construction of different types of propeller
AC2.4 describe how propellers and spinners are installed.

Range

AC2.1
Overview of typical:
Materials for composite, wood and metal blades
Composite, laminated, single piece

AC2.2

Overview of eg: blade station, blade face, blade shank and hub assembly, cuffs, fixed pitch, reverse-pitch, feathering, tractor, pusher, tipping and shielding

AC2.3
In simple terms an overview of fixed and controllable pitch and constant speed propellers

AC2.4
In simple terms an overview of typical installations eg:
Techniques used to ensure correct fitment
Types of bolts and locking devices
Alignment
Measuring and testing.

Learning outcome

The learner will:

LO3 Understand propeller pitch control

Assessment criteria

The learner can:

AC3.1 describe propeller speed control and pitch change methods
AC3.2 describe feathering and reverse pitch
AC3.3 explain how overspeed protection is achieved.

Range

AC3.1
In simple terms an overview of eg: flyweight governor, counterweight and piston, alpha and beta ranges, engine oil pressure, HP pump for metered pressure, electronic control, propeller control unit (PCU), pitch lock
Differences between typical piston engine and turbine engine systems

AC3.2
Reasons for feathering and reverse pitch controls
Overview of:
Methods of achieving necessary blade angles for each (eg: engine oil, feather pump)
Mechanism for unfeathering
Other methods

AC3.3
Overview of eg: overspeed governor, springs, flyweights.

Learning outcome

The learner will:

LO4 Understand propeller ice and rain protection systems

Assessment criteria

The learner can:

AC4.1 describe fluid de-icing equipment for propellers
AC4.2 describe electrical de-icing equipment for propellers.

Range

AC4.1
In simple terms typical systems eg:
Fluid storage
Control
Ducting
Pumps

AC4.2
In simple terms typical systems eg:
Sensors
Switches
Cabling and connectors
Other controls.

Learning outcome

The learner will:

LO5 Understand propeller maintenance, storage and preservation

Assessment criteria

The learner can:

AC5.1 describe propeller static and dynamic balancing
AC5.2 describe propeller blade tracking
AC5.3 describe how damage to propeller blades is assessed
AC5.4 describe propeller treatment and repair schemes
AC5.5 describe basic procedures for propeller engine running
AC5.6 describe how propellers are typically stored and preserved.

Range

AC5.1
In simple terms overview of:
Causes of propeller imbalance
Balance limits
Effects of an out-of-balance propeller
Balancing equipment
Balancing methods

Relative accuracy of static and dynamic balancing

AC5.2
In simple terms overview of:
Causes of out-of-track propeller blades
Effects of an out-of-track propeller blade
Methods of measuring tracking
Tracking limits
Repair and adjustment

AC5.3
In simple terms overview of:
Erosion, corrosion, delamination, impact damage
Visual inspection, x-ray, ultrasound, other methods
Limits

AC5.4
In simple terms overview of:
Types of damage that can and cannot be repaired
Typical repair and treatment schemes for each type of propeller construction eg: wood, composite, metal, and each area of the propeller
Limits for repairs
Post-repair measurements and actions such as balancing, tracking, tip clearance
Recording of repairs

AC5.5
Including: safety, authorisations,
Engine and propeller limits for ground running: power, condition, RPM

AC5.6
In simple terms overview of:
Methods of cleaning
Mounting to prevent distortion
Preservative coatings
Protective coverings – humidity and temperature-controlled bags and containers
Recovery from storage and preservation eg: cleaning, lubrication, inspection (visual, NDT), checking modification states.

Unit 012 Fundamentals of aircraft propellers

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers art 66 Basic Knowledge Requirements Module17 – Propeller.

The teaching of the knowledge content of this unit should be referenced to the latest Civil Aviation Authority (CAA) publication, or its military equivalents. The City & Guilds online multiple-choice examination is based on this content.

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Unit 035 Human factors in aviation

UAN:	M/503/1263
Level:	3
Credit value:	5
GLH:	40
Type of assessment:	Multiple choice test
Relationship to NOS:	This unit is linked to the Aeronautical Engineering Level 2 NOS Unit 001 and Level 3 NOS Unit 003
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA
Aim:	The aim of this unit is to give the learner a comprehensive knowledge of human factors within the aircraft industry to assist them in living and working safely. It is a mandatory subject within the industry. The unit covers the complete syllabus of CAA Module 9 for Category B1 and B2 licences.

Learning outcome

The learner will:

LO1 Understand why human factors are important in aviation

Assessment criteria

The learner can:

AC1.1 explain the term 'human factors'
AC1.2 explain why Human Factors is important in the aeronautical engineering workplace
AC1.3 explain categories of Human Factor that are important to aeronautical engineering staff.

Range

AC1.1
Meaning of the term and how it is used in aviation
SHEL Model, 'Murphy's Law', anthropometry

AC1.2
Eg:
Safety of employees, passengers, people on the ground etc
Safety of assets (eg: aircraft, equipment etc)
Long-term health of employees
Efficiency of the organisation

AC1.3
Eg:
Working environment
Work patterns
Social habits
Work load
Communication
Employee health

Learning outcome

The learner will:

LO2 Understand features and limitations of human performance

Assessment criteria

The learner can:

AC2.1 explain how images are seen and interpreted by humans
AC2.2 explain how sounds are heard and interpreted by humans
AC2.3 explain limitations of human memory
AC2.4 describe factors that affect mental attention span
AC2.5 describe how variations in an individual's sight and hearing can affect their behaviour
AC2.6 explain how working in challenging environments presents risks to airworthiness.

Range

AC2.1
To include:
Main parts of the eye
How each part of the eye reacts to light
Rods and cones
Seeing in high and low light
Peripheral vision
Interpretation by the brain

AC2.2
To include:
Main parts of the ear
Vulnerable parts of the ear
Effect of noise – percussive, prolonged high intensity, varying pitch

Noise Induced Hearing Loss (NIHL)
Legal requirements for hearing protection
Correct protection for frequency range

AC2.3
Simple explanation eg:
Time from exposure to information
Form that information is in (audio, visual, words, pictures etc.)
Fatigue
Age
Complexity of information
Artificial stimulants/depressants
Types (iconic, echoic, episodic, symantic)

AC2.4
Eg:
Overconfidence
Boredom
Fatigue
Complexity of information
Artificial stimulants/depressants

AC2.5
Individually and in combination (such as in older people)
Sight eg:

- Long and short sight
- Optical illusion including the strobe effect
- Persistence
- Moving from light area to work in the dark
- Optimum lighting for typical tasks
- Long and short sight
- Use of spectacles and magnifiers

Hearing eg:

- High and low tone deafness
- Tinnitus
- Hearing damage, poor communication

Social isolation (at work and at home)

AC2.6
At height and in confined spaces eg:

- Claustrophobia
- Fear of heights
- Limited access/egress to a large space
- Confined space

Specific tasks (eg: inspections on fuselage crown or in equipment bays)
Low concentration
Rushing the task
Cutting corners

Poor vision

Learning outcome

The learner will:

LO3 Understand aspects of social psychology

Assessment criteria

The learner can:

AC3.1 explain areas of individual and group responsibility in aircraft engineering environments
AC3.2 explain motivation and de-motivation
AC3.3 explain 'peer pressure'
AC3.4 explain company culture
AC3.5 explain the concepts of team working
AC3.6 identify the primary responsibilities of engineering managers and supervisors
AC3.7 discuss the basic concept of leadership.

Range

AC3.1
Outline of a typical organisation (must include maintenance)
Typical roles and responsibilities
Individuals and groups or teams
Individual responsibility when working alone and within a team
Group or team responsibilities
Overview of group and inter-group dynamics (eg: rivalry, polarisation, 'social loafing')

AC3.2
Overview of:
Fulfilling individual needs
Maslow's Hierarchy of Needs
Individual motivation
Motivation by management
Characteristics of motivation and de-motivation
How they can be affected by internal and external factors eg:

- Management decisions
- Personal situation

AC3.3
Eg:
Conformity and non-conformity
Pressure from co-workers, not management
Advice and pressure from more experienced colleagues to adopt particular work practices
How it can affect performance of maintenance tasks

AC3.4

Overview of different types of culture (eg: safety, organisational, shift, team, social etc.)
More detailed knowledge of safety culture and the individual
How company culture can compromise best working practices

AC3.5
What is a team?
Advantages and disadvantages of team working
Team identity
Working with other teams
Ownership of tasks
Communication
Co-operation
Mutual support

AC3.6
Difference between management and supervisor roles
What should an employee expect from a supervisor? (e.g. motivation, support, guidance etc.)
Engineering organisations (eg: part145, military maintenance organisation)

AC3.7
What is a leader?
The basic characteristics of a leader.
How and when any individual might provide leadership eg:
Passing on knowledge and experience to colleagues
Organising and directing group tasks
Inspection and reporting on the work of others

Learning outcome

The learner will:

LO4 Understand personal factors that affect human performance

Assessment criteria

The learner can:

AC4.1 explain effects of personal health and fitness on work performance
AC4.2 identify types of stress
AC4.3 explain effects of setting time deadlines on individual work performance
AC4.4 explain the concept of work overload and underload
AC4.5 explain the effects of shift work on sleep and fatigue
AC4.6 explain the effects of alcohol, medication and substance abuse
AC4.7 explain the personal legal obligations of individuals in the aviation industry

Range

AC4.1
Legal requirement for individual physical and mental fitness while at work

Types of medical condition that might affect work eg:
Minor illness (eg: cold, 'flu, sickness etc.)
Major physical illness (eg: heart attack, stroke, cancer etc.)
Mental illness (eg: depression etc.)
Minor physical injury (eg: sprained wrist, pulled muscle, cramp etc.)
Major physical injury (eg: broken bones, lacerations etc.)
Effects of toxins and other substances (eg: carbon monoxide, alcohol, drugs etc.)
Gradual deterioration in physical condition

AC4.2
Define 'stress' (eustress, distress, acute stress, chronic stress, hypo stress, hyper stress)
Sources:
Home (eg: family illness, divorce etc.)
Work (organisational, task related)
Types:
Acute and chronic stress
Signs of stress (physical, health, behaviour, cognitive, other)
Explain how stress can affect individual performance at work

AC4.3
Actual, perceived and self-imposed deadlines
Effects of time pressure and deadlines
Managing time pressure and deadlines

AC4.4
Definition of work overload and underload
Results of work overload and underload
Factors determining workload
Workload management

AC4.5
What is sleep?
Five stages of sleep
Circadian rhythms
Fatigue (causes, symptoms)
Advantages and disadvantages of shift work
Working at night
Types of shift pattern

AC4.6
Effects of alcohol
Removal of alcohol from the blood
Effects while fatigued, hungry or combined with medication
Types, effects, short and long term consequences of abuse of:

- Alcohol
- Prescription medication
- Over-the-counter medication
- Illegal drugs

Effects on individual work performance

AC4.7
Eg:
Alcohol limits and legal requirements for aircraft engineers
CAP 562/AN47
Transport legislation/AN45
Health and Safety legislation

Learning outcome

The learner will:

LO5 Understand how physical aspects of the working environment affect human performance

Assessment criteria

The learner can:

AC5.1 explain effects of noise on individuals and groups
AC5.2 explain effects of fumes on individual performance
AC5.3 explain effects of varying illumination on an individual performance
AC5.4 explain effects of variations in climate on an individual performance
AC5.5 explain effects of exposure to constant motion and vibration while working
AC5.6 explain effects of layout of a working environment on individual performance.

Range

AC5.1
Eg effects on:
Concentration
Communication

AC5.2
Eg effects on:
Concentration
Communication
Longer term effects
Safe oxygen levels

AC5.3
Eg:
Ability to see detail
Moving between areas of different illumination, including well-lit hangar and night flight line
Strobe effect and propellers

AC5.4
Eg:
Cold/wet, warm/dry, hot/humid environments

AC5.5
Eg:
Working at height on scissor platforms and cherry picker
Unsteady platforms
Use of rotating or percussive tools
Vibration White Finger (VWF)

AC5.6
Eg:
The three components of a working environment
Layout
Cleanliness
Ease of movement between work areas
Lighting, noise, atmosphere, temperature etc
Social environment
Tasks, tools and information

Learning outcome

The learner will:

LO6 Understand how categories of tasks can affect human performance

Assessment criteria

The learner can:

AC6.1 explain the importance of planning the execution of a task
AC6.2 explain effects of physically demanding work on individual performance
AC6.3 explain effects of repetitive tasks on individual performance
AC6.4 explain aspects of visual inspection
AC6.5 explain aspects of working on complex systems.

Range

AC6.1
Eg:
Defining the task
Defining the resources
Personal skills and proficiency
Information

AC6.2
Eg:
Health and physical condition, effects of ageing
Work environment
Physical effort
Effects of ageing

AC6.3
Eg:
Ignoring manuals, job cards etc.
Complacency
Making assumptions

AC6.4
Eg:
Importance of good eyesight
Knowledge of the inspection area
Illumination
Concentration
Systematic search

AC6.5
Eg:
Simple system: transparent to the engineer
Complex system: opaque to the engineer
Clear understanding of the purpose of the system
System-specific training
Pooling of knowledge and skills
Clear and comprehensive information and guidance

Learning outcome

The learner will:

LO7 Understand communication in the workplace

Assessment criteria

The learner can:

AC7.1 explain the importance of good communication in the workplace
AC7.2 explain the importance of accurate work logging
AC7.3 explain modes of communication between individuals and teams
AC7.4 explain the importance of maintaining individual professional currency
AC7.5 explain the importance of information dissemination.

Range

AC7.1
Within and between groups eg:
Prevention of accidents
Maintaining good working relations
Organisational efficiency

AC7.2
Eg:

Formal work logging
Shift logging
Shift handover
Task staging
Duplicate
Inspection
Stage sheets/check

AC7.3
Eg:
Verbal
Written
Body language
Workplace social culture
Communication between all levels of an organisation

AC7.4
Eg:
Refresher training
Reading briefing material
Notices and amendments to maintenance procedures
Reading professional journals
Undertaking up-skilling and further licence training.

Learning outcome

The learner will:

LO8 Understand the causes of human error

Assessment criteria

The learner can:

AC8.1 explain the error models and theories used in aeronautical engineering
AC8.2 explain types of error that occur during work on aircraft
AC8.3 describe the error-incident-accident chain
AC8.4 describe methods of managing and avoiding errors.

Range

AC8.1
Eg
Induced
Variable
Reversible/irreversible
Slips, lapses and mistakes

The ‘Swiss Cheese Model’

AC8.2
Eg:
Complacency
Environmental capture
Rule-based errors
Violations
Individual practices and habits
Errors associated with visual inspection
Latent/active errors

AC8.3
Eg:
Self discipline
Safety Management System
Anonymous and blame-free reporting
Training
Logging and analysis

Learning outcome

The learner will:

LO9 Understand the human factors aspects of aircraft incidents

Assessment criteria

The learner can:

AC9.1 analyse an incident report to extract information
AC9.2 identify a sequence of events from a narrative report
AC9.3 identify human factors contributing to an incident
AC9.4 draw conclusions from incident data.

Range

AC9.1
Using extracts from an actual report or a realistic example
Filter out irrelevant detail

AC9.2
How, why, when where, who
Use presentation aids such as flow diagrams
Identify what should have been done

AC9.3
Analyse the information and identify contributing factors
Including where possible:

- Personal behaviour
- Environmental conditions
- Management
- Organisational culture

Using eg:

- MEDA
- MEMS

AC9.4
Including where necessary, brief details of:
Environment
Personal issues
Organisation
Nature and mix of allocated tasks
Recommendations for preventative action

Learning outcome

The learner will:

LO10 understand risk assessments in aeronautical engineering environments

Assessment criteria

The learner can:

AC10.1 define the terms associated with risk assessment
AC10.2 describe the five steps to risk assessment
AC10.3 describe the associated risks for workplace hazards
AC10.4 describe conclusions from risk assessments
AC10.5 explain how to manage workplace emergencies.

Range

AC10.1
Hazard
Risk
Severity
Likelihood (probability)

AC10.2
Step 1 – Identify hazards
Step 2 – Decide who might be harmed and how
Step 3 – Evaluate risks and decide on precautions
Step 4 – Record findings and implement them
Step 5 – Review and update

AC10.3
Step 2

AC10.4
Steps 2 and 3
Recommend ways of eliminating or reducing to an acceptable level, a range of identified risks

AC10.5
Steps 3 and 4 eg:
Reduce the likelihood of them happening
Management of workplace emergency situations such as fire, spillage, personal injury etc

Unit 035 Human factors in aviation

Supporting information

Unit guidance

The UK Civil Aviation Authority (CAA) has replaced the European Union Aviation Safety Agency (EASA) regulations with its own legislative and licencing requirements. This includes the Part-66 licensing scheme for aircraft maintenance personnel.

This unit covers Part 66 Basic Knowledge Requirements Module 9 – Human Factors.

The teaching of the knowledge content of this unit should be referenced to the latest Civil Aviation Authority (CAA) publication, or its military equivalents. The City & Guilds online multiple-choice examination is based on this content.

The CAA is the governing body for all matters related to aircraft maintenance licensing in the UK, they all come under the jurisdiction of the CAA. It is therefore essential to refer to the official CAA documentation for the most accurate and up-to-date information and precise technical details on the topic area.

Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centre document library** on **www.cityandguilds.com** or click on the links below:

Centre Handbook: Quality Assurance Standards

This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on:

- centre quality assurance criteria and monitoring activities
- administration and assessment systems
- centre-facing support teams at City & Guilds/ILM
- centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the centre contract.

Centre Assessment: Quality Assurance Standards

This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre-assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre assessments.

Access arrangements: When and how applications need to be made to City & Guilds provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **Centre document library** also contains useful information on such things as:

- conducting examinations
- registering learners
- appeals and malpractice.

Useful contacts

Please visit the **Contact us** section of the City & Guilds website.

City & Guilds

For over 140 years, we have worked with people, organisations and economies to help them identify and develop the skills they need to thrive. We understand the life-changing link between skills development, social mobility, prosperity and success. Everything we do is focused on developing and delivering high-quality training, qualifications, assessments and credentials that lead to jobs and meet the changing needs of industry.

We partner with our customers to deliver work-based learning programmes that build competency to support better prospects for people, organisations and wider society. We create flexible learning pathways that support lifelong employability because we believe that people deserve the opportunity to (re)train and (re)learn again and again – gaining new skills at every stage of life, regardless of where they start.

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