



# **City & Guilds Level 4 Diploma in Aerospace and Aviation (Development Competence) (4608-40)**

**Version 1.4 (September 2024)**

**Qualification Handbook**

## Qualification at a glance

<b>Subject area</b>	Engineering
<b>City &amp; Guilds number</b>	4608
<b>Age group approved</b>	16+
<b>Entry requirements</b>	None
<b>Assessment</b>	Portfolio of evidence
<b>Grading</b>	Pass/Fail
<b>Approvals</b>	Full approval required
<b>Support materials</b>	Centre handbook
<b>Registration and certification</b>	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Regulatory reference number	GLH	TQT
City & Guilds Level 4 Diploma in Aerospace and Aviation (Development Competence)	4608-40	603/6244/3	1635	1965

Version and date	Change detail	Section
1.0 May 2020	Published	
1.1 June 2020	TQT added	Introduction
1.2 July 2020	Updated unit titles for units 540, 545 and 546	Introduction, Units
1.3 July 2020	Corrected typos in the Introduction; QAN added	Introduction
1.4 September 2024	Handbook reviewed and updated to new template	Throughout

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<b>Unit 519</b>	<b>Maintaining and certifying aircraft vacuum systems (ATA 37)</b>	<b>277</b>
<b>Unit 520</b>	<b>Maintaining and certifying aircraft water and waste systems (ATA 38)</b>	<b>289</b>
<b>Unit 521</b>	<b>Maintaining and certifying aircraft cabin systems (ATA 44)</b>	<b>300</b>
<b>Unit 522</b>	<b>Maintaining and certifying aircraft airborne-auxiliary power systems (ATA 49)</b>	<b>312</b>
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# 1 Introduction

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

Area	Description
Who is the qualification for?	The qualification is for those wanting to become an Aircraft Maintenance Certifying Engineer, and who will work on maintaining and certifying aircraft of all types from small aeroplanes to airliners, jet fighters and helicopters, both civil and military. An Aircraft Maintenance Licence will be required to carry out this role.
What does the qualification cover?	The qualification allows to learn, develop and practise the competence skills required for a career as an aircraft maintenance certifying engineer.
What opportunities for progression are there?	The qualification allows learners to progress through to EPA of the apprenticeship standard and into employment as an aircraft maintenance certifying engineer once they have gained the aircraft maintenance licence.
Who did we develop the qualification with?	We developed this qualification in collaboration with the trailblazer group for the standard.
Is it part of an apprenticeship framework or initiative?	The qualification is mandated within the Aircraft Maintenance Certifying Engineer

## Structure

To achieve the City & Guilds Level 4 Diploma in Aerospace and Aviation (Development Competence) (4608-40), learners must achieve all four units from Mandatory group A, plus two units from Optional group A and six units from Optional group B.

City & Guilds unit number	Unit title	Group	UAN	GLH
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### Mandatory group A:

Learners must achieve all **four** mandatory units.

301	Complying with Statutory Regulations and Organisational Safety Requirements	M	L/508/6383	35
302	Using and Interpreting Engineering Data and Documentation	M	R/508/6384	25
304	Reinstating the Work Area on Completion of Activities	M	D/508/63/86	25
501	Working Efficiently and Effectively in an Aircraft Maintenance Environment	M	M/618/0198	42

### Optional group A:

Learners must achieve **two** units from optional group A.

305	Lifting and Trestling/Shoring Aircraft for Maintenance/Repair Operations	O	H/508/6387	56
306	Levelling and Weighing Aircraft	O	K/508/6388	56
307	Towing, Marshalling and Parking Aircraft	O	M/508/6389	56
502	Carrying out flight servicing, scheduled maintenance and oversight activities on aircraft	O	R/618/0095	147

### Optional group B:

Learners must achieve **six** units from optional group B.

503	Maintaining and Certifying Aircraft Air Conditioning Systems (ATA 21)	O	T/618/0199	248
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504	Maintaining and Certifying Aircraft Auto Flight Systems (ATA 22)	O	D/618/0200	248
505	Maintaining and Certifying Aircraft Communication Systems (ATA 23)	O	H/618/0201	248
506	Maintaining and Certifying Aircraft Electrical Power Systems (ATA 24)	O	K/618/0202	248
507	Maintaining and Certifying Aircraft Equipment and Furnishings (ATA 25)	O	M/618/0203	248
508	Maintaining and Certifying Aircraft Fire Protection Systems (ATA 26)	O	T/618/0204	248
509	Maintaining and Certifying Aircraft Flight Control Systems (ATA 27)	O	A/618/0205	248
510	Maintaining and Certifying Aircraft Fuel Systems (ATA 28)	O	F/618/0206	248
511	Maintaining and Certifying Aircraft Hydraulic Systems (ATA 29)	O	J/618/0224	248
512	Maintaining and Certifying Aircraft Ice and Rain Protection Systems (ATA 30)	O	L/618/0225	248
513	Maintaining and Certifying Aircraft Indicating and Recording Systems (ATA 31)	O	Y/618/0227	248
514	Maintaining and Certifying Aircraft Landing Gear (ATA 32)	O	D/618/0228	248
515	Maintaining and Certifying Aircraft Lighting Systems (ATA 33)	O	D/618/0231	248
516	Maintaining and Certifying Aircraft Navigation Systems (ATA 34 )	O	H/618/0232	248
517	Maintaining and Certifying Aircraft Oxygen Systems (ATA 35)	O	M/618/0234	248
518	Maintaining and Certifying Aircraft Pneumatic Systems (ATA 36)	O	T/618/0235	248

519	Maintaining and Certifying Aircraft Vacuum Systems (ATA 37)	O	F/618/0237	248
520	Maintaining and Certifying Aircraft Water and Waste Systems (ATA 38)	O	J/618/0238	248
521	Maintaining and Certifying Aircraft Cabin Systems (ATA 44)	O	J/618/0241	248
522	Maintaining and Certifying Aircraft Airborne Auxiliary Power Systems (ATA 49)	O	L/618/0242	248
523	Maintaining and Certifying Aircraft Cargo and Accessory Compartments (ATA 50)	O	R/618/0243	210
524	Maintaining and Certifying Aircraft Doors (ATA 52)	O	Y/618/0244	248
525	Maintaining and Certifying Aircraft Fuselage, Nacelles and Pylons (ATA 53 & 54)	O	D/618/0245	240
526	Maintaining and Certifying Aircraft Stabilisers (ATA 55)	O	H/618/0246	250
527	Maintaining and Certifying Aircraft Windows (ATA 56)	O	K/618/0247	250
528	Maintaining and Certifying Aircraft Wings (ATA 57)	O	T/618/0249	248
529	Maintaining and Certifying Aircraft Propeller/Propulsor Systems (ATA 61)	O	K/618/0250	248
530	Maintaining and Certifying Rotorcraft Rotor Systems (ATA 62 & 64)	O	M/618/0251	248
531	Maintaining and Certifying Rotorcraft Rotor Drives Systems (ATA 63 & 65)	O	T/618/0252	248
532	Maintaining and Certifying Rotorcraft Rotor Blade and Tail Pylon Folding Systems (ATA 66)	O	A/618/0253	248
533	Maintaining and Certifying Rotorcraft Flight Control Systems (ATA 67)	O	F/618/0254	248

534	Maintaining and Certifying Aircraft Power Plant (ATA 71)	O	L/618/0256	248
535	Maintaining and Certifying Aircraft Turbine Engines (ATA 72)	O	R/618/0257	248
536	Maintaining and Certifying Aircraft Reciprocating Engines (ATA 72)	O	Y/618/0258	248
537	Maintaining and Certifying Aircraft Engine Fuel and Control Systems (ATA 73)	O	D/618/0259	210
538	Maintaining and Certifying Aircraft Ignition Systems (ATA 74)	O	R/618/0260	240
539	Maintaining and Certifying Aircraft Bleed Air Systems (ATA 75)	O	Y/618/0261	250
540	Maintaining and Certifying Aircraft Engine Control Systems (ATA 76)	O	D/618/0262	248
541	Maintaining and Certifying Aircraft Engine Indicating Systems (ATA 77)	O	H/618/0263	248
542	Maintaining and Certifying Aircraft Engine Exhaust Systems (ATA 78)	O	K/618/0264	250
543	Maintaining and Certifying Aircraft Lubricating Oil Systems (ATA 79)	O	M/618/0265	250
544	Maintaining Engine and Certifying Aircraft Starting Systems (ATA 80)	O	T/618/0266	250
545	Maintaining and Certifying Aircraft Reciprocating Engine Turbo-Supercharging Systems (ATA 81)	O	A/618/0267	250
546	Maintaining and Certifying Aircraft Engine Water Injection Systems (ATA 82)	O	J/618/0269	250
547	Maintaining and Certifying Aircraft Radar Systems (ATA 34)	O	A/618/0270	248
548	Leading the Oversight of Aircraft Maintenance Activities	O	F/618/0271	248



## 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
City & Guilds Level 4 Diploma in Aerospace and Aviation (Development Competence)	1635	1965

## 2 Centre requirements

### Approval

#### Full approval

To offer this qualification, 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.

## Resource requirements

### 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 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.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

### 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 these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualifications successfully.

## **Age restrictions**

This qualification is approved for learners aged 16 or above.

## **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 \(cityandguilds.com\)](https://www.cityandguilds.com/uk/qualifications/inclusion-and-diversity)

### 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 \(cityandguilds.com\)](https://www.cityandguilds.com/uk/qualifications/our-pathway-to-net-zero)

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
Full approval form	<a href="http://www.cityandguilds.com">www.cityandguilds.com</a>
Centre Handbook	<a href="http://www.cityandguilds.com">www.cityandguilds.com</a>

## 4 Assessment

### Assessment of the qualification

Candidates must:

- have a completed portfolio of evidence for each unit.

## Assessment strategy

Units are assessed through a portfolio of evidence. All evidence in the portfolio for the skills learning outcomes must be generated in the workplace or a realistic working environment.

## Portfolio of evidence

Candidate and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence candidates' progress towards achieving qualifications. Further details are available at [www.cityandguilds.com/eportfolios](http://www.cityandguilds.com/eportfolios).

City & Guilds has developed a set of **recording forms** including examples of completed forms for new and existing centres to use as appropriate. Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external quality assurers, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

## Evidence sources

A portfolio of evidence will typically include several pieces of evidence – it must contain sufficient evidence to demonstrate the knowledge and skills required for each appropriate unit.

Evidence sources may include:

- training logbooks
- centre-produced worksheets and activities
- annotated photographs
- video clips (maximum duration in total = 10 minutes)
- workplace documentation/records, for example job cards/job sheets, equipment check/maintenance/service records, parts order records.

This is not a definitive list; other evidence sources are permitted.

The evidence provided must be valid and attributable to the candidate; the portfolio of evidence must contain a statement from the centre confirming this.

Evidence **must not** include:

- any methods of self-assessment
- any employer contributions should focus on direct observation of evidence (for example witness statements) of competence rather than opinions.

## 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.

RPL is not allowed for this qualification.

## 5 Units

### Structure of the units

These units each have the following:

- City & Guilds reference number
- title
- unit accreditation number (UAN)
- level
- guided learning hours (GLH)
- unit aim
- Outcomes: performance (P), skills (S) and, knowledge and understanding (K) requirements
- supporting information.

### 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 **outcomes** which describe in further detail the skills and knowledge that a candidate should possess.

Each **outcome** has a set of **criteria** (performance, skills 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.

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

## Unit 301

## Complying with statutory regulations and organisational safety requirements

<b>RQF Reference:</b>	L/508/6383
<b>Unit level:</b>	Level 3
<b>GLH:</b>	35



**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to Deal with statutory regulations and organisational safety requirements, in accordance with approved procedures. They will be required to comply with all relevant regulations that apply to their area of work as well as their general responsibilities as defined in the Health and Safety at Work Act.


They must also be able to identify the relevant qualified first aiders or appointed person, and know the location of the first aid facilities. They will have an understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. They will also need to be fully conversant with the organisation's procedures for fire alerts and the evacuation of premises.

They will be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and equipment that they use, materials and substances that they use, working practices that do not follow laid down procedures, and manual lifting and carrying techniques.

Their responsibilities will require them to comply with organisational policy and procedures for the statutory regulations and organisational safety activities undertaken, and to report any problems with the safety activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the way in which they carry out the required manufacturing/engineering activities.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying statutory regulations and organisational safety requirements and procedures. They will understand the safety requirements and their application, and will know about the safety requirements in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives, including being able to demonstrate; personal responsibility and resilience, working effectively in



teams, effective communication and interpersonal skills, focus on quality and problem solving and continuous development

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## Outcome

P Performance requirements

### The learner must be able to:

- P1 comply with their duties and obligations as defined in the Health and Safety at Work Act
  - P2 demonstrate the required occupational behaviours in line with the job role and company objectives
  - P3 present themselves in the workplace suitably prepared for the activities to be undertaken
  - P4 follow organisational accident and emergency procedures
  - P5 recognise and control hazards in the workplace
  - P6 use correct manual lifting and carrying techniques
  - P7 apply safe working practices and procedures
- 

## Outcome

S Skills requirements

### The learner must be able to:

- S1 Demonstrate their understanding of their duties and obligations to health and safety by carrying out all of the following:
    - 1.1 apply in principle their duties and responsibilities as an individual under the Health and Safety at Work Act and relevant current legislation
    - 1.2 identifying within their organisation, appropriate sources of information and guidance on health and safety issues, to include:
    - 1.3 identifying the warning signs and labels of the main groups of hazardous or dangerous substances
    - 1.4 complying with the appropriate statutory regulations at all times
- 

## Outcome

S2 Comply with all emergency requirements, to include:

- 2.1 identifying the appropriate qualified first aiders or appointed person and the location of first aid facilities
- 2.2 identifying the procedures to be followed in the event of injury to self or others
- 2.3 following organisational procedures in the event of fire and the evacuation of premises
- 2.4 Identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions

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## Outcome

S3 Comply with all emergency requirements, to include:

- 3.1 their working environment
- 3.2 the tools and equipment that they use
- 3.3 materials and substances that they use
- 3.4 using working practices that do not follow laid down procedures

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## Outcome

S4 Demonstrate two of the following methods of manual lifting and carrying techniques:

- 4.1 lifting alone
- 4.2 with assistance of others
- 4.3 with mechanical assistance

---

## Outcome

S5 Apply safe working practices in an industrial environment, to include all of the following:

- 5.1 maintaining a tidy workplace with exits and gangways free from obstructions
- 5.2 using tools and equipment safely and only for the purpose intended
- 5.3 observing organisational safety rules, signs and hazard warnings
- 5.4 taking measures to protect others from harm by any work they are carrying out

---

## Outcome

K Knowledge and understanding.

### **The learner must be able to:**

- K1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act and current legislation (such as The Management of Health and Safety at Work Regulations; Workplace Health and Safety and Welfare Regulations; Personal Protective Equipment at Work Regulations ; Manual Handling Operations Regulations; Provision and Use of Work Equipment Regulations; Display Screen at Work Regulations; The Electricity at Work Regulations)
- K2 describe the specific regulations and safe working practices and procedures that apply to their work activities
- K3 describe the warning signs for the nine main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations
- K4 explain how to locate relevant health and safety information for their tasks and the sources of expert assistance when help is needed

- K5 explain what constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile or toxic materials, unshielded processes)
- K6 describe their responsibilities for dealing with hazards and reducing risks in the workplace (such as hazard spotting and safety inspections; the use of hazard check lists, carrying out risk assessments, COSHH assessments and safe systems of working)
- K7 describe the risks associated with their working environment, the tools, materials and equipment that they use, spillages of oil and chemicals, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures
- K8 describe the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K9 describe first aid facilities that exist within their work area and within the organisation in general and the procedures to be followed in the case of accidents involving injury
- K10 explain what constitutes dangerous occurrences and hazardous malfunctions, and why these must be reported even when no one was injured
- K11 describe the procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used and the need to report their presence at the appropriate assembly point
- K12 describe the organisational policy with regard to firefighting procedures, the common causes of fire and what they can do to help prevent them
- K13 describe the protective clothing and equipment that is available for their areas of activity
- K14 explain how to lift and carry loads safely, and the manual and mechanical aids available
- K15 explain how to prepare and maintain safe working areas, standards and procedures to ensure good housekeeping
- K16 describe the importance of safe storage of tools, equipment, materials and products
- K17 describe the extent of their own authority and to whom they should report in the event of problems that they cannot resolve

## **Unit 501**

# **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment Requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers

## Unit 302

## Using and interpreting engineering data and documentation

<b>RQF Reference:</b>	R/508/6384
<b>Unit level:</b>	Level 3
<b>GLH:</b>	25

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Advanced Manufacturing and Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to make effective use of text, numeric and graphical information by interpreting and using technical information extracted from engineering drawings, technical manuals, reference tables, specifications and charts, in accordance with approved procedures. They will be required to extract the necessary information from the various drawings and related documents in order to establish and carry out the maintenance requirements and to make valid decisions about the quality and accuracy of the equipment being maintained.

Their responsibilities will require them to comply with organisational policy and procedures for obtaining and using the drawings and related specifications. They will be expected to report any problems with the use and interpretation of the drawings and specifications that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of the types of drawings and documents used within a maintenance environment, and will provide an informed approach to applying instructions and procedures. They will be able to read and interpret the drawings and documents used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the maintenance activities to the required specification.

They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives, including being able to demonstrate; personal responsibility and resilience, working effectively in teams, effective communication and interpersonal skills, focus on quality and problem solving and continuous development

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**Outcome**

P Performance requirements



**The learner must be able to:**

- P1 use the approved source to obtain the required data, documentation or specifications
  - P2 demonstrate the required occupational behaviours in line with the job role and company objectives
  - P3 extract and interpret the required information from the data, documentation or specifications
  - P4 use the information obtained to establish work requirements
  - P5 deal promptly and effectively with any problems within their control and report those which cannot be solved
  - P6 record and/or communicate technical data and information using approved methods
  - P7 report any inaccuracies or discrepancies in drawings and specifications
  - P8 use the approved source to obtain the required data, documentation or specifications
- 

**Outcome**

**S Skills requirements**

**The learner must be able to:**

- S1 Use approved sources to obtain the necessary drawings and related specifications, and carry out all of the following:
    - 1.1 check the currency and validity of the documentation used
    - 1.2 exercise care and control over the documentation at all times
    - 1.3 correctly extract all necessary data in order to carry out the required tasks
    - 1.4 seek out additional information where there are gaps or deficiencies in the information obtained
    - 1.5 deal with and/or report any problems found with the data and documentation
    - 1.6 make valid decisions based on the evaluation of the information extracted from the documentation
    - 1.7 return all documentation to the approved location on completion of the work
    - 1.8 complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation
- 

**Outcome**

- S2 Use information extracted from engineering drawings and related documentation, to include two of the following:
    - 2.1 drawings (such as component drawings, general assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
    - 2.2 diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit, layout diagrams)
    - 2.3 manufacturers manuals/drawings
    - 2.4 approved sketches
    - 2.5 technical illustrations
-

- 2.6 photographic images/representations
  - 2.7 visual display screen information
  - 2.8 technical sales/marketing documentation
  - 2.9 contractual documentation
  - 2.10 other specific drawings/documents
- 

## Outcome

S3 Use information extracted from related documentation to include three from the following:

- 3.1 standard operating procedures
  - 3.2 instructions (such as job instructions, drawing instructions, manufacturers instructions)
  - 3.3 specifications (such as material, finish, process, contractual, calibration)
  - 3.4 reference materials (such as manuals, tables, charts, fault diagnosis guides)
  - 3.5 schedules
  - 3.6 operation sheets
  - 3.7 maintenance log reports
  - 3.8 service/test information/schedules/results
  - 3.9 planning documentation
  - 3.10 quality control documents
  - 3.11 company specific technical instructions
  - 3.12 national, international and organisational standards
  - 3.13 health and safety standards relating to the activity (such as COSHH)
  - 3.14 environmental requirements/information
  - 3.15 other specific related documentation
- 

## Outcome

S4 Extract information that includes three of the following:

- 4.1 materials or components required
  - 4.2 dimensions
  - 4.3 tolerances
  - 4.4 quality requirements
  - 4.5 installation requirements
  - 4.6 customer requirements
  - 4.7 time scales
  - 4.8 financial information
  - 4.9 operating parameters
  - 4.10 surface texture requirements
  - 4.11 location/orientation of parts
  - 4.12 process or treatments required
  - 4.13 dismantling/assembly sequence
  - 4.14 inspection/testing requirements
  - 4.15 number/volumes required
  - 4.16 repair/service methods
-

- 4.17 method of manufacture
  - 4.18 weld type and size
  - 4.19 operations required
  - 4.20 connections to be made
  - 4.21 surface finish required
  - 4.22 shape or profiles
  - 4.23 fault finding procedures
  - 4.24 test points
  - 4.25 safety/risk factors
  - 4.26 environmental controls
  - 4.27 technical data (such as component data, maintenance data, electrical data, fluid data)
  - 4.28 resources (such as tools, equipment, personnel)
  - 4.29 utility supply details (such as electricity, water, gas, air)
  - 4.30 location of services, including standby and emergency backup systems
  - 4.31 circuit characteristics (such as pressure, flow, current, voltage, speed)
  - 4.32 protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
  - 4.33 other specific related information (such as financial delivery or contractual data)
- 

## Outcome

K Knowledge and understanding

### The learner must be able to:

- K1 explain what information sources are used for the documentation and specifications that they use in their work activities
- K2 explain how the required documentation is obtained, and how to check that it is current and valid
- K3 explain the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K4 explain how to use other sources of information to support the activity (such as manuals, tables, charts, planning and quality documentation, national and international standards)
- K5 describe the procedure for reporting discrepancies, lost or damaged documentation
- K6 explain the care and control procedures for the documentation, and the importance of returning them to the designated location on completion of the work activities
- K7 explain what basic drawing conventions are used, and why there needs to be different types of drawings
- K8 explain what types of drawings/diagrams used, and how they interrelate (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
- K9 explain why technical information is presented in different forms
- K10 explain the meaning of common symbols and abbreviations used within the working environment/work area
- K11 explain the imperial and metric systems of measurement, tolerancing and fixed reference points
- K12 describe the meaning of the different symbols and abbreviations found on the documentation that they use (such as wiring and component symbols, surface finish,

electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)

- K13 describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers

## Unit 304

## Reinstating the work area on completion of activities

<b>RQF Reference:</b>	D/508/6386
<b>Unit level:</b>	Level 3
<b>GLH:</b>	25

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to reinstate the work area, in accordance with approved procedures. They will be required to follow the correct procedures for the safe storage of finished products and surplus materials and to correctly identify and separate all waste materials and ensure that they are removed to their designated locations. They will also need to ensure that all tools, equipment and documents used are accounted for and returned to the appropriate places. Tidying of the work area will be of prime importance and includes office and clean working area environments, workshops, staging and platforms, internal areas of aircraft such as wings, tanks and fuselage sections and areas that are airside.

Their responsibilities will require them to comply with organisational policy and procedures for the activities undertaken and to report any problems with the reinstatement activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality of the work they carry out.

Their underpinning knowledge will provide a good understanding of their work and provide an informed approach to applying the required procedures. They will understand the need for reinstating the work areas and will know about the storage requirements of the products, equipment, materials, documentation and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required standard and ensuring that the work area is reinstated satisfactorily.

They will understand the safety precautions required when reinstating the work area. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

---

## Outcome

P Performance requirements

### The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
  - P2 demonstrate the required behaviours in line with the job role and company objectives
  - P3 separate equipment, components and materials for re-use from waste items and materials
  - P4 store reusable materials and equipment in an appropriate location
  - P5 dispose of waste materials in line with organisational and environmental safe procedures
  - P6 restore the work areas to a safe condition in accordance with agreed requirements and schedules
  - P7 deal promptly and effectively with problems within their control and report those that cannot be solved
- 

## Outcome

S Skills requirements

### The learner must be able to:

- S1 Carry out all of the following activities during reinstatement of the work area
    - 1.1 work to current schedules
    - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
    - 1.3 report any loss or damage to equipment (where applicable)
    - 1.4 report any identified hazards within the work area (where applicable)
    - 1.5 return all consumables and materials to their correct location
    - 1.6 complete any documentation as required
- 

## Outcome

S2 Carry out reinstatement activities on two work areas from

- 2.1 workshops/hangers
  - 2.2 airside
  - 2.3 areas at height (such as platforms, staging, lifts)
  - 2.4 internal areas of aircraft (such as wings, tanks, fuselage sections)
  - 2.5 office environment
  - 2.6 Computer Aided Design (CAD) environment
  - 2.7 technical/clean room environment
-



## 2.8 other specific environment

---

### Outcome

S3 Correctly label and store four the following resources:

- 3.1 finished products/components
  - 3.2 scrap components
  - 3.3 components requiring overhaul/repair
  - 3.4 measuring and test instruments
  - 3.5 surplus materials/components
  - 3.6 finished drawings
  - 3.7 tooling, jigs, fixtures or other equipment used
  - 3.8 finished documentation
  - 3.9 drawings requiring actioning/adjusting
  - 3.10 documentation requiring actioning/adjusting
- 

### Outcome

S4 Deal with waste materials, in line with company and environmental regulations, to include two of the following:

- 4.1 correctly segregating waste materials
  - 4.2 correctly dispose of waste materials
  - 4.3 disposing of joining compounds, sealants and adhesives
  - 4.4 disposing of other chemical products
  - 4.5 removing non-hazardous materials
  - 4.6 disposing of fluid waste (such as oil, hydraulic fluids, fuel)
- 

### Outcome

K Knowledge and understanding

**The learner must be able to:**

- K1 explain the specific safety practices and procedures that they need to observe when reinstating the work area (such as any specific legislation, regulations/codes of practice for the activities, equipment or materials) and the responsibility these requirements place on them
  - K2 describe the hazards associated with reinstating the work area and how to minimise them and reduce any risks
  - K3 explain the safe working practices and procedures to be followed when carrying out the various activities (such as lifting and handling techniques)
  - K4 explain what Personal Protective Clothing and Equipment (PPE) needs to be worn and where this can be obtained
  - K5 explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
-

- K6 explain why work areas need to be restored to a set standard and what these requirements are
- K7 describe the types of work area that will need to be restored (such as office environments, Computer Aided Design (CAD) environment, technical/clean room environment, workshops, test areas, stages and platforms and aircraft areas such as wing, tank, fuselage, airside section areas)
- K8 explain the importance of tool and equipment control and why this is critical within the aerospace industry
- K9 explain the meaning of 'Foreign Object Debris' (FOD) and why it is vital to ensure that this does not occur or is removed
- K10 describe the stores procedures for tools and equipment, documentation and surplus or waste materials
- K11 explain what materials will need to be stored and disposed of and why they need to be segregated, correctly identified and labelled
- K12 explain how the various disposal bins can be identified (such as colour coded, labelled)
- K13 explain the procedures for disposing of hazardous materials (such as chemicals, adhesives, oil, hydraulic fluids, fuel)
- K14 explain what documentation to be used on completion of reinstatement
- K15 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers

## Unit 305

## Lifting and trestling/shoring aircraft for maintenance/repair operations

<b>RQF Reference:</b>	H/508/6387
<b>Unit level:</b>	Level 3
<b>GLH:</b>	56

**Unit aim:**


This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to lift and where appropriate, trestle/shore commercial, military or light aircraft, both fixed wing and rotary aircraft, for maintenance operations (such as routine maintenance, repair, refurbishment or recovery), in accordance with the aircraft maintenance manual or approved change documentation (service bulletin) requirements. They will be required to use correctly specified items of lifting and supporting equipment, which will include hand and/or power operated lifting and jacking equipment, and associated lifting accessories. They must check that the lifting equipment is within current authorisation dates, is undamaged and within the permitted safe working load (SWL) or working load limit (WLL). They will be expected to establish the weight of the aircraft to be lifted, and to attach the appropriate lifting equipment/slides to the designated lifting points on the aircraft, in order to achieve a safe and balanced lift.

Their responsibilities will require them to comply with the specific practices and procedures identified in the aircraft manual or change/service bulletin documentation for the aircraft lifting and shoring activities undertaken, and to report any problems with the lifting and trestling/shoring activities or with the equipment used, that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision and, as part of a team, they must demonstrate a significant personal contribution during the team activities, in order to satisfy the requirements of this standard, and competence in all the areas required by the standard must be demonstrated. They will be expected to take personal responsibility for their own actions, for their contribution to the team, and for the safety and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the correct aircraft lifting and trestling/shoring techniques and procedures. They will understand the lifting and trestling/shoring techniques used, and their application, and will know about the lifting equipment and accessories for lifting, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

They will understand the safety precautions required when carrying out the lifting and trestling/shoring, and the safeguards that are necessary for undertaking these activities.



They will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Notes: This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 07 Lifting and Shoring.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

---

## Outcome

### P Performance requirements

#### The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 position the lifting equipment so that the weight of the load is evenly distributed
- P4 attach the appropriate lifting equipment securely to the load, using approved methods to eliminate slippage
- P5 confirm that the load is secure before moving
- P6 lift the load using approved techniques and procedures
- P7 position and release the load safely in its intended location
- P8 confirm that the lifting equipment is safe for use (such as passes visual inspection and has the correct SWL identification) and has the capacity for the intended lift

---

## Outcome

### S Skills requirements

#### The learner must be able to:

- S1 Carry out all of the following during the aircraft lifting and trestling/shoring activities
  - 1.1 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
  - 1.2 obtain and use the appropriate documentation (such as job instructions, technical instructions, aircraft manuals and lifting/shoring maintenance documentation)
  - 1.3 check that the work area is free from hazards and suitably prepared for the activities to be undertaken

- 1.4 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.5 ensure that the relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 1.6 use approved lifting and trestling/shoring techniques and procedures at all times
  - 1.7 return tools and equipment to the correct storage location on completion of the activities
  - 1.8 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are maintained free from damage and Foreign Object Debris (FOD)
  - 1.9 return tools and equipment to the correct storage location on completion of the activities
  - 1.10 ensure that the work carried out is correctly documented and recorded
- 

## Outcome

S2 Ensure that the lifting and trestling/shoring equipment to be used is correct for the aircraft being lifted and is in a safe and usable condition, by establishing all of the following

- 2.1 the lifting equipment selected is as specified for the aircraft being lifted (such as type, lifting capacity)
  - 2.2 the lifting equipment is certified and is compliant, within current test dates (such as LOLER regulations and health and safety requirements)
  - 2.3 all lifting equipment documents/registers are up to date
  - 2.4 where appropriate, all slings and ancillary equipment are free from obvious defects
  - 2.5 all trestles and shoring equipment are in a safe and usable condition
- 

## Outcome

S3 Use two of the following lifting methods and technique

- 3.1 bellyband suspension
  - 3.2 tail wheel jacking
  - 3.3 rotor head suspension
  - 3.4 nose wheel jacking
  - 3.5 complete aircraft jacking
  - 3.6 hard point attachment slings
  - 3.7 main undercarriage jacking
  - 3.8 stress jacking
  - 3.9 other specific technique
- 

## Outcome

S4 Carry out jacking and trestling/shoring of an aircraft, to include carrying out all of the following

- 4.1 establishing the weight of the aircraft to be lifted, including fuel on board
-

- 4.2 determining the correct lifting/jacking points on the aircraft
  - 4.3 removing access panels to expose the jacking/lifting points
  - 4.4 positioning the lifting/jacking equipment correctly on the aircraft
  - 4.5 attaching any required balance weights (ballast) to the aircraft (where appropriate)
  - 4.6 carrying out the lifting/jacking using the approved techniques and procedures for the aircraft type
  - 4.7 positioning the supporting equipment (such as contoured/cushioned supports, trestles, tail supports) and ensuring that it is installed at the appropriate/defined positions on the aircraft (where appropriate)
  - 4.8 lowering the aircraft onto the supporting equipment without causing damage to the aircraft structure (where appropriate)
  - 4.9 checking that the aircraft is correctly and safely balanced and held
- 

### Outcome

S5 Jack and trestle/shore an aircraft for one of the following conditions

- 5.1 routine maintenance
  - 5.2 modifications
  - 5.3 repair work
  - 5.4 refurbishment
  - 5.5 recovery
- 

### Outcome

S6 Carry out aircraft lifting and trestling/shoring operations in compliance with one of the following

- 6.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 6.2 Ministry of Defence (MoD)
  - 6.3 Military Aviation Authority (MAA)
  - 6.4 Aerospace Quality Management Standards (AS)
  - 6.5 Federal Aviation Authority (FAA)
  - 6.6 aircraft maintenance manual/approved change documentation (service bulletin)
  - 6.7 aircraft manufacturer's requirements
- 

### Outcome

K Knowledge and understanding

#### **The learner must be able to:**

- K1 explain the specific safety precautions to be taken when lifting and trestling/shoring aircraft, and the need for ensuring aircraft security (such as general workshop and site safety, appropriate personal protective equipment (PPE), protecting other workers during the lifting operations, accident procedures, statutory regulations, risk assessment procedures and COSHH regulations)
-



- K2 describe the hazards associated with lifting and trestling/shoring aircraft, and how to minimise them and reduce any risk
- K3 explain the Approved Code of Practice (ACOP) for safe use of lifting equipment, and Lifting Operation and Lifting Equipment Regulations (LOLER)
- K4 describe the requirements and explain the importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K5 explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K6 explain the specific requirements for the marking of lifting equipment and the specific method used in the organisation in which they are working
- K7 describe the range of equipment that is to be used for the lifting operations (such as hydraulic jacks, power operated cranes, winches, pulling equipment)
- K8 describe the lifting equipment accessories that are to be used (such as slings, eye bolts)
- K9 explain what checks should be made on the lifting equipment prior to use and the problems that they should look for
- K10 explain how to carry out visual in-service inspections of the equipment and what to do should any defective equipment be identified
- K11 describe the factors which affect the selection of the lifting equipment and lifting accessories (such as weight, type of load, operating environment)
- K12 explain how to check that the lifting equipment is capable of lifting the load to be moved
- K13 explain the signalling techniques used to communicate with crane drivers (to include both hand signals and verbal commands)
- K14 explain how to identify the lifting and trestling/shoring points on the aircraft and why they must not use any other
- K15 explain why balance/ballast weights are sometimes required during the lifting operations
- K16 explain how to determine the type of ballast/balance weight material (such as water, sand, newspaper bulk) with regard to suspension points and floorboard loading limits
- K17 describe the various trestling/shoring methods that may be used, and the types of trestling/shoring material, contour dimensions and trestling/shoring locations on the aircraft
- K18 explain the need to carry out the lifting and trestling/shoring operations without causing damage or undue stress to the airframe and its components
- K19 explain how lifting and trestling/shoring equipment should be stored and handled
- K20 describe the problems that can occur during the lifting, trestling or shoring of the aircraft and how these problems can be rectified
- K21 describe the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers

## Unit 306

## Levelling and weighing aircraft

<b>RQF Reference:</b>	K/508/6388
<b>Unit level:</b>	Level 3
<b>GLH:</b>	56

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to prepare for levelling and weighing commercial, military or light aircraft; both fixed wing and rotary aircraft, in accordance with the aircraft maintenance manual and approved change documentation (service bulletin) requirements.

They will be required to prepare the aircraft ready for levelling and weighing, which will include carrying out activities such as defueling, replenishing oil and other liquids/gaseous substances, removing foreign objects (such as tools, luggage) and cleaning the aircraft interior and exterior. They will be expected to obtain the correct equipment to use, as specified in the aircraft maintenance manual and weighing procedures, and to check that the equipment is within current certification requirements and is in a safe and usable condition. In carrying out the levelling and weighing activities, they will be expected to determine/locate the correct levelling points on the aircraft, to level the aircraft using appropriate techniques, to weigh the aircraft, to determine the weigh point arms and to determine the centre of gravity for the aircraft.

Their responsibilities will require them to comply with the specific practices and procedures identified in the aircraft manual or change/service bulletin documentation for levelling and weighing the aircraft, and to complete the necessary documentation. They will be required to report any problems with the levelling and weighing activities that they cannot personally resolve, or which are outside their defined authority, to the relevant people. They will be expected to work with a minimum of supervision and as part of a team, communicating (where appropriate) using hand signals and other communication devices. They must demonstrate a significant personal contribution during the team activities in order to satisfy the requirements of this standard, and competence in all the areas required by the standard must be demonstrated. They will be expected to take personal responsibility for their own actions, for their contribution to the team, and for the safety and accuracy of the work that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to the levelling and weighing of aircraft. They will understand the levelling and weighing process, and its application, and will know about the levelling and weighing requirements and equipment to be used, in sufficient depth to

provide a sound basis for carrying out the activities to the required standards.

They will understand the safety precautions required when carrying out the levelling and weighing operations. They will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Notes: This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 08 Levelling and Weighing.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

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## Outcome

### P Performance requirements

#### The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 obtain all the required equipment and ensure that it is in safe and usable condition
- P4 carry out the necessary preparations to the equipment, in line with work requirements
- P5 level and weigh the aircraft, using the approved techniques and procedures
- P6 use the information gained to determine the weight and centre of gravity of the aircraft
- P7 record the information accurately and legibly in the appropriate documentation
- P8 deal promptly and effectively with problems within their control and report those that cannot be solved

---

## Outcome

### S Skills requirements

#### The learner must be able to:

- S1 Carry out all of the following during the aircraft levelling and weighing activities
  - 1.1 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures

- 1.2 obtain and use the correct documentation (such as job instructions, aircraft configurations, technical instructions, aircraft manuals and levelling and weighing documentation)
  - 1.3 check that the work area is free from hazards and is suitably prepared for the activities to be undertaken
  - 1.4 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 1.5 obtain the correct tools and equipment for the levelling and weighing activity, and check that they are in a safe, tested and usable condition and within current calibration date(s)
  - 1.6 use the approved levelling and weighing techniques and procedures at all times
  - 1.7 return tools and equipment to the correct storage location on completion of the activities
  - 1.8 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are maintained free from damage and Foreign Object Debris (FOD)
  - 1.9 ensure that work carried out is correctly documented and recorded
- 

## Outcome

S2 Prepare the aircraft for the levelling and weighing operations, to include carrying out all of the following

- 2.1 de-fuel the aircraft to the unusable fuel level
  - 2.2 empty all waste tanks
  - 2.3 replenish oil, hydraulic fluid, cooling and anti-icing fluids, liquid oxygen and other gaseous substances to the appropriate level
  - 2.4 remove any items surplus to requirements (such as tools, cabin equipment or luggage)
  - 2.5 clean and dry the aircraft
  - 2.6 move the aircraft to a suitable environment, away from elements effecting the aircraft
  - 2.7 obtain or construct an inventory of equipment actually installed on the aircraft
  - 2.8 correct the basic weight and balance record, based upon the inventory
- 

## Outcome

S3 Level the aircraft, to include carrying out three of the following

- 3.1 setting and adjusting hydraulic jacks at the appropriate points (such as wing and nose)
  - 3.2 determining/locating the correct levelling points on the aircraft
  - 3.3 placing levelling bars across the levelling lugs
  - 3.4 creating a straight line on the floor from which measurements can be taken, or exposing the levelling plate on the aircraft floor
  - 3.5 using suitable equipment to check the level of the aircraft (such as spirit level, clinometers, plumb bob, steel tape, chalk line, laser levelling equipment)
  - 3.6 making adjustments to level the aircraft until the plumb bob tip or clinometers are at the required attitude
- 

## Outcome

S4 Use one of the following types of equipment for weighing the aircraft

- 4.1 stationary platform/pit weighing
  - 4.2 mobile electronic weighing system
  - 4.3 shear-beam load cells
  - 4.4 heavy duty portable scales
  - 4.5 self-levelling pressure transducer
  - 4.6 on-board weight and balance equipment
  - 4.7 hydrostats
- 

### Outcome

S5 Weigh the aircraft, to include carrying out five of the following

- 5.1 obtaining the appropriate type and number of scales/load cells to use
  - 5.2 checking that all the equipment to be used is within current calibration dates
  - 5.3 placing portable weighing equipment in the appropriate positions on a level surface
  - 5.4 setting and levelling the equipment where required
  - 5.5 positioning the aircraft on the scales, or jacking the aircraft at the appropriate points using load cell jacks
  - 5.6 allowing electronic equipment to warm up before taking readings
  - 5.7 taking and recording all the load readings
- 

### Outcome

S6 Use the information gained to determine four of the following

- 6.1 weigh point arms
  - 6.2 empty weight of the aircraft
  - 6.3 centre of gravity/balance point of the aircraft
  - 6.4 basic weight of the aircraft
  - 6.5 most forward centre of gravity
  - 6.6 gross weight of the aircraft
  - 6.7 most rearward centre of gravity
  - 6.8 weight and location of any required ballast
- 

### Outcome

S7 Complete the relevant paperwork, to include one from the following and pass it to the appropriate people

- 7.1 job cards/work sheets
- 7.2 aircraft technical log

Plus one of the following

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### 7.3 aircraft log book



- 7.4 aircraft cabin log
  - 7.5 component log card
  - 7.6 other record specified by the employer
- 

## Outcome

S8 Carry out aircraft levelling and weighing in compliance with one of the following:

- 8.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 8.2 extended range Twin Engined Operations Procedures (ETOPS) (where appropriate)
  - 8.3 Ministry of Defence (MoD)
  - 8.4 Military Aviation Authority (MAA)
  - 8.5 Aerospace Quality Management Standards (AS)
  - 8.6 Federal Aviation Authority (FAA)
  - 8.7 aircraft maintenance manual or approved change documentation (service bulletin) requirements
  - 8.8 aircraft manufacturer's requirements
- 

## Outcome

K Knowledge and understanding

### The learner must be able to:

- K1 explain the specific safety precautions to be taken when levelling and weighing aircraft, and the need for ensuring aircraft security (such as general airside and site safety, appropriate personal protective equipment, protecting other workers during the levelling and weighing operations, accident procedures, statutory regulations, risk assessment procedures and COSHH regulations)
  - K2 describe the hazards associated with levelling and weighing aircraft, and how to minimise them and reduce any risk
  - K3 explain why it is necessary to check periodically the weight of the aircraft (such as mandatory requirements and changes in weight due to maintenance, added or changed equipment)
  - K4 the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
  - K5 the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K6 explain how a change in the aircraft weight will affect its handling characteristics
  - K7 explain what manuals and documentation they will require for the levelling and weighing activities and how to obtain and complete them
  - K8 explain what information they will need to extract from the manuals and documentation in order to carry out the activities correctly
  - K9 explain the reasons for completing inventories of the actual equipment installed in the aircraft; the need to compare this with the aircraft basic weight and balance record and to update this as required
-

- K10 explain the need to carry out the levelling and weighing activities in a controlled environment (such as a closed hangar or building) with no blowers or ventilating system blowing air onto the aircraft
- K11 explain what preparations and checks that must be made on the aircraft and its systems prior to weighing (such as cleaning, emptying all waste and fuel tanks, replenishing oil, liquid and gaseous systems to the appropriate level)
- K12 describe the range of levelling and weighing equipment that is to be used during the process (such as portable scales, load cells, hydraulic jacks, levels, clinometers and plumb bobs)
- K13 explain the purpose and use of the respective pieces of equipment and the limitations (particularly with regard to Safe Working Limit (SWL) or Working Load Limit (WLL))
- K14 explain what checks need to be made on the equipment to ensure that it is safe to use, correctly calibrated and configured for the intended purpose
- K15 describe the various methods that may be used to level aircraft, depending on their type and size (such as chalk lines on the floor, levelling plates in the aircraft floor)
- K16 describe the various methods that may be used to weigh aircraft, depending on their type and size (such as stationary platform/pit scales, mobile electronic weighing systems, load cells on hydraulic jacks)
- K17 explain the information to be calculated from the loadings gathered (such as empty, basic and gross weight of the aircraft, the centre of gravity of the aircraft, weight and location of any required ballast)
- K18 describe the disposal methods for waste oil, fuel and other liquids and waste
- K19 describe the problems with the weighing and levelling procedures and explain the importance of informing appropriate people of defects
- K20 explain what recording documentation needs to be completed for the activities undertaken and how to fully complete it
- K21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set out in the relevant Qualification Assessment Strategy available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Qualification Assessment Strategy and specify the title of the relevant Trailblazer Standard

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers

## Unit 307

## Towing, marshalling and parking aircraft

<b>RQF Reference:</b>	M/508/6389
<b>Unit level:</b>	Level 3
<b>GLH:</b>	56

**Unit aim:**

This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.

This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to carry out aircraft handling operations on commercial, military or light aircraft, both fixed wing and rotary, in accordance with approved procedures. They will be required to select the correct tools and equipment to use, based on the handling activities to be carried out, and to check that they are in a safe and serviceable condition. They will be required to assist in manoeuvring the aircraft to the appropriate location, and to prepare the aircraft for flight operations or post-flight recovery. The handling activities will involve assisting in aircraft towing, preparation for flight, starter crew, aircraft marshalling, recovery from flight, marshalling and parking.

Their responsibilities will require them to comply with organisational policy and procedures for the aircraft handling activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to work with a minimum of supervision and as part of a team, communicating (where appropriate) using hand signals and other communication devices. They must demonstrate a significant personal contribution during the team activities in order to satisfy the requirements of this standard, and competence in all the areas required by the standard must be demonstrated. They will be expected to take personal responsibility for their own actions, for their contribution to the team, and for the quality and accuracy of the work that they carry out.

Their underpinning knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying aircraft handling techniques and procedures. They will have an understanding of the preparations to be carried out on the aircraft prior to moving it, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

They will understand the safety precautions required when carrying out the aircraft handling operations, especially those for jet intakes and exhaust dangers. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

**Notes:**

This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA)

Chapter 09 Towing and Taxiing and Chapter 10 Parking, Mooring, Storage and Return to Service  
They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

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## Outcome

### P Performance requirements

#### The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 prepare the aircraft and work area for the handling activities to be undertaken
- P4 carry out the activities within the limits of their personal authority
- P5 carry out the activities in the specified sequence and in an agreed timescale
- P6 report any instances where the activities cannot be fully met or where defects are identified
- P7 ensure that the aircraft and work area are left in a safe and secure condition on completion of the activities

---

## Outcome

### S Skills requirements

#### The learner must be able to:

- S1 Carry out all of the following during the aircraft handling activities
  - 1.1 ensure that airport procedures applicable to movement in restricted (such as airside) areas, including necessary security procedures, are understood and carried out
  - 1.2 ensure that appropriate authorisation to move the aircraft is obtained and that authorisations relevant to operating towing vehicles are held and valid
  - 1.3 check that the work area is free from hazards and suitably prepared for the aircraft to be moved
  - 1.4 adhere to procedures or systems in place for risk assessment, COSHH, and other relevant safety regulations and procedures to realise a safe system of work
  - 1.5 ensure that the relevant required safety procedures are implemented
  - 1.6 obtain appropriate personal protection equipment and emergency equipment, and check that it is in a usable condition

- 1.7 obtain any required support equipment, and check that it is in a safe and useable condition
- 1.8 use approved aircraft handling and moving techniques at all times
- 1.9 return tools and equipment to the correct storage location on completion of the activities
- 1.10 leave the work area and the aircraft in a safe and secure condition

---

### Outcome

S2 Prepare the aircraft for towing, by carrying out five of the following:

- 2.1 ensure that the aircraft is in safe condition to move, by checking aircraft documentation
- 2.2 check/set brake pressure
- 2.3 make cockpit checks and apply internal power, as required
- 2.4 check/fit required safety locks/pins (such as landing gear, nose steering, control surface)
- 2.5 fit the towing arm
- 2.6 check/remove electrical earthing and chocks (where appropriate)
- 2.7 obtain clearance for movement
- 2.8 ensure that the aircraft is prepared in accordance with local regulations

---

### Outcome

S3 Assist in three of the following aircraft handling activities:

- 3.1 towing
- 3.2 marshalling
- 3.3 parking/storing
- 3.4 mooring
- 3.5 picketing

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### Outcome

S4 Undertake three of the following roles when moving aircraft:

- 4.1 brake man
- 4.2 wing tip man
- 4.3 tractor/steering operator
- 4.4 blade man
- 4.5 tail safety man
- 4.6 towing supervisor
- 4.7 safety chock man

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### Outcome

S5 Assist in carrying out all of the following during the preparation for flight operations:

- 5.1 removing any fitted blanks, bungs and covers
  - 5.2 removing any locking/safety devices (such as undercarriage, nose steering, control surface)
  - 5.3 carrying out cockpit checks and applying ground power
  - 5.4 carrying out engine starter crew activities (using headset operations and/or hand signals)
  - 5.5 carrying out pre-flight checks
  - 5.6 marshalling
- 

### Outcome

S6 Carry out all of the following during recovery from flight operations:

- 6.1 marshalling (where applicable)
  - 6.2 fitting any blanks, bungs and covers that may be required
  - 6.3 fitting any required locking/safety devices (such as undercarriage, nose steering, control surface)
  - 6.4 parking of the aircraft (to include the use of wheel chocks, mooring blocks and where appropriate, earthing)
- 

### Outcome

S7 Carry out aircraft handling operations in compliance with one of the following:

- 7.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 7.2 Extended Range Twin Engine Operations Procedures (ETOPS) (where appropriate)
  - 7.3 Federal Aviation Authority (FAA)
  - 7.4 Ministry of Defence (MoD)
  - 7.5 Military Aviation Authority (MAA)
  - 7.6 Aerospace Quality Management Standards (AS)
  - 7.7 specific organisation standards and procedures
  - 7.8 aircraft manufacturer's requirements
- 

### Outcome

K Knowledge and understanding

#### **The learner must be able to:**

- K1 explain the specific safety precautions and procedures to be observed whilst carrying out the aircraft handling operations (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
  - K2 explain the health and safety requirements of the work area in which they are carrying out the activities, and the responsibility these requirements place on them
  - K3 explain the authorisation they require to commence work on the aircraft
-



- K4 describe the requirements and explain the importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K5 describe the hazards associated with towing, marshalling, parking and securing the aircraft (including airfield hazards and procedures), and explain how to minimise them and reduce any risk
- K6 describe the hazards associated with engine start and running and how they can be minimised
- K7 the importance of aircraft husbandry and of ensuring that, throughout the activity, the aircraft and area are free from foreign objects; the implications of Foreign Object Debris (FOD) to the safety of the aircraft
- K8 explain what protective equipment they need to use for both personal protection and protection of the aircraft
- K9 explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K10 explain what specifications are used during aircraft handling and the importance of following the procedures listed in these documents
- K11 explain the process and procedures for preparing an aircraft for flight operations (including engine start and 'see off')
- K12 explain the process and procedures for recovering an aircraft from flight operations ('see in')
- K13 describe the standard signals used when marshalling and handling aircraft
- K14 explain how to attach the towing devices to the aircraft and how to identify the appropriate attachment points
- K15 explain what equipment is to be used to tow the aircraft (such as towing vehicles, tow bars, towing cables) and how to check that they are in a safe and usable condition
- K16 explain their understanding of the minimum turning radius for the particular aircraft being handled and the ground turning techniques to be used
- K17 explain the methods used to communicate with the handling team and/or flight crew using both headsets and hand signals
- K18 explain the importance of correctly securing of the aircraft (using such items as wheel chocks, mooring blocks and mooring cables)
- K19 explain the need to fit blanking plugs, covers, locking/safety devices and where appropriate, cocooning materials
- K20 explain the importance of correct static grounding of the aircraft
- K21 explain the importance of tool control and company tool control procedures
- K22 explain what methods and equipment are to be used to manoeuvre the aircraft and how to check that the equipment is in a usable condition
- K23 explain how to deal with problems with aircraft handling processes or procedures, and the importance of informing appropriate people of any defects
- K24 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

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##### **Additional information**

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This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 501

## Working efficiently and effectively in an aircraft maintenance environment

<b>UAN:</b>	M/618/0198
<b>Level:</b>	Level 4
<b>GLH:</b>	42
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to:</p> <p>Work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the aircraft maintenance activity, they will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition.</p> <p>On completion of the aircraft maintenance activity, they will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used.</p> <p>Their responsibilities will require them to comply with organisational policy and procedures for the aircraft maintenance activities undertaken, and to report any problems with the activities, tools or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to take personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out and to identify and make recommendations where improvements could be made in their working area.</p> <p>Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an aircraft</p>

maintenance environment. They will understand the need to work efficiently and effectively, and will know about the things they need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships, and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

They will understand the safety precautions required when carrying out aircraft maintenance activities. They will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

They will be able to apply the occupational behaviours required in the workplace to meet the job profile and overall company objectives.

---

## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and environmental legislation, regulations and other relevant guidelines
- P2 demonstrate the required occupational behaviours in line with the job role and company objectives/values
- P3 plan the aircraft maintenance activities before they start them
- P4 prepare the work area for carrying out the aircraft maintenance activity
- P5 obtain all necessary consumables, tools and equipment and check that they are in a safe and usable condition
- P6 deal promptly and effectively with any problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
- P7 contribute to the business by identifying possible opportunities for improving working practices, processes and/or procedures
- P8 maintain effective working relationships with colleagues and supervisors
- P9 review personal training and development, as appropriate to the job role
- P10 clean, tidy up and restore the work area on completion of the aircraft maintenance activity

---

## Outcome

### S Skills requirements

The learner must be able to:

- S1 ensure that they apply all the following checks and practices at all times:
- 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
  - 1.2 wear the appropriate personal protective equipment for the work area and specific activity being carried out
  - 1.3 use all tools and equipment safely and correctly, and only for their intended purpose including adherence to the Control of Vibration at Work Regulations (Hand and Arm)
  - 1.4 **ensure that the work area is maintained and left in a safe and tidy**
- 

### Outcome

- S2 demonstrate and apply all the following occupational behaviours:
- 2.1 strong work ethic- motivated, proactive, committed
  - 2.2 dependable and responsible- punctual, reliable
  - 2.3 positive attitude - constructive thinking, motivated to succeed, committed to equality and diversity, environmental, social and economic sustainability, safety mind-set
  - 2.4 team player - able to work and interact effectively within a team
  - 2.5 effective communicator - spoken, listening, body language, presentation, written
  - 2.6 adaptable - able to adjust to change
  - 2.7 honesty and integrity - truthful, sincere and ethical
  - 2.8 self-motivated - self-starter, able to make appropriate decisions and lead their own professional development
  - 2.9 personal commitment - prepared to make a personal commitment to the industry
  - 2.10 leadership - deliver reliable and dependable results in work outputs, quality, work ethics and self-development, as well as encouraging and supporting the development of others
  - 2.11 accountable - follow the specified company procedures and controls and be responsible for their monitoring review and development
  - 2.12 reflective - reflect on current and past performance and provide information and recommendations for improvements in planning, delivery of working practices as well as training and development
- 

### Outcome

- S3 prepare to carry out the aircraft maintenance activity, ensuring all the following as applicable to the activity to be undertaken:
- 3.1 the work area is free from hazards and is suitably prepared for the activities to be undertaken
  - 3.2 all required safety procedures are implemented
  - 3.3 any necessary personal protection equipment is obtained, and is in a usable condition
-

- 3.4 all necessary drawings, specifications and associated documents are obtained
  - 3.5 job instructions are obtained and understood and checked for currency such as version/revision status
  - 3.6 tools and equipment required are obtained and checked that they are in a safe and useable condition
  - 3.7 the correct materials or components are obtained
  - 3.8 appropriate authorisation to carry out the work is obtained
- 

### Outcome

S4 complete the work activities to include all of the following:

- 4.1 returning tools and equipment to the designated location
  - 4.2 returning drawings and work instructions
  - 4.3 disposing of waste materials, in line with organisational and environmental requirements, maintaining/restoring the 'husbandry' of the work area
  - 4.4 completing all necessary documentation accurately and legibly
  - 4.5 identifying, where appropriate, any damaged or unusable tools or equipment
- 

### Outcome

S5 recognise and deal with problems affecting the aircraft maintenance activity to include four of the following:

- 5.1 materials/replacement components
  - 5.2 job specification
  - 5.3 timescales
  - 5.4 tool and equipment
  - 5.5 quality
  - 5.6 safety
  - 5.7 drawings/documentation
  - 5.8 people/resource
  - 5.9 work activities or procedures
  - 5.10 other (to be specified)
- 

### Outcome

S6 Contribute to the business by identifying possible opportunities for improving working practices and/or process that will impact on one of the following:

- 6.1 standard operating procedures
  - 6.2 quality
  - 6.3 cost
-

- 6.4 time such as lead or processing time
- 6.5 waste
- 6.6 energy utilisation
- 6.7 equipment performance or condition
- 6.8 resource
- 6.9 engineering designs

Plus **one** from the following:

- 6.10 health and safety
- 6.11 customer service
- 6.12 training and development
- 6.13 regulatory compliance
- 6.14 supplier relationships
- 6.15 communication (internal and/or external)
- 6.16 team working
- 6.17 other improvement to be specified by the employer

---

### Outcome

S7 Contribute to developing their own Continuous Development Plan (CPD) relevant to their career aspirations to include all the following:

- 7.1 describing the levels of skill, knowledge and understanding needed for competence in the areas of work expected of them
- 7.2 describing their development objectives/program, and how these were identified
- 7.3 providing information on their expectations and progress towards their identified objectives
- 7.4 using feedback and advice to improve their personal development and performance objectives

---

### Outcome

K Knowledge and understanding

The learner must be able to:

- K1 describe safe working practices and procedures to be followed whilst preparing and cleaning the work area
- K2 explain the importance of applying the appropriate occupational behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 describe how to present themselves in the workplace suitably dressed for the activities to be undertaken (such as being neat, clean and dressed in clothes appropriate to the area of activity)
- K4 explain the importance of reporting to work on time and returning from breaks on time and the potential consequences if this is not adhered to

- K5 describe the types of attitudes and behaviours that are likely to create conflict or negative responses
- K6 explain the benefits of team working and understanding of team objectives.
- K7 describe the roles of individual team members and the strengths they bring to the team.
- K8 explain the importance of clear communication both oral and written, using appropriate language and format.
- K9 explain the need to change communication styles to meet the needs of the target audience
- K10 explain the need to adhere to timescales set for work, whilst maintaining appropriate quality standards and the implications if these are not adhered to.
- K11 explain the importance of seeking additional support and guidance when required.
- K12 explain why it is important to be open and honest and admit to any errors and/or mistakes
- K13 describe the need to be flexible in their approach to work, responding positively to changes or amendments required by the business.
- K14 explain the importance of taking an active and positive part in the implementation of any amendments or changes to work requirements
- K15 describe their individual responsibility to work in an ethical manner and the organisations policies relating to ethical working and behaviours.
- K16 explain the importance of respecting others, including an awareness of diversity and inclusion.
- K17 explain what personal protective equipment (PPE) needs to be worn for the aircraft maintenance activities undertaken (such as correctly fitting overalls, safety shoes, eye protection, ear protection)
- K18 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues
- K19 describe the processes of planning and preparing to carry out the aircraft maintenance activity (such as obtaining the appropriate drawings/documentation to be used, determining the materials required, determining the tools and equipment required, determining a suitable sequence of operations, determining the quality checks to be made and equipment to be used)
- K20 describe the procedure for ensuring that all documentation relating to the work being carried out is available, prior to starting the activity
- K21 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity
- K22 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity
- K23 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity
- K24 describe how to deal effectively with problems that could arise with areas such as quality, safety, people, drawings and other documentation, tools and equipment or if material are incomplete or do not meet the requirements of the activity and the action that should be taken
- K25 describe the process and procedure used for making suggestions for improving the business



- K26 describe the importance of taking responsibility for identifying and making suggestions for making business improvements
- K27 explain their role in helping to develop their own skills and knowledge (such as checking with their supervisor about the work they are expected to carry out and the standard required to achieve; the safety points to be aware of and the skills and knowledge they need to develop)
- K28 describe the benefits of continuous personal development, and the training opportunities that are available in the workplace
- K29 describe the importance of reviewing their training and development with trainers and supervisors, of comparing the skills, setting objectives to overcome any shortfall or address any development needs
- K30 explain their responsibilities for providing evidence of performance and progress (such as submitting work for assessment or the completion of assignments or tests)
- K31 describe the importance of maintaining effective working relationships within the workplace (such as listening attentively to instructions from their supervisor, making sure they ask for help and advice in a polite and courteous manner, responding positively to requests for help from others)
- K32 explain the reason for informing others of their activities which may have impact on their work (such as the need to temporarily disconnect a shared resource like electricity or compressed air supply; making undue noise or creating sparks, fumes or arc flashes from welding)
- K33 describe how to deal with disagreements with others in ways which will help to resolve difficulties and maintain long term relationships
- K34 describe the organisational procedures to deal with and report any problems that can affect working relationships
- K35 describe the difficulties that can occur in working relationships, and how to resolve them
- K36 describe the current legislation covering discrimination in the workplace on the ground of race, religion sex, age and disability
- K37 explain the need to dispose of waste materials and consumables (such as oils and chemicals) in a safe and environmentally friendly way
- K38 explain where tools and equipment should be stored and located, and the importance of returning all tools and documentation to their designated area on completion of their work activities
- K39 describe when to act on their own initiative and when to seek help and advice from others
- K40 explain the importance of leaving the work area in a safe condition on completion of the aircraft maintenance activities (such as equipment correctly isolated, cleaning the work area and removing and disposing of waste)

## **Unit 501**

## **Working efficiently and effectively in an aircraft maintenance environment**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 502

## Carrying out flight servicing, scheduled maintenance and oversight activities

<b>UAN:</b>	R/618/0095
<b>Level:</b>	Level 4
<b>GLH:</b>	147
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake flight servicing and scheduled maintenance activities on aircraft in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. They will be required to select the correct tools and equipment to use for the activities to be carried out in accordance with the aircraft maintenance manual, and to check that they are in a safe and serviceable condition. They will be required to manoeuvre the aircraft to the appropriate location and to prepare the aircraft for the work. The activities will involve defueling, refuelling or checking fluid levels, replenishing oxygen systems, replenishing oil systems, checking undercarriages, wheels and brakes, and completing the servicing records. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics.</p> <p>Their responsibilities will require them to plan all aspects of the servicing/maintenance activity. They will also be required to check the progress and quality of the activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly,</p>

accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the servicing/maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate servicing/maintenance techniques and procedures on aircraft. They will know how any equipment used, functions, the common problems that can occur in adequate depth to provide a sound basis for carrying out the servicing/maintenance activities, correcting faults and for ensuring that the aircraft is serviced/maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the servicing/maintenance activities.

They will understand the safety precautions required when working on the aircraft, especially those for ensuring system cleanliness and the avoidance of contamination. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 12.

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## Outcome

P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives

- P3 plan the servicing/maintenance activity in line with the overall aircraft maintenance programme
  - P4 use the correct servicing/maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
  - P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
  - P6 ensure oversight of the servicing/maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
  - P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
  - P8 sign off the servicing/maintenance activity confirming that it has been completed to the required specification and quality standards
  - P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
  - P10 report any instances where the servicing/maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
  - P11 complete all relevant aircraft servicing/maintenance documentation legibly and accurately
  - P12 update aircraft personal log book with details of the maintenance activities completed
- 

## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft servicing/maintenance activity by carrying out all the following:
    - 1.1 provide regular communication on the progress of the servicing/maintenance activity
    - 1.2 contribute to the overarching planning on how the servicing/maintenance activity will be undertaken
    - 1.3 plan how to undertake the specific servicing/maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
    - 1.4 support servicing/maintenance activities within the team, taking into account
      - a) their existing workloads
      - b) aircraft specific skills, knowledge and understanding
      - c) opportunities for training and development
    - 1.5 identify potential improvements that could be made to the servicing/maintenance process and/or procedures
-

- 1.6 review and communicate the progress and quality of the servicing/maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the servicing/maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the servicing/maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out **all** of the following during the servicing/maintenance of the aircraft:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 ensure that the aircraft is correctly earthed and follow approved safe procedures for connecting ground power
- 2.3 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual

- 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft engine water injection system:

- 4.1 water storage
  - 4.2 distribution
  - 4.3 dumping and purging
  - 4.4 indicating
- 

## Outcome

S5 Carry out one of the following:

- 5.1 refuelling
  - 5.2 defueling
  - 5.3 checking fluid levels such as hydraulics, engine/gearbox oil and water
- 

## Outcome

S6 Carry out three the following flight inspections in accordance with the approved servicing schedule:

- 6.1 daily
- 6.2 before flight
- 6.3 transit
- 6.4 turnaround
- 6.5 after flight
- 6.6 Extended Range Twin-Engine Operations Procedures (ETOPS)

To include the replenishment and servicing of **all** the following health and safety

- 6.7 gas systems
  - 6.8 aircraft lights
  - 6.9 structure examination
  - 6.10 oil systems
  - 6.11 cabin/flight deck inspections
-

- 6.12 landing gear examination and tyre pressure checks
  - 6.13 hydraulic systems
  - 6.14 engines
  - 6.15 water/toilet systems (as appropriate)
  - 6.16 liquid oxygen (LOX) system (as appropriate)
- 

### Outcome

- S7 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 7.1 job cards/work sheets
  - 7.2 aircraft technical log
- Plus **one** of the following:
- 7.3 aircraft log book
  - 7.4 aircraft cabin log
  - 7.5 component log card
  - 7.6 other record specified by the employer
- 

### Outcome

- S8 Carry out maintenance on aircraft electrical power systems in compliance with one of the following:

- 8.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 8.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 8.3 Ministry of Defence (MoD)
  - 8.4 Military Aviation Authority (MAA)
  - 8.5 Aerospace Quality Management Standards (AS)
  - 8.6 Federal Aviation Authority (FAA)
  - 8.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 8.8 manufacturers standards and procedures
- 

### Outcome

- K Knowledge and understanding

The learner must be able to:



- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of maintenance on, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K3 Explain the authorisation they require to commence work on the aircraft
- K4 Describe the hazards associated with carrying out flight servicing of the aircraft, and how to minimise them and reduce any risk
- K5 Describe the hazards associated with working on and replenishing aircraft systems (such as fuel, gaseous systems and oils), and how they can be minimised
- K6 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K7 Explain the importance of human factors in aircraft maintenance and how it is applied when leading the oversight of maintenance teams
- K8 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K9 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K10 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K11 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K12 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K13 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K14 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K15 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K16 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K17 Explain what protective equipment they need to use for both personal protection (PPE) and protection of the aircraft
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the servicing/maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft engine water injection systems, and other documents needed in the maintenance activities
- K21 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock

- K22 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain how to carry out currency/issue checks on the specifications they are working with
- K30 Explain the terminology used in aircraft servicing /scheduled maintenance
- K31 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow settings, travel and working clearance)
- K32 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K33 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K34 Explain how to identify the fuels, lubricants and gases to be used, and how to ensure that systems are not contaminated
- K35 Explain the procedures for checking undercarriages, wheels and brakes, and what to look for (such as tyre damage, tyre creep, tyre pressure, hydraulic leaks, shock absorber/oleo extension, security of fastenings and brake wear)
- K36 Describe the quality control procedures to be followed during the servicing procedures
- K37 Explain how to conduct any necessary checks to ensure the system integrity and functionality
- K38 Describe the problems that can occur with the servicing/maintenance operations, and how these can be overcome
- K39 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K40 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K41 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 502**

## **Carrying out flight servicing, scheduled maintenance and oversight activities**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 503

## Maintaining and certifying aircraft air conditioning systems (ATA 21)

<b>UAN:</b>	T/618/0199
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft air conditioning systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide a means of pressurising, heating, cooling, moisture controlling, filtering and treating air used to ventilate the areas of the fuselage within the pressure zone, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of air conditioning system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft air conditioning systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the air conditioning system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on aircraft air conditioning systems, especially those for isolating the system, ensuring system cleanliness and the avoidance of contamination. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

**Notes:**

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 21 Air Conditioning.

2. To display competence in this standard it is necessary to both remove and fit aircraft air conditioning system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks

cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out **all** of the following during the maintenance of the aircraft air conditioning system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance activities on three of the following parts of an aircraft air conditioning system:

- 4.1 compression
- 4.2 heating
- 4.3 temperature control
- 4.4 distribution
- 4.5 cooling
- 4.6 air contaminant control
- 4.7 pressurisation control
- 4.8 filtration control
- 4.9 humidity control

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### Outcome

S5 Remove and fit four different aircraft air conditioning system components, at least one must be from group A:

Group A:

- 5.1 reservoirs/supply tanks
- 5.2 pressure intensifiers
- 5.3 valves (such as by-pass, shut-off, check, pressure relief, temperature control, outflow, anti-g)
- 5.4 air receivers
- 5.5 diffusers
- 5.6 compressor
- 5.7 cooling units
- 5.8 regulators
- 5.9 heat exchanger
- 5.10 safety devices
- 5.11 pumps
- 5.12 cabin blowers



- 5.13 air-conditioning packs
- 5.14 air cycle unit
- 5.15 vapour cycle unit
- 5.16 pressure/pressurisation controller

Group B:

- 5.17 filters
- 5.18 hoses
- 5.19 gauges
- 5.20 strainers including water separator
- 5.21 gaskets and seals
- 5.22 sensors
- 5.23 earthing straps/jumper braids
- 5.24 unions and couplings
- 5.25 electrical controls (solenoids, motors, switches)
- 5.26 rigid pipework
- 5.27 ducting
- 5.28 actuating mechanisms
- 5.29 scoops
- 5.30 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers

- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft air conditioning system, to include carrying out five of the following:

- 7.1 Checking filters
  - 7.2 inspecting outflow valves
  - 7.3 cleaning outflow valves
  - 7.4 checking fluid content of reservoirs (such as deodorisers, insecticides)
  - 7.5 replenish heat transfer valves
  - 7.6 checking operation of air conditioning/heating system
  - 7.7 checking operation of pressurisation system
  - 7.8 checking indicating systems
  - 7.9 replenishing vapour system
  - 7.10 checking safety devices (such as bursting disc)
- 

## Outcome

S8 Carry out **three** of the following tests on the aircraft air conditioning system:

- 8.1 cabin pressure test
  - 8.2 airline vapour tests
  - 8.3 pressure balancing
  - 8.4 reduced system test
  - 8.5 bulkhead and dome pressure tests
  - 8.6 equipment functional test
  - 8.7 air flow tests
  - 8.8 visual inspection
  - 8.9 leak test
  - 8.10 built in test equipment (BITE) test
  - 8.11 air temperature tests
  - 8.12 'special-to-type' tests
  - 8.13 safety interlock test
  - 8.14 aircraft self-test printout
- Using **one** of the following:
- 8.15 aircraft power source/system
  - 8.16 ground test rig
-

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## Outcome

S9 Complete relevant documentation to include **both** the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus **one** of the following:

9.3 computer records

9.4 aircraft log book

9.5 aircraft cabin log

9.6 component log card

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## Outcome

S10 Carry out maintenance on aircraft air conditioning systems in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft air conditioning systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

- K5 Explain the importance of ensuring that personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on air conditioning systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with carrying out maintenance activities on aircraft air conditioning systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the methods to ensure health and safety is maintained during pressurisation checks
- K15 Describe the procedures required to carry out pressurisation checks
- K16 Describe the effects maintenance personnel health issues can have when carrying out aircraft pressurisation checks i.e. head colds and sinus problems
- K17 Explain how to recognise problems during pressurisation checks as both an observer and the person carrying out the test
- K18 Describe the use of test equipment and external pressurisation rigs in carrying out these checks
- K19 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K20 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K21 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K22 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K23 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft air conditioning systems, and other documents in the maintenance activities
- K24 Explain how to carry out currency/issue checks on the specifications they are working with
- K25 Explain the terminology used in aircraft air conditioning systems, and the use of system diagrams and associated symbols

- K26 Describe the basic principles of operation of the aircraft air conditioning system being worked on (such as system layout, compression, distribution, pressurisation control, heating, cooling, temperature control and air contaminant control; indication and warning), along with corresponding safety devices
- K27 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K28 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K29 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K30 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K31 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K32 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K33 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K34 Describe the various types of pipe and component that make up the aircraft air conditioning system (such as rigid and flexible pipes; ducting; supporting devices; valves used for pressure, flow and directional control; pumps; heaters; cooling units; air cycle units; cabin blowers; mechanical and electrical control devices)
- K35 Explain the techniques used to remove components from aircraft air conditioning systems without damage to the components or surrounding structure (such as removal of components, and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K36 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K37 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K38 Explain methods of lifting, handling and supporting components/equipment during the maintenance activities
- K39 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and that any exposed components or pipe ends are correctly covered/protected, and the implications of foreign object debris (FOD) to the safety of the aircraft
- K40 Explain the recognition of contaminants, and the problems they can create: the effects and likely symptoms of contamination in the system

- K41 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K42 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking the security of joints and that the system is safe to re-charge)
- K43 Explain how to make adjustments to components/assemblies to ensure that they function correctly
- K44 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K45 Explain how to carry out routine servicing of the aircraft air conditioning system (including checking for leaks, checking and changing filters, cleaning outflow valves)
- K46 Explain what types of test need to be carried out on the aircraft air conditioning system (such as functional checks, pressure tests, pressure balancing, air temperature tests, safety interlock tests, leak checks)
- K47 Describe the methods and procedures to be used to carry out the various tests on the air conditioning system
- K48 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft air conditioning system
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain what recording documentation needs to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K53 Describe the procedure for the safe disposal of waste materials and scrap components
- K54 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 503**

## **Maintaining and certifying aircraft air conditioning systems (ATA 21)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 504

## Maintaining and certifying aircraft auto flight systems (ATA 22)

<b>UAN:</b>	D/618/0200
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft auto flight systems, in accordance with the approved aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes units and components which provide a means of automatically controlling the flight of the aircraft, including direction, heading, altitude and speed, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of auto flight components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as computers, controllers, air data units, detectors, gyros (rate and vertical), trim units, actuators, stick position cancellers, and angle of attack and stall warning components. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>



bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft auto flight systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with auto flight system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft auto flight system, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 22 Auto Flight.

2. To display competence in this standard it is necessary to both remove and fit aircraft auto flight system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a

system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out **all** of the following during the maintenance of the aircraft auto flight system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft auto flight system:

- 4.1 autopilot
- 4.2 auto pilot system monitoring
- 4.3 mach trim
- 4.4 integrated flight director system
- 4.5 auto throttle
- 4.6 aerodynamic load alleviating
- 4.7 auto land systems
- 4.8 command stability and augmentation system
- 4.9 disorientation recovery system

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## Outcome

S5 Remove and fit three different aircraft auto flight system components (at least one must be from group A):

Group A:

- 5.1 computers
- 5.2 trim units
- 5.3 controllers
- 5.4 actuators
- 5.5 amplifier
- 5.6 transformers
- 5.7 detectors/position sensors
- 5.8 stick position cancellers
- 5.9 receiver units
- 5.10 embedded GPS and INS (EGI)
- 5.11 gyros (rate and vertical)

Group B:

- 5.12 batteries
- 5.13 servos
- 5.14 wires/cables
- 5.15 switches

- 5.16 aerals
  - 5.17 plugs/sockets
  - 5.18 relays
  - 5.19 instruments/gauges/indicators
  - 5.20 other specific components
- 

## Outcome

S6 Carry out **fifteen** of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft auto flight systems, to include carrying out four of the following:

- 7.1 check operation of autopilot
  - 7.2 perform autopilot gain adjustments
  - 7.3 check operation of auto throttle
  - 7.4 perform mach trim functional check
  - 7.5 check operation of yaw damper
-

- 7.6 check autoland system
  - 7.7 check and adjust servo clutch
  - 7.8 check stability augmentation system
  - 7.9 other specific aircraft auto flight checks
- 

## Outcome

S8 Carry out five of the following types of test/check on aircraft auto flight systems:

- 8.1 functional check
- 8.2 continuity checks
- 8.3 audio warning
- 8.4 bonding tests
- 8.5 signal injection tests
- 8.6 visual warning
- 8.7 BITE test
- 8.8 rate/range/sense of movement
- 8.9 'special-to-type' tests
- 8.10 voltage checks

Using four of the following:

- 8.11 simulators
  - 8.12 external power source (electrical/hydraulic)
  - 8.13 oscilloscope
  - 8.14 clinometers
  - 8.15 aircraft power source (electrical/hydraulic)
  - 8.16 reference gyros
  - 8.17 air data test sets
  - 8.18 bonding tester
  - 8.19 tilt tables
  - 8.20 'special to type' test equipment
  - 8.21 multimeter
  - 8.22 internal aircraft equipment
- 

## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
  - 9.2 aircraft technical log
- Plus one of the following:
- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
-

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## Outcome

S10 Carry out maintenance on aircraft auto flight systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft auto flight systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process

- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on auto flight systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, RVSM operations, Electrical Wiring Interconnect Systems (EWIS), Autoland system status and legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft flight control system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft flight control systems, other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft flight control systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the auto flight system being worked on, and the function of the various units within the system
- K23 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem



- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft auto flight systems without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the removal and fitting activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K44 Explain how to carry out routine servicing of the aircraft auto flight system
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K46 Explain what types of test that need to be carried out on the aircraft auto flight system, and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the auto flight system

- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft auto flight systems
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Describe the problems that can occur with the auto flight system maintenance operations, and how these can be overcome
- K53 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials and scrap components
- K55 Describe the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

## **Unit 504                      Maintaining and certifying aircraft auto flight systems (ATA 22)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 505

## Maintaining and certifying aircraft communication systems (ATA 23)

<b>UAN:</b>	H/618/0201
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft communication systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide a means of communicating from one part of the aircraft to another, between aircraft and aircraft to ground stations, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of communication system components. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The communication system will include units and components associated with speech and satellite communication, data transmission, automatic calling, passenger address, interphone, audio integrating, static discharging, integrated automatic tuning, audio and video monitoring, as applicable to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will remove the required components and to fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality</p>

requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft communication systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft communication systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 23 Communications.

2. To display competence in this standard, it is necessary to both remove and fit aircraft communication system components. They must remove components; however, they

may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the communication systems

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on three of the following aircraft communication systems:

- 4.1 speech communication (such as HF radio, VHF radio, UHF radio, intercom (clear), intercom (secure speech))
- 4.2 satellite communications (such as SATCOM, GPS systems, crash position indicators)
- 4.3 data transmission and automatic calling (such as telecommunications/teleprinter, Selcal, Calsel, ACARS)
- 4.4 passenger address
- 4.5 interphone
- 4.6 audio integrating (such as microphones, headphones, cockpit loudspeakers)
- 4.7 static discharging
- 4.8 integrated automatic tuning (such as digital data links)
- 4.9 audio and video monitoring (such as voice recorders, passenger conversation/movement, external cameras)
- 4.10 communication and audio management system
- 4.11 on – board intercom (clear or secure) Intercom to ground handling crew

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## Outcome

S5 Remove and fit four different communication system components (at least two must be from group A):

Group A:

- 5.1 aerials/antennas
- 5.2 voice recorder
- 5.3 amplifiers
- 5.4 intercom station boxes
- 5.5 receiver units



- 5.6 antenna switching units
- 5.7 cameras
- 5.8 monitors
- 5.9 satellite beacons
- 5.10 tuning units
- 5.11 transformers
- 5.12 display panels
- 5.13 transponders
- 5.14 transmitter units
- 5.15 control units

Group B:

- 5.16 switches
- 5.17 static discharge wicks
- 5.18 speakers
- 5.19 instruments/gauges/indicators
- 5.20 relays
- 5.21 headsets
- 5.22 wires/cables
- 5.23 microphone units
- 5.24 unit trays
- 5.25 headsets
- 5.26 plugs/sockets
- 5.27 other specific components

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Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required

- 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft communication systems, to include carrying out five of the following:

- 7.1 checking operation of speech communication system
  - 7.2 checking operation of satellite communications
  - 7.3 checking operation of data transmission and automatic calling system
  - 7.4 checking operation of passenger address, entertainment and comfort system
  - 7.5 replacing static discharge wicks
  - 7.6 checking operation of interphone system
  - 7.7 checking operation of audio integrating system
  - 7.8 checking operation of integrated automatic tuning system
  - 7.9 checking operation of audio and video monitoring system
  - 7.10 checking software state of communication system
  - 7.11 upload software to relevant standard
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## Outcome

S8 Carry out three of the following types of test/check on aircraft communication systems:

- 8.1 continuity check
  - 8.2 built in test equipment BITE test
  - 8.3 'special-to-type' tests
  - 8.4 bonding tests
  - 8.5 distortion checks
  - 8.6 power output
  - 8.7 voltage standing wave ratio (VSWR) checks
  - 8.8 software status
  - 8.9 secure code load
- Using five of the following:

- 8.10 'special to type' test equipment
  - 8.11 oscilloscope
  - 8.12 multimeter
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- 8.13 modulation analyser
  - 8.14 time domain reflectometer (TDR) equipment
  - 8.15 RF signal generator
  - 8.16 bonding tester
  - 8.17 voltage standing wave ratio (VSWR) equipment
  - 8.18 headset
  - 8.19 aircraft power source
  - 8.20 wattmeter
  - 8.21 external power source
  - 8.22 insulation resistance (Megger) tester
  - 8.23 ground loading unit (GLU)
  - 8.24 secure code equipment
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## Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus one of the following:

9.3 aircraft log book

9.4 aircraft cabin log

9.5 component log card

9.6 other record specified by the employer

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## Outcome

- S10 Carry out maintenance on aircraft communication systems in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft communication systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft communication systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft communication system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft communication systems, and other documents in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft communication systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the communication system being worked on, and the function of the various units that make up the system
- K23 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used and their method of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft communication systems without damage to the components or surrounding structure (such as the need to protect the circuit integrity by covering and labelling exposed circuits)

- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Describe the tools and equipment used in the maintenance activities and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K44 Explain how to carry out routine checks and servicing of the aircraft communication system (including performing antenna VSWR checks, checking function of radios and passenger address system)
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K46 Explain what types of test need to be carried out on the aircraft communication system and the test equipment to be used
- K47 Explain what methods and procedures are used to carry out the various tests on the communication system
- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results, and make valid decisions about the acceptability of the communication system
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K53 Describe the procedure for the safe disposal of waste materials and scrap components
- K54 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 505**

## **Maintaining and certifying aircraft communication systems (ATA 23)**

### **Supporting Information**

### **Unit guidance**

#### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

#### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 506

## Maintaining and certifying aircraft electrical power systems (ATA 24)

<b>UAN:</b>	K/618/0202
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft electrical power systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which generate, control and supply AC and/or DC electrical power for other systems, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a of electrical power system components. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft components will include items such as control units, batteries, generators, alternators, regulators, invertors, transformers, rectifier units, contactors and relays, under- voltage phase sequence units, switches and circuit breakers. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the system before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality</p>



requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft electrical power systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft electrical power systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 24 Electrical Power.

2. To display competence in this standard, it is necessary to both remove and fit aircraft electrical power system components. They must remove components; however, they

may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft electrical power systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on three of the following aircraft electrical power systems:

- 4.1 generator drive system
- 4.2 DC power generation equipment
- 4.3 AC power generation equipment
- 4.4 AC electrical load distribution
- 4.5 external power equipment
- 4.6 DC electrical load distribution
- 4.7 emergency power backup equipment
- 4.8 secondary/standby power generation equipment

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### Outcome

S5 Remove and fit six different electrical power system components (at least three must be from group A):

Group A:

- 5.1 starter/generators
- 5.2 regulators
- 5.3 transformer/rectifier units
- 5.4 alternators
- 5.5 invertors
- 5.6 main contactors
- 5.7 integrated drive generator
- 5.8 circuit breakers
- 5.9 generator control panels/units
- 5.10 main batteries
- 5.11 voltage regulators
- 5.12 ram air turbine
- 5.13 under-voltage phase sequence units
- 5.14 power system control units

Group B:

- 5.15 switches
  - 5.16 batteries (such as emergency lighting),
  - 5.17 wires/cables
  - 5.18 relays
  - 5.19 connectors
  - 5.20 plugs/sockets
  - 5.21 transducers/sensors
  - 5.22 warning lights
  - 5.23 transformer
  - 5.24 indicators (such as volts/frequency)
  - 5.25 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out four of the following types of test/check on aircraft electrical power systems:

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- 7.1 functional check
  - 7.2 insulation test
  - 7.3 comparison check
  - 7.4 continuity check
  - 7.5 built in test equipment BITE test
  - 7.6 'special-to-type' tests
  - 7.7 voltage check
  - 7.8 standby power failure checks
  - Using two of the following:
  - 7.9 external power source
  - 7.10 aircraft power source/system
  - 7.11 'special-to-type' test sets
  - 7.12 measuring equipment (such as multimeters, insulation testers)
- 

## Outcome

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
  - 8.2 aircraft technical log
  - Plus one of the following:
  - 8.3 aircraft log book
  - 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
- 

## Outcome

- S9 Carry out maintenance on aircraft electrical power systems in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 9.3 Ministry of Defence (MoD)
  - 9.4 Military Aviation Authority (MAA)
  - 9.5 Aerospace Quality Management Standards (AS)
  - 9.6 Federal Aviation Authority (FAA)
  - 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 9.8 manufacturers standards and procedures
-

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft electrical power systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Explain the procedures to follow before putting an aircraft in flight mode and the effect this can have on aircraft systems and components.
- K11 Explain the methods used to download and upload software on aircraft electrical systems
- K12 Explain the control of software changes and use of software
- K13 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K14 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K15 Explain the importance of maintenance on aircraft electrical power systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K16 Describe the hazards associated with removing, fitting and testing aircraft electrical power system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K17 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

- K18 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K19 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K20 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K21 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K22 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications and other documents needed in the maintenance process
- K23 Explain how to carry out currency/issue checks on the specifications they are working with
- K24 Explain the terminology used in aircraft electrical power systems, and the use of system diagrams and associated symbols
- K25 Describe the basic principles of operation of the electrical power system being worked on; AC and DC power supplies and the function of the various units within the system
- K26 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K27 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K28 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K29 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K30 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K31 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K32 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K33 Describe the various mechanical fasteners that are used, and their method of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K35 Explain why securing devices need to be locked and labelled, and the methods that are used to remove and install them
- K36 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved



- K37 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K38 Explain the techniques used to remove components from aircraft electrical power systems without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)
- K39 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K40 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K41 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K42 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
- K43 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K44 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K45 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K46 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K47 Describe the problems that can occur with the maintenance operations, and how these can be overcome
- K48 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K49 Explain how to carry out routine checks and servicing of the aircraft electrical power system (including adjusting voltage regulators, checking battery capacity and charging batteries)
- K50 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K51 Explain what types of test need to be carried out on the aircraft electrical power system, and the test equipment used
- K52 Explain what methods and procedures are used to carry out the various tests on the electrical power system
- K53 Explain how to record the results of each individual test and the documentation that must be used
- K54 Explain how to analyse the test results and make valid decisions about the acceptability of the electrical power system
- K55 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K56 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

- K57 Describe the procedure for the safe disposal of waste materials and scrap components
- K58 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 506**

## **Maintaining and certifying aircraft electrical power systems (ATA 24)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 507

## Maintaining and certifying aircraft equipment and furnishings (ATA 25)

<b>UAN:</b>	M/618/0203
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft equipment and furnishings, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes those removable items of equipment and furnishings externally mounted on the aircraft or contained in the flight, passenger, cargo and accessory compartments, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and, where appropriate, testing of a range of equipment and furnishings. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the equipment to be removed or fitted. The aircraft equipment and furnishings will include galley and toilet equipment, flight crew seats, tables, food containers, wardrobes, curtains, wall coverings, carpets, overhead storage compartments, movable partitions, mirrors and other similar equipment. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality</p>

requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft equipment and furnishings. They will understand the removal, fitting and testing methods and procedures, and their application, along with the equipment and furnishings system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft equipment and furnishings, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 25 Equipment and Furnishings.

2. To display competence in this standard, it is necessary to both remove and fit aircraft equipment and furnishings. They must remove equipment and furnishings; however, they may fit

replacement equipment and furnishings where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft equipment and furnishings

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on equipment and furnishings from two of the following areas of the aircraft:

- 4.1 flight compartment
- 4.2 buffet/galley
- 4.3 emergency kit
- 4.4 passenger compartment
- 4.5 toilet/dressing rooms
- 4.6 insulation
- 4.7 cargo compartments
- 4.8 accessory compartments

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### Outcome

S5 Remove and fit six different aircraft equipment and furnishing components (at least two must be from group A):

Group A:

- 5.1 flight crew seats
- 5.2 movable partitions
- 5.3 cargo rollers/drive equipment
- 5.4 passenger seats
- 5.5 removable and fixed cabinets
- 5.6 cargo restraint equipment
- 5.7 berths
- 5.8 ovens
- 5.9 evacuation equipment
- 5.10 wardrobes
- 5.11 refrigerators
- 5.12 drag parachutes
- 5.13 overhead storage compartments
- 5.14 garbage containers/compactor
- 5.15 Kevlar/armour plating



- 5.16 inertia reels
- 5.17 coffee maker and dispenser

Group B:

- 5.18 carpets
- 5.19 mirrors
- 5.20 life rafts
- 5.21 sound proofing
- 5.22 curtains
- 5.23 cargo restraint nets
- 5.24 life jackets
- 5.25 signal flares
- 5.26 wall coverings
- 5.27 emergency locator transmitters (ELT)
- 5.28 first aid kit
- 5.29 spare bulbs/fuses
- 5.30 insulation blankets
- 5.31 seat belts
- 5.32 batteries
- 5.33 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers

- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft equipment and furnishings, to include carrying out four of the following:

- 7.1 checking inertia reels for correct operation
  - 7.2 checking seat belts for damage and security
  - 7.3 checking that emergency equipment is all present and in a serviceable condition
  - 7.4 checking emergency locator transmitters (ELT) for compliance with regulations
  - 7.5 changing cabin configuration
  - 7.6 repairing upholstery
  - 7.7 checking seat structure, recline and table mechanisms
  - 7.8 checking contents of first aid kit
  - 7.9 checking operation of emergency megaphone
  - 7.10 checking operation of galley compartment door primary and secondary latches
- 

## Outcome

S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
  - 8.2 aircraft technical log
- Plus one of the following:
- 8.3 aircraft log book
  - 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
- 

## Outcome

S9 Carry out maintenance on aircraft equipment and furnishings in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
-

- 9.3 Ministry of Defence (MoD)
- 9.4 Military Aviation Authority (MAA)
- 9.5 Aerospace Quality Management Standards (AS)
- 9.6 Federal Aviation Authority (FAA)
- 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 9.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft equipment and furnishings (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft equipment and furnishings, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, legislation and local procedures
- K13 Describe the hazards associated with removing and fitting aircraft equipment and furnishings, and with the tools and equipment used, and how to minimise them and reduce any risk

- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Describe the range of equipment and furnishings that may need to be maintained/replaced
- K22 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the various mechanical fasteners that are used to hold the equipment in place, and their method of removal and replacement (such as threaded fasteners, special securing devices)
- K30 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K31 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

- K32 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to take care when removing equipment and furnishings so as not to cause damage to the equipment or surrounding structure
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K36 Explain the need to correctly position, align, adjust and secure the replaced equipment in the aircraft without damage to the components or surrounding structure
- K37 Explain the methods of lifting, handling and supporting the components/equipment during the removal and fitting activities
- K38 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K39 Explain how to carry out routine checks of the aircraft equipment and furnishings (such as checking contents of emergency and first aid equipment, checking condition and security of seat belts)
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K42 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K43 Describe the procedure for the safe disposal of waste materials and scrap components
- K44 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 507                      Maintaining and certifying aircraft equipment and furnishings (ATA 25)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 508

## Maintaining and certifying aircraft fire protection systems (ATA 26)

<b>UAN:</b>	T/618/0204
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft fire protection systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers both fixed and portable units and components which detect and indicate fire or smoke, and which store and distribute fire extinguishing agents to all protected areas of the aircraft, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of fire protection system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment or fitting extinguishing trip defeat mechanisms before testing/trouble shooting the protection system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the</p>

maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft fire protection systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the fire protection system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft fire protection systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 26 Fire Protection.

2. To display competence in this standard, it is necessary to both remove and fit aircraft fire protection system components. They must remove components; however, they may fit a replacement component where the original was previously



removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by confirming that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the fire protection systems

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of an aircraft fire protection system:

- 4.1 detection
- 4.2 indicating
- 4.3 extinguishing
- 4.4 explosion suppression

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## Outcome

S5 Carry out maintenance on fire protection systems operated by two of the following:

- 5.1 thermal switch
- 5.2 thermocouple
- 5.3 continuous loop
- 5.4 continuous element
- 5.5 other to be specified by the employer

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## Outcome

S6 Remove and fit four different aircraft fire protection system components (at least two must be from group A):

### Group A

- 6.1 smoke detectors (optical)
- 6.2 overheat detectors
- 6.3 thermal switches
- 6.4 rate-of-temperature-rise detectors
- 6.5 fibre-optic detectors
- 6.6 control valves
- 6.7 radiation sensing detectors

- 6.8 sprays/nozzles
- 6.9 fire wire
- 6.10 carbon monoxide detectors
- 6.11 fire bottles
- 6.12 combustible mixture detectors
- 6.13 pumps
- 6.14 sensors/transmitters

#### Group B

- 6.15 pipes and hoses
- 6.16 gauges
- 6.17 pyrotechnic cartridges
- 6.18 wiring/switches/plugs
- 6.19 foam suppressant
- 6.20 nitrogen equipment
- 6.21 other specific components

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### Outcome

S7 Carry out fifteen of the following maintenance activities:

- 7.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 7.2 removing access panels and covers to expose components to be removed
- 7.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 7.4 disconnecting electrical connections
- 7.5 replacing single use items (such as seals, filters, gaskets)
- 7.6 disconnecting/removing hoses and pipes
- 7.7 removing securing devices and mechanical fasteners
- 7.8 refitting components in the correct position, orientation and alignment
- 7.9 dismantling equipment to an appropriate level
- 7.10 setting, and adjusting replaced components (such as travel, working clearance)
- 7.11 ensuring that any part-dismantled components are secure/supported
- 7.12 making mechanical connections
- 7.13 covering (protecting) exposed components, wires, pipework or vents
- 7.14 making electrical connections
- 7.15 torque loading as required
- 7.16 checking components for serviceability
- 7.17 re-pressurising the system
- 7.18 replacing damaged/defective components
- 7.19 carrying out a system functional check
- 7.20 ensuring that replacement components have the correct part numbers
- 7.21 labelling (and storing in the correct location) components that require repair or overhaul
- 7.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 7.23 carrying out area inspections prior to task close-up

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## Outcome

S8 Service/check the aircraft fire protection system, to include carrying out three of the following:

- 8.1 checking fire bottle contents
- 8.2 checking operation of fire warning system
- 8.3 checking cabin fire extinguisher contents
- 8.4 checking cargo bays fire extinguishing system
- 8.5 checking toilet smoke detector system
- 8.6 inspecting engine fire wire detection system
- 8.7 checking auto-shutdown function if installed (such as APU)
- 8.8 function testing of fire bottle activation circuits

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## Outcome

S9 Carry out one of the following tests on the aircraft fire protection system:

- 9.1 smoke test
- 9.2 built in test equipment (BITE) test
- 9.3 heat test
- 9.4 'special-to-type' tests
- 9.5 'no volts' test

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## Outcome

S10 Complete relevant documentation to include **both** the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 10.1 job cards/work sheets
- 10.2 aircraft technical log

Plus one of the following:

- 10.3 aircraft log book
- 10.4 aircraft cabin log
- 10.5 component log card
- 10.6 other record specified by the employer

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## Outcome

S11 Carry out maintenance on aircraft fire protection systems in compliance with one of the following:

- 11.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 11.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 11.3 Ministry of Defence (MoD)
- 11.4 Military Aviation Authority (MAA)
- 11.5 Aerospace Quality Management Standards (AS)
- 11.6 Federal Aviation Authority (FAA)
- 11.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 11.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft fire protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the risks and health and safety requirements for working with explosive devices and how to ensure safe working practices are maintained
- K3 Describe the types of explosive devices used to operate fire extinguishing systems
- K4 Describe the types of specialist test equipment used to check explosive devices
- K5 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K6 Explain how to prioritise their own workload to ensure that targets are met
- K7 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K8 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K9 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K10 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K11 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K12 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K13 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)

- K14 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K15 Explain the importance of maintenance on aircraft fire protection systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K16 Describe the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K17 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K18 Describe the hazards associated with carrying out maintenance activities on aircraft fire protection systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K19 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K20 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K21 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K22 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K23 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft fire protection systems, and other documents in the maintenance activities
- K24 Explain how to carry out currency/issue checks on the specifications they are working with
- K25 Explain the terminology used in aircraft fire protection systems, and the use of system diagrams and associated symbols
- K26 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K27 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K28 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K29 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K30 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis

- K31 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K32 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K33 Describe the various types of pipe and component that make up the aircraft fire protection system (such as rigid pipes; hoses; pipe connectors; pipe sealing and supporting devices; valves; pumps; mechanical and electrical control devices)
- K34 Describe the basic principles of operation of the aircraft fire protection system being worked on (such as thermal switch, thermocouple, continuous loop, continuous element; fire detection, and warning; sources and types of extinguishing agent; extinguishing agent control and distribution)
- K35 Explain the techniques used to remove components from aircraft fire protection systems without damage to the components or surrounding structure
- K36 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K37 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K38 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K39 Explain the importance of ensuring that any exposed components, wires or pipe ends are correctly covered/protected
- K40 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K41 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K42 Explain how to make adjustments to components/assemblies to ensure that they function correctly
- K43 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K44 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K45 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K46 Explain how to carry out routine checks and servicing of the aircraft fire detection system (including checking content of fire bottles and extinguishers, replacing fire bottle squib, checking operation of warning system, checking operation of smoke detectors)
- K47 Explain what types of test need to be carried out on the aircraft fire protection system, and the test equipment to be used
- K48 Explain the methods and procedures to be used to carry out the various tests on the fire protection system



- K49 Explain the importance of carrying out tests in the specified sequence, checking readings and movements at each stage
- K50 Explain how to record the results of each individual test, and the documentation that must be used
- K51 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft indicating and recording systems
- K52 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K53 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials and scrap components
- K55 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 508**

## **Maintaining and certifying aircraft fire protection systems (ATA 26)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 509

## Maintaining and certifying aircraft flight control systems (ATA 27)

<b>UAN:</b>	A/618/0205
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft flight control systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements.</p> <p>It includes units and components which manually control the flight, attitude and characteristics of the aircraft, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of flight control components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed, fitted and tested. The aircraft components will include items such as ailerons and tabs, horizontal stabilizer, elevator, rudder, flaps, spoilers/drag devices, gust locks and dampers, lift augmenting system components. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems</p>

with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft air flight control systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft flight control system maintenance requirements. They will know how the aircraft flight controls functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft flight control systems, especially those for isolating the equipment, and lifting and handling control components. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 27 Flight Controls.

2. To display competence in this standard, it is necessary to both remove and fit aircraft flight control system components. They must remove components; however, they may fit a

replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft flight control systems

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

---

### Outcome

S4 Carry out maintenance on two of the following aircraft flight control systems:

- 4.1 spoiler, drag devices and variable aerodynamic fairings (such as air brakes, speed brakes)
- 4.2 ailerons/tailerons and tab
- 4.3 elevators and trim tabs
- 4.4 gust lock and damper
- 4.5 flaps/slats/flaperons
- 4.6 rudder/yaw/ruddervator and tab
- 4.7 throttles
- 4.8 lift augmenting devices
- 4.9 horizontal stabilisers/stabilator/canards
- 4.10 thrust reverser
- 4.11 nose and body steering
- 4.12 spoilers, air brakes, lift dumpers
- 4.13 propeller controls
- 4.14 other specific flight control system

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### Outcome

S5 Remove and fit six different aircraft flight control system components (at least three must be from group A):

Group A

- 5.1 horizontal stabiliser
- 5.2 trim wheels
- 5.3 spoilers
- 5.4 elevator
- 5.5 reaction control nozzles
- 5.6 drag devices
- 5.7 aileron
- 5.8 powered flying control units
- 5.9 gradient boxes

- 5.10 rudder
- 5.11 automatic stall recovery device
- 5.12 actuators
- 5.13 flaps rudder pedals
- 5.14 auxiliary controls
- 5.15 mixer units
- 5.16 flap selectors
- 5.17 torque tubes
- 5.18 artificial feel units
- 5.19 control columns
- 5.20 boosters
- 5.21 auxiliary servo equipment (ASE)
- 5.22 stick shaker units
- 5.23 tab control wheel
- 5.24 primary servo jack
- 5.25 air/speed brake selectors
- 5.26 control surfaces
- 5.27 primary flight computers (including actuator control electronic – ACE)
- 5.28 other specific component

#### Group B

- 5.29 cables and pulleys
- 5.30 levers and linkages
- 5.31 turnbuckles
- 5.32 locks and stops
- 5.33 connecting rods
- 5.34 pedal shakers
- 5.35 jack screws
- 5.36 bell cranks
- 5.37 position transmitters
- 5.38 actuators/motors/servos
- 5.39 sensors
- 5.40 reaction control ducting
- 5.41 other specific components

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners



- 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out five of the following types of test/check on the aircraft flight control systems:

- 7.1 functional
- 7.2 built in test equipment (BITE)
- 7.3 ground run tests
- 7.4 rigging check
- 7.5 timings
- 7.6 range and freedom of movement
- 7.7 static friction check
- 7.8 cable tension check
- 7.9 leak test
- 7.10 'special-to-type' tests
- 7.11 safety interlock test

Using two of the following:

- 7.12 built in test equipment (BITE)
  - 7.13 ground support equipment
  - 7.14 'special-to-type' test equipment
  - 7.15 aircraft power source/displays and gauges
  - 7.16 use of safety locks
  - 7.17 measuring equipment
- 

## Outcome

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

8.1 job cards/work sheets

8.2 aircraft technical log

Plus one of the following:

8.3 aircraft log book

8.4 aircraft cabin log

8.5 component log card

8.6 other record specified by the employer

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## Outcome

- S9 Carry out maintenance on aircraft flight control systems in compliance with one of the following:

9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

9.3 Ministry of Defence (MoD)

9.4 Military Aviation Authority (MAA)

9.5 Aerospace Quality Management Standards (AS)

9.6 Federal Aviation Authority (FAA)

9.7 aircraft maintenance manual/approved change documentation (service bulletin)

9.8 manufacturers standards and procedures

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## Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft flight control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Describe the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards

- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Describe the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft flight control systems, and impact upon ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft flight control system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment that they need to use for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft maintenance manuals, log books, flight logs, and other documents needed in the removal and replacement process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft flight control systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the aircraft flight control system being worked on, and the function of the various units/components within the system
- K23 Explain the techniques used to remove components from aircraft flight control systems without damage to the components or surrounding structure (such as release of pressures/force, proof marking, extraction of components), and the need to protect the system integrity (by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)

- K24 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K25 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K26 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K27 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K28 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K29 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K30 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K31 Describe the various mechanical fasteners to be removed and replaced (such as threaded fasteners, special securing devices), and their method of removal and replacement
- K32 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K33 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K34 Explain methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K35 Explain methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K36 Explain the need to replace items such as seals and gaskets
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to replace and reconnect components into the system (such as ensuring correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, preloading bearings)
- K40 Explain why electrical bonding is critical and why it must be both mechanically and electrically secure

- K41 Explain the purpose of symmetry and rigging checks; how they are carried out; how to locate the rigging points and faces; and the use of incidence boards
- K42 Explain how to carry out routine checks and servicing of the aircraft flight control system
- K43 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K44 Explain the types of test to be carried out on the aircraft flight control system and the test equipment to be used
- K45 Explain the methods and procedures to be used to carry out the various tests on the flight control system
- K46 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K47 Explain how to record the results of each individual test and the documentation that must be used
- K48 Explain how to analyse the test results and make valid decisions about the acceptability of the flight control systems
- K49 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K50 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K51 Describe the problems that can occur with flight control system maintenance operations, and how these can be overcome
- K52 Explain the recording documentation to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K53 Describe the procedure for the safe disposal of waste materials and scrap components
- K54 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 509**

## **Maintaining and certifying aircraft flight control systems (ATA 27)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 510

## Maintaining and certifying aircraft fuel systems (ATA 28)

<b>UAN:</b>	F/618/0206
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft fuel systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which store and deliver fuel to the engine. It includes engine driven fuel pumps for reciprocating engines, tanks (bladder), tanks (integral), tanks auxiliary, valves, boost pumps, fuel dump systems, fuel tank leak detection components, fuel draining, fuel tank capacitance units, float switches, float valves, temperature sensing, refuel diffuser systems, dip sticks, magnetic level indicators, fuel tank baffling, flame arrester components and tank venting systems, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of fuel system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices</p>

and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft fuel systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft fuel system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required standard. They will need to understand the impact of the SFAR88 legislation and its impact, as well as the impact of CDCCL (Critical Design Configuration Control Limitations) requirements. They will need to be aware of the regulations appertaining to working in confined spaces and for working with flammable liquids and gases. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft fuel systems especially those for ensuring system cleanliness and the avoidance of spillage, fire and explosion. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:



1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 28 Fuel. It does not include fuel flow rate sensing and transmitting or engine fuel flow or pressure which is covered in Chapter 73 Engine Fuel and Control.

2.To display competence in this standard, it is necessary to both remove and fit aircraft fuel system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

## S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft fuel system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft fuel system:

- 4.1 fuel storage
  - 4.2 fuel drain
  - 4.3 fuel indicating
  - 4.4 distribution
  - 4.5 in-flight refuelling
  - 4.6 fuel jettison/dump
- 

### Outcome

S5 Remove and fit four different aircraft fuel system components (at least one must be from group A):

#### Group A

- 5.1 control valves (such as drain, bleed, change over, fire wall, dump)
  - 5.2 main fuel tanks/cells/bladders
  - 5.3 refuel and de-fuel connections
  - 5.4 fuel flow regulators
  - 5.5 auxiliary fuel tank
  - 5.6 fuel selector
  - 5.7 motors
  - 5.8 external/drop down fuel tanks
  - 5.9 high/low level shutoff
  - 5.10 solenoids
-

- 5.11 pumps
- 5.12 jet pumps
- 5.13 cell and tank inter-connectors
- 5.14 densitometer
- 5.15 float switch
- 5.16 sender unit
- 5.17 fuel cooling units
- 5.18 float valve
- 5.19 fuel manifold

#### Group B

- 5.20 pipes/hoses
- 5.21 fuel filters
- 5.22 ventilating components
- 5.23 over wing filler necks and caps
- 5.24 safety devices
- 5.25 sensors
- 5.26 pressure switches
- 5.27 strainers
- 5.28 gaskets and seals
- 5.29 bleed valve
- 5.30 other specific components

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check

- 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft fuel system, to include carrying out three of the following:

- 7.1 checking the system and tanks for leaks
  - 7.2 checking and cleaning/replacing filters
  - 7.3 checking calibration of fuel quantity gauges (labelling or other methods)
  - 7.4 checking operation of feed/selectors
  - 7.5 checking indicating systems (such as pressure drop, temperature warning, valve position and status)
- 

## Outcome

S8 Carry out four of the following tests on the aircraft fuel system:

- 8.1 leak test
- 8.2 fuel level/contents check
- 8.3 pressure test
- 8.4 fuel capacity tests
- 8.5 full system fuel flow
- 8.6 fuel sampling/heck/fuel system icing inhibitor/water
- 8.7 reduced system fuel flow results
- 8.8 system flush
- 8.9 built in test equipment (BITE) test
- 8.10 system fuel flow functional test
- 8.11 `special-to-type' tests
- 8.12 fuel transfer tests

Using one of the following:

- 8.13 fuel sampling devices
  - 8.14 aircraft power source/system
  - 8.15 ground test rig
  - 8.16 `special to type' test equipment
- 

## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus one form the following:

9.3 aircraft log book

9.4 aircraft cabin log

9.5 component log card

9.6 other record specified by the employer

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### Outcome

S10 Carry out maintenance on aircraft fuel systems in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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### Outcome

K Knowledge and understanding

The learner must be able to:

K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft fuel systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 Explain the procedures required for working in confined spaces

K3 Explain the methods and procedures to be carried out on aircraft electrical systems used in fuel tanks (EWIS) Electrical Wiring Interconnection Systems

K4 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K5 Explain how to prioritise their own workload to ensure that targets are met

K6 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

- K7 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K8 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K9 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K10 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K11 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K12 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K13 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K14 Explain the importance of maintenance on aircraft fuel systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K15 Explain the safety procedures that must be carried out before work is started on removing the fuel system components (such as displaying warning notices, ensuring adequate firefighting equipment)
- K16 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K17 Describe the hazards associated with removing aircraft fuel system components, and with the tools and equipment used, (such as handling fluids, flammable fluids, fire and explosion, misuse of tools), and how to minimise them and reduce any risk
- K18 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K19 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K20 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K21 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K22 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft fuel systems, and other documents needed in the maintenance process
- K23 Explain how to carry out currency/issue checks on the specifications they are working with
- K24 Explain the terminology used in aircraft fuel systems, and the use of system diagrams and associated symbols
- K25 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions

- K26 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K27 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K28 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K29 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K30 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K31 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K32 Describe the various types of pipe and component that make up the aircraft fuel system (such as rigid pipes; flexible hoses; pipe connectors; pipe sealing and supporting devices; valves used for flow, change over, fuel dumping; fuel pumps; mechanical and electrical control devices)
- K33 Describe the basic principles of operation of the aircraft fuel system being worked on, and the function of the various units/components within the system
- K34 Explain the techniques used to remove components from aircraft fuel systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, extraction of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K35 Describe the various mechanical fasteners to be removed and replaced, and their method of removal and replacement (such as threaded fasteners, special securing devices)
- K36 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K37 Explain the methods of lifting, and supporting the components/equipment during the maintenance activities
- K38 Explain the importance of ensuring that the work area is free from dirt, debris and foreign objects, and of ensuring that any exposed components or pipe ends are correctly covered/protected
- K39 Explain the recognition of contaminants and the problems they can create; the effects and likely symptoms of contamination in the fuel system
- K40 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K41 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct tightness of pipe fittings and connections;



- eliminating stress on pipework/connections; carrying out visual checks of all components; checking security of joints and that the system is safe to refill)
- K42 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow and pressure settings, and their effect on the system, travel and working clearance)
- K43 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K44 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K45 Explain how to carry out routine checks and servicing of the aircraft fuel system (including checking for leaks, checking and changing filters, checking calibration of fuel quantity gauges)
- K46 Explain what types of test need to be carried out on the aircraft fuel system and the test equipment to be used
- K47 Explain what methods and procedures are used to carry out the various tests on the fuel system
- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft fuel system
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K53 Describe the procedure for the safe disposal of waste materials, scrap components and waste fuel
- K54 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

# **Unit 510                      Maintaining and certifying aircraft fuel systems (ATA 28)**

## **Supporting Information**

### **Unit guidance**

#### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

#### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 511

## Maintaining and certifying aircraft hydraulic systems (ATA 29)

<b>UAN:</b>	J/618/0224
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft hydraulic systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. . It covers both fixed wing and rotary winged aircraft, and covers the units and components which supply the hydraulic fluid under pressure (includes tanks, pumps, accumulators, valves, pipes) to a common point (manifold) for redistribution to other defined systems, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of hydraulic components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating and de-pressurising the system, breaking into the system circuit and catching/containing any spilled fluids. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems</p>

with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft hydraulic systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the hydraulic systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft hydraulic systems especially those for handling hydraulic fluids, isolating and depressurising the equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

**Notes:**

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 29 Hydraulic Power.

2. To display competence in this standard, it is necessary to both remove and fit aircraft hydraulic system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be

completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft hydraulic system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft hydraulic system:

- 4.1 hydraulic power supply
- 4.2 emergency/auxiliary system
- 4.3 main hydraulic system
- 4.4 indicating system

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## Outcome

S5 Remove and fit four different aircraft hydraulic system components (at least one must be from group A):

Group A

- 5.1 engine driven pump
- 5.2 standby pump
- 5.3 accumulator
- 5.4 heat exchanger
- 5.5 hand pump
- 5.6 manifold
- 5.7 electric motor driven pump
- 5.8 reservoirs/tanks
- 5.9 auxiliary servo equipment
- 5.10 gearbox driven pump
- 5.11 primary servo jack/actuator
- 5.12 ram air turbine

Group B

- 5.13 control valves
- 5.14 pipes and hoses
- 5.15 chip detectors
- 5.16 check valve
- 5.17 filters
- 5.18 gauges/wiring/switches/plugs
- 5.19 automatic cut-out valve
- 5.20 sensors/transmitters

- 5.21 in-flight refuelling components
  - 5.22 ground connector
  - 5.23 hydraulic fuses
  - 5.24 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft hydraulic system, to include carrying out all of the following:

- 7.1 visually checking the system for leaks
  - 7.2 checking for correct operation of valves
  - 7.3 checking filters
  - 7.4 checking the fluid content of reservoirs
  - 7.5 replenishing the hydraulic system
  - 7.6 charging the nitrogen accumulator
-



- 7.7 checking accumulator gas/nitrogen pressure
  - 7.8 checking indicating systems
- 

### Outcome

S8 Carry out three of the following tests on the aircraft hydraulic system:

- 8.1 leak test
- 8.2 built in test equipment (BITE) test
- 8.3 pressure test
- 8.4 'special-to-type' tests
- 8.5 fluid sampling test

Using one of the following:

- 8.6 aircraft power source/pumps
  - 8.7 ground test rig
- 

### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one from the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
- 

### Outcome

S10 Carry out maintenance on aircraft hydraulic system components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
-

## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft hydraulic systems and when using synthetic oils (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the health and safety requirements of the various hydraulic fluids used in aircraft systems including mineral; and phosphate ester
- K3 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K4 Explain how to prioritise their own workload to ensure that targets are met
- K5 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K6 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K7 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K8 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K9 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K10 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K11 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K12 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K14 Explain the importance of maintenance on aircraft hydraulic systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures

- K15 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K16 Describe the hazards associated with carrying out maintenance activities on aircraft hydraulic systems, and with the tools and equipment used (such as the safe release of pressurised systems, handling hydraulic fluids, traps from moving parts, misuse of tools), and how to minimise them and reduce any risk
- K17 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K18 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K19 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K20 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K21 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft hydraulic systems, and other documents needed in the maintenance activities
- K22 Explain how to carry out currency/issue checks on the specifications they are working with
- K23 Explain the terminology used in aircraft hydraulic systems, and the use of fluid power diagrams and associated symbols
- K24 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K25 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K26 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K27 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K28 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K29 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K30 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K31 Describe the various types of pipe and component that make up the aircraft hydraulic system (such as rigid pipes; hydraulic hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure relief, flow and directional control; pumps; pressure intensifiers, mechanical and electrical control devices)

- K32 Describe the types of hydraulic fluids used and why these are used for specific applications
- K33 Describe the basic principles of operation of the hydraulic system being worked on (such as system layout, hydraulic fluids, the use of reservoirs and accumulators, pressure generation, pressure control and distribution, pressure indication and warning)
- K34 Describe the types and use of hydraulic fluids, and their interaction and effect on the integrity of other parts of the aircraft
- K35 Explain the techniques used to remove components from aircraft hydraulic systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K36 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K37 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K38 Explain the importance of ensuring that any exposed components or pipe ends are correctly covered/protected
- K39 Explain the recognition of contaminants, and the problems they can create; the effects and likely symptoms of contamination in the hydraulic system
- K40 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K41 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct tightness of pipe fittings and pump connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking security of joints and that the system is safe to re-pressurise)
- K42 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure settings, and their effect on the system, travel and working clearance)
- K43 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K44 Explain how to carry out routine checks and servicing of the aircraft hydraulic system (including replenishing hydraulic fluid and accumulator charging)
- K45 Explain the types of test to be carried out on the aircraft hydraulic system, and the test equipment to be used
- K46 Explain what methods and procedures are used to carry out the various tests on the hydraulic systems
- K47 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
- K48 Explain how to record the results of each individual test, and the documentation that must be used
- K49 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft

- K50 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K51 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K52 Describe the procedure for the safe disposal of waste materials, scrap components and hydraulic fluids
- K53 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

# **Unit 511                      Maintaining and certifying aircraft hydraulic systems (ATA 29)**

## **Supporting Information**

### **Unit guidance**

#### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

#### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 512

## Maintaining and certifying aircraft ice and rain protection systems (ATA 30)

<b>UAN:</b>	L/618/0225
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft ice and rain protection systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide a means of preventing or disposing of ice and rain on various parts of the aircraft, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of ice and rain protection system components associated with aerofoil surfaces, air intakes and cowls, pitot static, windows and doors, antennas and radomes, propellers and rotors, water supply and drain lines, and ice detection and indicating systems. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the</p>

maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft ice and rain protection systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft ice and rain protection system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft ice and rain protection systems, especially those involved with handling de-icing fluids. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 30 Ice and Rain Protection.

2. To display competence in this standard, it is necessary to both remove and fit aircraft ice and rain protection system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be



aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

---

## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft ice and rain protection systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

---

### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft ice and rain protection systems:

- 4.1 aerofoil surfaces
- 4.2 propellers/rotors
- 4.3 antennas/radomes
- 4.4 air intakes/cowlings
- 4.5 windows/windshields
- 4.6 water supply and drain lines
- 4.7 pitot static
- 4.8 doors
- 4.9 ice detection and indicating

---

### Outcome

S5 Carry out maintenance on ice and rain protection systems operated by two of the following:

- 5.1 mechanical/pneumatic actuation
- 5.2 hot air
- 5.3 alcohol spray
- 5.4 electrically heated elements

---

### Outcome

S6 Remove and fit four different aircraft ice and rain protection components (at least one must be from group A):

Group A

- 6.1 pump
- 6.2 solenoids
- 6.3 wiper motor
- 6.4 manifold
- 6.5 wing heaters
- 6.6 pitot probes/pressure heads
- 6.7 valves (such as check, de-icing, distributing)
- 6.8 heated windshields
- 6.9 pitot heaters
- 6.10 pressure regulator
- 6.11 nozzles (air or fluid)
- 6.12 scoop heaters
- 6.13 fluid reservoirs/tanks
- 6.14 water line heaters
- 6.15 ice detectors
- 6.16 rubber de-icer boots
- 6.17 electrical elements
- 6.18 control unit
- 6.19 displays/indicators
- 6.20 databus
- 6.21 switches

#### Group B

- 6.22 windshield wipers
- 6.23 pipes and hoses
- 6.24 moisture drains/traps
- 6.25 sensors/transmitters
- 6.26 air filters
- 6.27 wiring/switches/plugs
- 6.28 timers
- 6.29 gauges
- 6.30 temperature probes
- 6.31 electrical probes
- 6.32 transparency/heated windscreen
- 6.33 other specific components

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### Outcome

S7 Carry out fifteen of the following maintenance activities:

- 7.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 7.2 removing access panels and covers to expose components to be removed
- 7.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 7.4 disconnecting electrical connections
- 7.5 replacing single use items (such as seals, filters, gaskets)
- 7.6 disconnecting/removing hoses and pipes

- 7.7 removing securing devices and mechanical fasteners
  - 7.8 refitting components in the correct position, orientation and alignment
  - 7.9 dismantling equipment to an appropriate level
  - 7.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 7.11 ensuring that any part-dismantled components are secure/supported
  - 7.12 making mechanical connections
  - 7.13 covering (protecting) exposed components, wires, pipework or vents
  - 7.14 making electrical connections
  - 7.15 torque loading as required
  - 7.16 checking components for serviceability
  - 7.17 re-pressurising the system
  - 7.18 replacing damaged/defective components
  - 7.19 carrying out a system functional check
  - 7.20 ensuring that replacement components have the correct part numbers
  - 7.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 7.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 7.23 carrying out area inspections prior to task close-up
  - 7.24 cleaning using chemical agents
- 

## Outcome

S8 Service/check aircraft ice and rain protection systems, to include carrying out two of the following:

- 8.1 checking the system for leaks
  - 8.2 replacing filters
  - 8.3 replenishing fluids (such as de-icing, rain repellent)
  - 8.4 checking and adjusting spray nozzles
  - 8.5 checking the operation of pitot, static and stall detection heating elements
  - 8.6 changing windshield wiper blades (as appropriate)
  - 8.7 checking indicating systems
  - 8.8 applying rain repellent
  - 8.9 inspect for distortion
- 

## Outcome

S9 Carry out two of the following tests on the aircraft ice and rain protection systems:

- 9.1 leak test
  - 9.2 reduced system test
  - 9.3 pressure test
  - 9.4 built in test equipment (BITE) test
  - 9.5 system charging
-

9.6 operational/functional test

9.7 'special-to-type' tests

Using one of the following:

9.8 aircraft pumps

9.9 ground test rig

9.10 aircraft electrical power

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### Outcome

S10 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

10.1 job cards/work sheets

10.2 aircraft technical log

Plus one of the following:

10.3 aircraft log book

10.4 aircraft cabin log

10.5 component log card

10.6 other record specified by the employer

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### Outcome

S11 Carry out maintenance on aircraft ice and rain protection systems in compliance with one of the following:

11.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

11.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

11.3 Ministry of Defence (MoD)

11.4 Military Aviation Authority (MAA)

11.5 Aerospace Quality Management Standards (AS)

11.6 Federal Aviation Authority (FAA)

11.7 aircraft maintenance manual/approved change documentation (service bulletin)

11.8 manufacturers standards and procedures

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### Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft ice and rain protection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on ice and rain protection systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft ice and rain protection systems, and with the tools and equipment used (such as the safe release of fluids, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft ice and rain protection systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft ice and rain protection systems, and the use of system diagrams and associated symbols
- K23 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various types of pipe and component that make up the aircraft ice and rain protection system (such as rigid pipes; air hoses; rubber de-icing boots; heating elements; valves; pumps; mechanical and electrical control devices)
- K31 Describe the basic principles of operation of the ice and rain protection system being worked on (such as hot air, electrically heated elements, mechanically/pneumatic operated rubber de-icing boots, alcohol spray and water repellent systems; ice indication and warning)
- K32 Explain the techniques used to remove components from aircraft ice and rain protection systems without damage to the components or surrounding structure (such as release of fluids, removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K33 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation



- K36 Explain how to fit components into the circuit (such as ensuring the correct tightness of fastenings, fittings and pump connections; eliminating stress on pipework/connections; correctly making electrical connections; carrying out visual checks of all components)
- K37 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow settings, travel and working clearance)
- K38 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K39 Explain how to carry out routine checks and servicing of the aircraft ice and rain protection system (including checking for leaks, checking and changing filters, replenishing fluids, changing windshield wiper blades)
- K40 Explain what types of test need to be carried out on the aircraft ice and rain protection system, and the test equipment to be used (such as testing operation of pitot, static and stall detectors)
- K41 Explain what methods and procedures are used to carry out the various tests on the ice and rain protection system
- K42 Explain the importance of carrying out tests in the specified sequence, checking readings and movements at each stage
- K43 Explain how to record the results of each individual test and the documentation that must be used
- K44 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft ice and rain protection system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials and scrap components
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 512                      Maintaining and certifying aircraft ice and rain protection systems (ATA 30)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 513

## Maintaining and certifying aircraft indicating and recording systems (ATA 31)

<b>UAN:</b>	Y/618/0227
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft indicating and recording systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes visual display units, instruments, instrument panels and control of those systems which give visual or aural warning of conditions in unrelated systems, as applicable to the aircraft type. It also covers units which record, store or compute data from unrelated systems, and includes systems/units which integrate indicating instruments into a central display system and instruments not related to any specific system. The maintenance activities will include the removal, fitting and testing of a range of aircraft indicating and recording system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the circuit /system. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities. They will also be required to check the</p>

progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft indicating and recording systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft indicating and recording system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft indicating and recording systems. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 31 Indicating and Recording Systems.

2.To display competence in this standard, it is necessary to both remove and fit aircraft indicating and recording system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft indicating and recording systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

S4 Carry out maintenance on two of the following parts of aircraft indicating and recording systems:

- 4.1 instrument and control panels (such as instruments, switches, circuit breakers)
  - 4.2 independent instruments (such as clocks, inclinometers)
  - 4.3 recorders (such as flight recorders, cockpit voice recorders, maintenance recorders including structure health monitoring SHM)
  - 4.4 central computers (such as Digital Core Avionic Systems (DCAS), stored checklists, integrated instrument systems)
  - 4.5 central warning system (such as master warning or flight warning systems, central instrument warning, tone generators, annunciators)
  - 4.6 central display systems (such as those that give visual display of conditions in unrelated systems)
  - 4.7 automatic data reporting systems (such as ASDAR systems)
- 

### Outcome

S5 Remove and fit four different indicating and recording system components (at least two must be from group A):

Group A

- 5.1 flight data recorder (FDR)
  - 5.2 performance/maintenance recorders
  - 5.3 display units
  - 5.4 cockpit voice recorder
-

- 5.5 digital core avionic systems (DCAS)
- 5.6 inclinometer
- 5.7 master caution unit
- 5.8 generators (such as pulse, speed/taco, tone)
- 5.9 quick access recorder (QAR)
- 5.10 independent instruments (such as clocks)
- 5.11 processors
- 5.12 interface units
- 5.13 power supplies
- 5.14 video recorder
- 5.15 mounting tray
- 5.16 camera
- 5.17 transponders
- 5.18 interrogators
- 5.19 control panels
- 5.20 keyboards

#### Group B

- 5.21 transmitters (such as position, flow, pressure, level)
- 5.22 computers
- 5.23 gauges/indicators
- 5.24 switches (such as micro, proximity)
- 5.25 relays
- 5.26 capacitance units
- 5.27 input and follow-up potentiometers
- 5.28 transducers/sensors
- 5.29 wires/cables
- 5.30 actuators
- 5.31 circuit breakers
- 5.32 plugs/sockets
- 5.33 motors
- 5.34 warning panel electronic unit (WPEU)
- 5.35 electroluminescent panel
- 5.36 sensors

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners



- 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out two of the following tests on the aircraft indicating and recording systems:

- 7.1 continuity check
- 7.2 built in test equipment BITE test
- 7.3 voltage check
- 7.4 'special-to-type' tests
- 7.5 compass swing
- 7.6 check swing
- 7.7 comparison check
- 7.8 crash survival memory unit (CSMU) check
- 7.9 operational test
- 7.10 functional test
- 7.11 harmonisation test

Using three of the following:

- 7.12 measuring equipment
  - 7.13 'special-to-type' test sets
  - 7.14 external power source (such as electrical/hydraulic)
  - 7.15 aircraft power source (such as electrical/hydraulic)
  - 7.16 pitot/static pump/digital air data test equipment
- 

## Outcome

S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

8.1 job cards/work sheets

8.2 aircraft technical log

Plus one of the following:

8.3 aircraft log book

8.4 aircraft cabin log

8.5 component log card

8.6 other record specified by the employer

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### Outcome

S9 Carry out maintenance on aircraft indicating and recording systems in compliance with **one** of the following:

9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

9.3 Ministry of Defence (MoD)

9.4 Military Aviation Authority (MAA)

9.5 Aerospace Quality Management Standards (AS)

9.6 Federal Aviation Authority (FAA)

9.7 aircraft maintenance manual/approved change documentation (service bulletin)

9.8 manufacturers standards and procedures

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### Outcome

K Knowledge and understanding

The learner must be able to:

K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft indication and recording systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K3 Explain how to prioritise their own workload to ensure that targets are met

K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on indicating and recording systems and the impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft indication and recording systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft indication and recording systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft indication and recording systems, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the indicating and recording system being worked on, and the function of the various units that make up the system

- K24 Explain the techniques used to remove components from aircraft indicating and recording systems without damage to the components or surrounding structure (such as removal of components and the need to protect the circuit integrity by labelling and covering exposed circuits)
- K25 Describe the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K26 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K27 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K28 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K29 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K30 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K31 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K36 Explain how to fit equipment and components into the system (such as ensuring correct position and orientation; ensuring the correct tightness of fastenings; eliminating stress on cables; correctly making electrical connections; carrying out visual checks of all components)
- K37 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as zero, range, travel and working clearance)
- K38 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K39 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities

- K41 Explain why electrical bonding is critical and why it must be both mechanically and electrically secure
- K42 Explain how to carry out routine checks and servicing of the aircraft indicating and recording system (including checking for security of equipment, changing filters, inspecting for High Intensity Radiated Fields (HIRF) requirements)
- K43 Explain what types of test need to be carried out on the aircraft indicating and recording system, and the test equipment to be used (such as continuity, voltage and soak tests)
- K44 Explain what methods and procedures are used to carry out the various tests on the indicating and recording system
- K45 Explain the importance of carrying out tests in the specified sequence, checking all readings and movements at each stage
- K46 Explain how to record the results of each individual test and the documentation that must be used
- K47 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft indicating and recording systems
- K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K49 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K50 Describe the procedure for the safe disposal of waste materials and scrap components
- K51 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

# **Unit 513                      Maintaining and certifying aircraft indicating and recording systems (ATA 31)**

## **Supporting Information**

### **Unit guidance**

#### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

#### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 514

## Maintaining and certifying aircraft landing gear (ATA 32)

<b>UAN:</b>	D/618/0228
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft landing gear, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide a means of supporting and steering the aircraft on the ground or water, and which make it possible to retract and store the landing gear in flight (including main gear and nose wheel, tail skid assemblies, brakes, wheels, floats, skids, skis, doors, shock struts, tyres, linkages and indicating and warning systems), as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of landing gear components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating and, where appropriate, de-pressurising the system, before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the</p>

maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft landing gear. They will understand the removal, fitting and testing methods and procedures, and their application, along with the landing gear maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the landing gear is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft landing gear, especially those for ensuring that the undercarriage locks are in place, and when isolating and depressurising the equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 32 Landing Gear.

2. To display competence in this standard, it is necessary to both remove and fit aircraft landing gear components. They must remove components; however, they may fit a replacement



component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 allocate specific maintenance activities to each team member taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft landing gear:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on three of the following parts of aircraft landing gear:

- 4.1 main gear
- 4.2 extension and retraction system
- 4.3 wheels and brakes
- 4.4 nose gear
- 4.5 landing gear door mechanism
- 4.6 nose wheel steering
- 4.7 tail gear
- 4.8 supplementary gear (skis, floats)
- 4.9 gear position, warning and ground safety devices
- 4.10 drag chute system
- 4.11 arrestor hook system

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### Outcome

S5 Remove and fit four different aircraft landing gear components (at least two must be from group A):

Group A

- 5.1 shock struts
- 5.2 nose gear actuators
- 5.3 gear selector valve
- 5.4 bogie axles
- 5.5 main gear actuators
- 5.6 motors
- 5.7 drag struts
- 5.8 bogie trim
- 5.9 bearings
- 5.10 swivel glands
- 5.11 operating controls
- 5.12 anti-skid devices

- 5.13 brake master cylinder
- 5.14 de-boosters
- 5.15 skis/floats
- 5.16 brake units/components
- 5.17 shimmy damper
- 5.18 emergency landing devices
- 5.19 computer/landing gear control unit
- 5.20 actuators
- 5.21 drag chute
- 5.22 lock/release units
- 5.23 arrestor hook

#### Group B

- 5.24 linkages
- 5.25 nose/main gear locking mechanisms
- 5.26 relays
- 5.27 attachment bolts
- 5.28 cables
- 5.29 solenoids
- 5.30 bungees
- 5.31 pipes and hoses
- 5.32 wiring/switches/plugs
- 5.33 tyres
- 5.34 pressure indicators
- 5.35 indicators and warning devices
- 5.36 seals
- 5.37 pressure switch
- 5.38 wheel well fire loops
- 5.39 sensors
- 5.40 brake control valve
- 5.41 charging valve
- 5.42 jacking pad
- 5.43 snubber
- 5.44 other specific components

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners

- 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft landing gear, to include carrying out eight of the following:

- 7.1 visually checking the system for leaks
  - 7.2 rigging the steering
  - 7.3 inspecting tyres for wear, impact damage and creep
  - 7.4 adjusting micro switches
  - 7.5 charging struts
  - 7.6 replacing wheels
  - 7.7 checking the indicating and warning systems
  - 7.8 checking and cleaning the braking system
  - 7.9 charging the braking accumulator
  - 7.10 replacing brake units/components
  - 7.11 checking the oleo extension
  - 7.12 bleeding the braking system
- 

## Outcome

S8 Carry out three of the following tests on the aircraft landing gear:

- 8.1 leak test
  - 8.2 built in test equipment (BITE) test
  - 8.3 pressure test
  - 8.4 'special-to-type' tests
  - 8.5 functional
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- 8.6 cable tension check
- 8.7 rigging check
- 8.8 safety interlock test
- 8.9 static friction check
- 8.10 freedom and range of movement
- 8.11 testing outbreak system
- 8.12 testing anti-skid unit
- 8.13 landing gear door functional testing
- 8.14 timing checks
- 8.15 sequence checks

Using two of the following:

- 8.16 aircraft power source/pumps
- 8.17 ground test rig
- 8.18 measuring equipment
- 8.19 built in test equipment (BITE)

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### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

S10 Carry out maintenance on aircraft landing gear components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft landing gear systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of ensuring systems controlled by weight on wheels switches are correctly selected or deselected prior to aircraft jacking
- K14 Explain the use of specialist tooling to simulate weight on wheels conditions
- K15 Explain the checks and processes required following and heavy or over weight landing
- K16 Explain the importance of maintenance of aircraft landing gear, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K17 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

- K18 Describe the hazards associated with carrying out maintenance activities on aircraft landing gear, and with the tools and equipment used (such as the safe release of pressurised systems, traps from moving parts, misuse of tools), and how to minimise them and reduce any risk
- K19 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K20 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K21 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K22 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K23 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft landing gear systems, and other documents needed in the maintenance activities
- K24 Explain how to carry out currency/issue checks on the specifications they are working with
- K25 Explain the terminology used in aircraft landing gear systems, and the use of system diagrams and associated symbols
- K26 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K27 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K28 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K29 Describe the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K30 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K31 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K32 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K33 Describe the various types of pipe and component that make up the aircraft landing gear system (such as rigid pipes; hydraulic hoses; valves; struts, steering and braking mechanisms; extension and retraction mechanisms; mechanical and electrical control devices)
- K34 Describe the basic principles of operation of the landing gear being worked on and the function of the units that make up the system



- K35 Explain the techniques used to remove components from aircraft landing gear systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K36 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K37 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K38 Explain the importance of ensuring that the aircraft and work area is maintained free from dirt, debris and foreign objects, and of ensuring that any exposed components or pipe ends are correctly covered/protected
- K39 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K40 Explain how to fit landing gear components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K41 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance)
- K42 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K43 Explain the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K44 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K45 Explain how to carry out routine checks and servicing of the aircraft landing gear (including checking tyres and braking systems)
- K46 Explain the types of test to be carried out on the aircraft landing gear and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the landing gear
- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft landing gear
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K53 Describe the procedure for the safe disposal of waste materials, scrap components and fluids

K54 Describe the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

## **Unit 514                      Maintaining and certifying aircraft    landing gear (ATA 32)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 515

## Maintaining and certifying aircraft lighting systems (ATA 33)

<b>UAN:</b>	D/618/0231
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft lighting systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes electrically powered units and components which provide for external and internal illumination, such as landing lights, taxi lights, position lights, rotating lights, ice lights, master warning lights, passenger reading and cabin dome lights, as applicable to the aircraft type. It does not include warning lights for individual systems or self-illuminating signs. The maintenance activities will include the removal, fitting and testing of a range of lighting system components. The aircraft lighting system components will include items such as light fixtures and fittings, rotating beacons, switches and wiring. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular</p>

intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to the aircraft lighting systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft lighting systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 33 Lights.

2. To display competence in this standard, it is necessary to both remove and fit aircraft lighting system components. They must remove components; however, they may fit a replacement



component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

---

## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft lighting systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on three of the following parts of aircraft lighting systems:

- 4.1 flight compartment and annunciator panel (such as direct and indirect illumination of work areas, panels and instruments)
- 4.2 passenger compartment (such as cabin dome lights, reading lights, toilet, galley, lounges and coat rooms)
- 4.3 cargo and service compartments
- 4.4 exterior lighting (such as landing, navigation, wing illumination, position indicating, rotating, taxi and courtesy)
- 4.5 additional lighting (such as search lights, spot lights, flood lights, electroluminescent panels)
- 4.6 emergency lighting (such as low level, inertia flashlights, lanterns)
- 4.7 formation lighting

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### Outcome

S5 Remove and fit six different lighting system components (at least four must be from group A):

Group A

- 5.1 rotating beacon
- 5.2 courtesy lights
- 5.3 master warning lights/attention getters
- 5.4 strobe light
- 5.5 low level emergency lights
- 5.6 landing lights
- 5.7 portable emergency torches
- 5.8 cabin dome lights
- 5.9 wing illumination lights
- 5.10 ice lights
- 5.11 reading lights
- 5.12 position lights



- 5.13 strobe anti-collision lights and power/synchronising units
- 5.14 illuminated signs
- 5.15 navigation lights
- 5.16 taxi lights
- 5.17 formation lighting
- 5.18 display lighting
- 5.19 instrument lighting
- 5.20 electroluminescent panels
- 5.21 enhanced lighting controller

#### Group B

- 5.22 switches
- 5.23 dimming equipment
- 5.24 relays
- 5.25 inertia flash lights
- 5.26 wires/cables
- 5.27 connectors/plugs/sockets
- 5.28 light fixtures
- 5.29 batteries
- 5.30 sensor
- 5.31 other specific components

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers

- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft lighting systems, to include carrying out two of the following:

- 7.1 perform emergency lighting system check
  - 7.2 check all flight compartment and passenger compartment lights and replace any found defective
  - 7.3 check all cargo and service compartment lights and replace any found defective
  - 7.4 check all exterior lighting and replace any found defective
  - 7.5 check portable emergency torch lights
- 

## Outcome

S8 Carry out two of the following tests/checks on aircraft lighting systems:

- 8.1 functional check
- 8.2 built in test equipment BITE test
- 8.3 emergency power failure checks
- 8.4 'special-to-type' tests
- 8.5 operational test

Using two of the following:

- 8.6 external power source
  - 8.7 aircraft power source
  - 8.8 'special-to-type' test sets
- 

## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
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- 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
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## Outcome

S10 Carry out maintenance on aircraft lighting systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
  - 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 10.8 manufacturers standards and procedures
- 

## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft lighting systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K3 Explain how to prioritise their own workload to ensure that targets are met
  - K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
  - K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
  - K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
  - K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
  - K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
  - K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
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- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft lighting systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft lighting system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft lighting systems, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft lighting systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the lighting system being worked on, and the function of the various units within the system
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufacturers SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem

- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the particular installation and why they must not substitute others
- K32 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K33 Explain the techniques used to remove components from aircraft lighting systems without damage to the components or surrounding structure
- K34 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K35 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K36 Explain the need to check that replacement components have the correct part/identification markings and accompanying release documentation
- K37 Explain procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
- K38 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K39 Describe the tools and equipment used in the maintenance activities and their calibration/care and control procedures
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K42 Explain how to recognise defects in the lighting systems (such as faulty switches, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K43 Explain how to carry out routine checks and servicing of the aircraft lighting system (including emergency lighting checks)
- K44 Explain the need to check that cabin/cockpit switches and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K45 Explain the types of test to be carried out on the aircraft lighting system and the test equipment to be used
- K46 Explain the methods and procedures to be used to carry out the various tests on the lighting system
- K47 Explain how to record the results of each individual test and the documentation that must be used

- K48 Explain how to analyse the test results and how to make valid decisions about the acceptability of the lighting system
- K49 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K50 Explain what recording documentation needs to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K51 Describe the procedure for the safe disposal of waste materials and scrap components
- K52 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 515                      Maintaining and certifying aircraft lighting systems (ATA 33)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 516

## Maintaining and certifying aircraft navigation systems (ATA 34)

<b>UAN:</b>	H/618/0232
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft navigation systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements.</p> <p>It covers both fixed wing and rotary winged aircraft, and includes units and components which provide aircraft navigational information, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of navigational components. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or replaced. The aircraft system components will include items such as air data computers, pitot/static, distance measuring equipment (DME), very high frequency omnidirectional range (VOR), instrument landing (ILS), auto direction finder (ADF), global positioning (GPS), Doppler, long range navigation (LORAN), homing, inertial navigation system (INS), compasses and other devices, as applicable to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the system before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the</p>



progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft navigational systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft navigational system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft navigational systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 34 Navigation.

2.To display competence in this standard, it is necessary to both remove and fit aircraft navigation system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft navigation systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on three of the following parts of aircraft lighting navigation systems:

- 4.1 flight environment data (such as central air data computers, pitot/static, rate-of-climb, air speed, high speed warning, altitude, altitude reporting, altimeter correction, air disturbance detection, air temperature)
  - 4.2 attitude and direction (such as magnetic compasses, vertical and directional references, magnetic heading systems, attitude director systems, symbol generators, turn and bank, rate of turn)
  - 4.3 landing and taxiing aids (such as localizer, glide slope, instrument landing systems (ILS), markers and paravisual director ground guidance systems, microwave landing systems (MLS), radio altimeter)
  - 4.4 independent position determining (such as inertial guidance systems, weather radar, Doppler, enhanced ground proximity warning system (EGPWS), traffic collision avoidance system (TCAS))
  - 4.5 dependant position determining (such as distant measuring equipment (DME), long range navigation (LORAN), very high frequency omnidirectional range (VOR), auto direction finder (ADF), global positioning system (GPS), tactical airborne navigation (TACAN, Inertial Navigation System (ITS)
  - 4.6 flight management computing (such as course computers, flight management, performance data computers)
- 

### Outcome

S5 Remove and fit six different aircraft navigation system components (at least four must be from group A):

Group A

- 5.1 airspeed indicator
- 5.2 air data computer
- 5.3 analogue/digital converters (A-D/D-A)
- 5.4 altimeter
- 5.5 VHF nav receiver
- 5.6 navigation display units (including head-up)
- 5.7 vertical speed indicator
- 5.8 ADF receiver
- 5.9 horizontal situation indicator unit (HSI)
- 5.10 satellite beacons
- 5.11 transmitter units
- 5.12 computers (such as FMS, EGPWS, TCAS)
- 5.13 ATC and DME transponders
- 5.14 control units
- 5.15 heading and vertical reference gyro
- 5.16 compensation units
- 5.17 interface units
- 5.18 attitude/direction indicator (ADI)
- 5.19 compass flux valve
- 5.20 DME indicator
- 5.21 radio magnetic indicator
- 5.22 standby compass
- 5.23 receiver units
- 5.24 standby/artificial horizon
- 5.25 radio/radar altimeter
- 5.26 aerials
- 5.27 weather radar Tx/Rx
- 5.28 pitot/static probes/plates/sensors
- 5.29 weather radar antenna
- 5.30 global positioning system
- 5.31 multi mode receiver
- 5.32 defensive aids computer

Group B

- 5.33 batteries
- 5.34 unit trays
- 5.35 plugs/sockets
- 5.36 switches
- 5.37 instruments/gauges/indicators
- 5.38 transformers
- 5.39 relays
- 5.40 wires/cables/antenna
- 5.41 line replacement units (LRU)
- 5.42 circuit breakers
- 5.43 feeder/waveguide

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up
- 6.24 loading of data (such as mission, crypto)

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## Outcome

S7 Service/check aircraft navigation systems, to include carrying out six of the following:

- 7.1 checking calibration of magnetic direction indicator
- 7.2 functional check weather radar
- 7.3 checking pitot static system for leaks
- 7.4 functional check Doppler
- 7.5 checking of pitot static instruments
- 7.6 functional check TCAS
- 7.7 function check of TACAN
- 7.8 checking operation of directional directional/vertical reference gyros and indication systems

- 7.9 functional check DME
- 7.10 functional check of VOR
- 7.11 checking calibration of pressure altitude reporting system
- 7.12 functional check ATC transponder
- 7.13 checking instrument landing systems
- 7.14 functional check stand-alone flight director system
- 7.15 checking marker systems
- 7.16 checking the satcom system
- 7.17 functional check inertial navigation/reference system
- 7.18 checking GPS
- 7.19 checking of radar altimeter
- 7.20 carrying out FMS/ EGPWS database update
- 7.21 functional check FMS
- 7.22 functional check ADF

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## Outcome

S8 Carry out four of the following types of test/check on aircraft navigation systems:

- 8.1 functional check
- 8.2 built in test equipment BITE test
- 8.3 signal-to-noise checks
- 8.4 bonding tests
- 8.5 power output
- 8.6 continuity checks
- 8.7 standard serviceability checks
- 8.8 compass swing
- 8.9 'special-to-type' tests
- 8.10 applying a dummy load
- 8.11 distant object test
- 8.12 time-domain reflectometer (TDR) checks
- 8.13 voltage standing wave ratio (VSWR) checks
- 8.14 signal injection tests
- 8.15 receiver sensitivity
- 8.16 distortion checks

Using four of the following:

- 8.17 multimeter
- 8.18 headset
- 8.19 bonding tester
- 8.20 oscilloscope
- 8.21 'special to type' test equipment
- 8.22 reference gyros
- 8.23 radio frequency (RF) signal generators
- 8.24 delay lines
- 8.25 external power source (electrical/hydraulic)

- 8.26 time-domain reflectometer (TDR) equipment
- 8.27 aircraft power source (electrical/hydraulic)
- 8.28 voltage standing wave ratio (VSWR) equipment
- 8.29 vacuum systems
- 8.30 databus tester
- 8.31 ground loading unit
- 8.32 weight on wheels (WoW)

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## Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

- S10 Carry out maintenance on aircraft navigation systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

- K Knowledge and understanding

The learner must be able to:



- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft navigation systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft navigation systems and equipment, and the impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, RVSM requirements, Autoland systems/status requirements, Elementary and Enhanced Mode 'S' Surveillance, Electrical Wiring Interconnect Systems (EWIS), legislation and local/company/customer procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft navigation system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft navigation systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the aircraft navigation system being worked on, and the function of the various units within the system
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation, and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft navigation systems without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices

- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Explain the tools and equipment used in the maintenance activities and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K44 Explain how to carry out routine checks and servicing of the aircraft navigation system
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K46 Explain the types of test to be carried out on the aircraft navigation system and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the navigation system
- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft navigation systems
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Describe the problems that can occur with the aircraft navigation system maintenance operations and how these can be overcome
- K53 Explain what recording documentation needs to be completed for the activities undertaken and where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials and scrap components
- K55 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 516**

## **Maintaining and certifying aircraft navigation systems (ATA 34)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 517

## Maintaining and certifying aircraft oxygen systems (ATA 35)

<b>UAN:</b>	M/618/0234
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake oversight of maintenance activities on aircraft oxygen systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which store, regulate and deliver oxygen to the passengers and/or crew, including bottles, relief valves, shut-off valves, outlets, regulators, masks and walk-around bottles, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of oxygen components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the system before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to recharge the system and test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan, communicate and allocate the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these</p>

requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance and oversight that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft oxygen systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft oxygen system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft oxygen systems, especially those for ensuring system cleanliness and the avoidance of hydrocarbon contamination. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 35 Oxygen.

2. To display competence in this standard, it is necessary to both remove and fit aircraft oxygen system components. They must remove components; however, they may fit a replacement component where the original was previously removed by



another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft oxygen system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome



S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft oxygen system:

- 4.1 oxygen supply
- 4.2 portable liquid oxygen (LOX) equipment
- 4.3 oxygen reservoir
- 4.4 crew supply
- 4.5 indicating
- 4.6 passenger/crew supply
- 4.7 emergency supply

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### Outcome

S5 Remove and fit four different aircraft oxygen system components (at least one must be from group A):

#### Group A

- 5.1 oxygen generator
- 5.2 oxygen regulator
- 5.3 portable LOX equipment
- 5.4 LOX converter/pack
- 5.5 concentrator
- 5.6 manifold
- 5.7 oxygen cylinder
- 5.8 oxygen candle
- 5.9 fill, build-up and vent valve
- 5.10 air crew service pack
- 5.11 personal equipment connector
- 5.12 oxygen monitor (such as paramagnetic or zirconia)

#### Group B

- 5.13 therapeutic masks

- 5.14 pipes and hoses
  - 5.15 face mask and allied equipment
  - 5.16 walk around set
  - 5.17 filter
  - 5.18 sensors/transmitters
  - 5.19 control valves
  - 5.20 gauges/wiring/switches/plugs
  - 5.21 check valve
  - 5.22 ground connector
  - 5.23 water extractor
  - 5.24 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft oxygen system, to include carrying out all of the following:

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- 7.1 checking the system for leaks
  - 7.2 replacing filters
  - 7.3 testing the crew oxygen system
  - 7.4 performing auto oxygen system deployment check (where applicable)
  - 7.5 testing the passenger oxygen system (where applicable)
  - 7.6 checking the indicating systems (such as pressure drop, temperature warning)
- 

## Outcome

S8 Carry out three of the following tests on the aircraft oxygen system:

- 8.1 leak test
- 8.2 reduced system test
- 8.3 pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 system charging
- 8.6 flow tests
- 8.7 'special-to-type' tests

Using one of the following:

- 8.8 aircraft power source/system
  - 8.9 ground test rig
- 

## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
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## Outcome

S10 Carry out maintenance on aircraft oxygen system components in compliance with one of the following:

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- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft oxygen systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)

- K13 Explain the importance of maintenance on aircraft oxygen systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft oxygen systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain the differences between therapeutic oxygen used in EMS applications and emergency oxygen systems used in aircraft applications
- K18 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K19 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K20 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K21 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft oxygen systems, and other documents needed in the maintenance activities
- K22 Explain how to carry out currency/issue checks on the specifications they are working with
- K23 Explain the terminology used in aircraft oxygen systems and the use of system diagrams and associated symbols
- K24 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K25 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K26 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K27 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K28 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K29 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences

- K30 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K31 Describe the various types of pipe and component that make up the aircraft oxygen system (such as rigid pipes; air hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure relief, flow and directional control; pumps; mechanical and electrical control devices)
- K32 Describe the basic principles of operation of the oxygen system being worked on (such as system layout, sources of oxygen (such as bottles, chemical generators, ground supply); oxygen control and distribution; oxygen indication and warning)
- K33 Explain the techniques used to remove components from aircraft oxygen systems without damage to the components or surrounding structure (such as removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K34 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the importance of ensuring that any components or pipe ends are correctly covered/protected
- K37 Explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the system (especially hydrocarbons in oxygen systems)
- K38 Explain the need to label and store correctly components that require repair or overhaul and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K39 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking security of joints and that the system is safe to re-charge)
- K40 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure deployment settings and their effect on the system, travel and working clearance)
- K41 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K42 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K43 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K44 Explain how to carry out routine checks and servicing of the aircraft oxygen system (including checking for leaks, checking and changing filters, changing masks and adjusting or replacing regulator)
- K45 Explain the types of test to be carried out on the aircraft oxygen system and the test equipment to be used
- K46 Explain the methods and procedures to be used to carry out the various tests on the oxygen system

- K47 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
- K48 Explain how to record the results of each individual test and the documentation that must be used
- K49 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft oxygen system
- K50 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K51 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K52 Describe the procedure for the safe disposal of waste materials and scrap components
- K53 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

# **Unit 517                      Maintaining and certifying aircraft oxygen systems (ATA 35)**

## **Supporting Information**

### **Unit guidance**

#### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

#### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 518

## Maintaining and certifying aircraft pneumatic systems (ATA 36)

<b>UAN:</b>	T/618/0235
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft pneumatic systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements.</p> <p>It covers both fixed wing and rotary winged aircraft, and covers the units and components which deliver large volumes of compressed air from a power source to connecting points for other systems, such as air conditioning, pressurization and de-icing, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of pneumatic components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating and de-pressurising the system before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to pressurise the system and test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft pneumatic systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft pneumatic system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft pneumatic systems, especially those for isolating and depressurising the equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 36 Pneumatic.

2. To display competence in this standard, it is necessary to both remove and fit aircraft pneumatic system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how

to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and check the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft pneumatic system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft pneumatic system:

- 4.1 pneumatic supply
- 4.2 indicating
- 4.3 distribution
- 4.4 gauging

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### Outcome

S5 Remove and fit four different aircraft pneumatic system components (at least one must be from group A):

#### Group A

- 5.1 pump
- 5.2 air reservoirs/tanks
- 5.3 manifold
- 5.4 compressors
- 5.5 accumulator
- 5.6 desiccators
- 5.7 standby pump
- 5.8 oil and water trap
- 5.9 heat exchangers
- 5.10 pre cooler
- 5.11 control units
- 5.12 bellows
- 5.13 exhausts
- 5.14 sensors

#### Group B

- 5.15 control valves
- 5.16 pipes, hoses and gaskets

- 5.17 wiring/switches/plugs/relays
  - 5.18 check valve
  - 5.19 ducting
  - 5.20 pressure regulating valve
  - 5.21 ground connector
  - 5.22 air filters
  - 5.23 warning devices (temperature, pressure)
  - 5.24 pressure relief valve
  - 5.25 actuators
  - 5.26 gauges
  - 5.27 control mechanisms
  - 5.28 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft pneumatic system, to include carrying out four of the following:

- 7.1 checking the system for leaks
  - 7.2 replacing filters
  - 7.3 recharging desiccators
  - 7.4 checking and adjusting pressure regulator
  - 7.5 checking the indicating systems (such as pressure, temperature warning)
- 

### Outcome

S8 Carry out three of the following tests on the aircraft pneumatic system:

- 8.1 leak test
- 8.2 reduced system test
- 8.3 pressure test
- 8.4 movement tests (such as range, timing, sequencing)
- 8.5 system charging
- 8.6 built in test equipment (BITE) test
- 8.7 air line vapour tests
- 8.8 functional test
- 8.9 'special-to-type' tests

Using one of the following:

- 8.10 aircraft power source/system
  - 8.11 ground test rig
- 

### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
-

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## Outcome

S10 Carry out maintenance on aircraft pneumatic system components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS) Federal Aviation Authority (FAA)
- 10.6 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.7 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft pneumatic systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities



- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft pneumatic systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft pneumatic systems, and with the tools and equipment used (such as the safe release of pressurised systems, traps from moving parts, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pneumatic systems, and other documents in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft pneumatic systems, and the use of system diagrams and associated symbols
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufacturers SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences

- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Explain how to carry out the servicing of a typical pneumatic system and the test / checks that are required post servicing
- K31 Describe the various types of pipe and component that make up the aircraft pneumatic system (such as rigid pipes; air hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure relief, flow and directional control; pumps; pressure intensifiers, mechanical and electrical control devices)
- K32 Describe the basic principles of operation of the pneumatic system being worked on (such as system layout, sources of air pressure (such as engine, compressor, ground supply); the use of air reservoirs/tanks; pressure control and distribution; pressure indication and warning)
- K33 Explain the techniques used to remove components from aircraft pneumatic systems without damage to the components or surrounding structure (such as release of pressures/force, removal of components and the need to protect the circuit integrity by ensuring that any exposed components or pipe ends are correctly covered/protected)
- K34 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the pneumatic system
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and pump connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking the security of joints and that the system is safe to re-pressurise)
- K39 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure settings and their effect on the system, travel and working clearance)
- K42 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K43 Explain how to carry out routine checks and servicing of the aircraft pneumatic system (including checking for leaks, checking and changing air filters, charging desiccators, checking and adjusting pressure regulator)
- K44 Explain the types of test to be carried out on the aircraft pneumatic system and the test equipment to be used
- K45 Explain the methods and procedures to be used to carry out the various tests on the pneumatic system

- K46 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
- K47 Explain how to record the results of each individual test, and the documentation that must be used
- K48 Explain how to analyse the test results, and make valid decisions about the acceptability of the aircraft pneumatic system
- K49 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K50 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K51 Describe the procedure for the safe disposal of waste materials and scrap components
- K52 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 518**

## **Maintaining and certifying aircraft pneumatic systems (ATA 36)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 519

## Maintaining and certifying aircraft vacuum systems (ATA 37)

<b>UAN:</b>	F/618/0237
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft vacuum systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements.</p> <p>It covers both fixed wing and rotary winged aircraft, and covers the units and components used to generate, deliver and regulate negative air pressure, including pumps, regulators and lines, through to and including the manifold, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of vacuum components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating and bringing the system to atmospheric pressure before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to pressurise the system and test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>

bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft vacuum systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft vacuum system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft vacuum systems, especially those for isolating and depressurising the equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 37 Vacuum.

2.To display competence in this standard, it is necessary to both remove and fit aircraft vacuum system components. They



must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft vacuum system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented



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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft vacuum system:

- 4.1 vacuum generation
- 4.2 indicating
- 4.3 distribution
- 4.4 gauging

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## Outcome

S5 Remove and fit four different aircraft vacuum system components (at least one must be from group A):

### Group A

- 5.1 vacuum pump
- 5.2 standby pump
- 5.3 regulator valve
- 5.4 manifold

### Group B

- 5.5 control valves
- 5.6 sensors/transmitters
- 5.7 check valve
- 5.8 venturi
- 5.9 ground connector
- 5.10 gauges/wiring/switches/plugs
- 5.11 reducing valve
- 5.12 oil separator
- 5.13 pipes and hoses

- 5.14 suction relief valve
  - 5.15 air filters
  - 5.16 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft vacuum system, to include carrying out all of the following:

- 7.1 checking the system for leaks
- 7.2 replacing filters
- 7.3 recharging desiccators
- 7.4 checking and adjusting pressure regulator
- 7.5 checking the indicating systems (such as pressure, temperature warning)

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## Outcome

S8 Carry out three of the following tests on the aircraft vacuum system:

- 8.1 leak test
- 8.2 movement tests (such as range, timing, sequencing)
- 8.3 vacuum pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 vacuum line vapour tests
- 8.6 'special-to-type' tests
- 8.7 reduced system test

Using one of the following:

- 8.8 aircraft power source/ pumps
- 8.9 ground test rig

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft vacuum system components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Aerospace Quality Management Standards (AS)
- 10.5 Federal Aviation Authority (FAA)
- 10.6 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.7 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft vacuum systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft vacuum systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft vacuum systems, and with the tools and equipment used (such as safely bringing the system to atmospheric pressure, traps from moving parts, misuse of tools) and how to minimise them and reduce any risk

- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft vacuum systems, and the use of system diagrams and associated symbols
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various types of pipe and component that make up the aircraft vacuum system (such as rigid pipes; hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure relief, flow and directional control; pumps; pressure intensifiers, mechanical and electrical control devices)
- K31 Describe the basic principles of operation of the vacuum system being worked on (such as system layout, sources of vacuum pressure (such as engine, compressor, ground supply); the use of vacuum reservoirs/tanks; pressure control and distribution; pressure indication and warning)
- K32 Explain the techniques used to remove components from aircraft vacuum systems without damage to the components or surrounding structure (such as bringing system up to atmospheric pressure; removal of components and the need to protect the circuit

- integrity by ensuring any exposed components or pipe ends are correctly covered/protected)
- K33 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
  - K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
  - K35 Explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the vacuum system
  - K36 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
  - K37 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and pump connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking security of joints and that the system is safe to re-pressurise)
  - K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as pressure settings and their effect on the system, travel and working clearance)
  - K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
  - K40 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
  - K41 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
  - K42 Explain how to carry out routine checks and servicing of the aircraft vacuum system (including checking for leaks, checking and changing air filters, charging desiccators, checking and adjusting pressure regulator)
  - K43 Explain the types of test to be carried out on the aircraft vacuum system and the test equipment to be used
  - K44 Explain the methods and procedures to be used to carry out the various tests on the vacuum system
  - K45 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
  - K46 Explain how to record the results of each individual test and the documentation that must be used
  - K47 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft vacuum system
  - K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
  - K49 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
  - K50 Describe the procedure for the safe disposal of waste materials and scrap components
  - K51 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 519**

## **Maintaining and certifying aircraft vacuum systems (ATA 37)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 520

## Maintaining and certifying aircraft water and waste systems (ATA 38)

<b>UAN:</b>	J/618/0238
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft water and waste systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which store and deliver for use, fresh water and those fixed components which store and provide a means of removing water and waste, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of water and waste system components, such as wash basins, toilet assemblies, water and waste tanks, valves and pipes. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspect of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the</p>

maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft water and waste systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft water and waste system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft water and waste systems, especially those involved with working on pressurised systems. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 38 Water and Waste.

2. To display competence in this standard, it is necessary to both remove and fit aircraft water and waste system components. They must remove components; however, they



may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft water and waste systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft water and waste systems:

- 4.1 potable (drinking water)
- 4.2 wash
- 4.3 waste disposal
- 4.4 air supply

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## Outcome

S5 Remove and fit four different aircraft water and waste system components (at least two must be from group A):

### Group A

- 5.1 water pump
- 5.2 fresh water tanks
- 5.3 water heaters
- 5.4 toilet pump
- 5.5 waste water tanks
- 5.6 electrical elements
- 5.7 valves
- 5.8 toilet assemblies
- 5.9 taps
- 5.10 water pressure regulator
- 5.11 flushing system
- 5.12 wash basins
- 5.13 solenoids

## Group B

- 5.14 sensors/transmitters
- 5.15 water filters
- 5.16 temperature probes
- 5.17 drains/taps
- 5.18 water pipes and hoses
- 5.19 portable toilet
- 5.20 wiring/switches/plugs
- 5.21 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up

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## Outcome

S7 Service/check aircraft water and waste systems, to include carrying out all of the following:

- 7.1 checking the system for leaks
- 7.2 replacing water filters
- 7.3 checking and adjusting supply water pressure
- 7.4 checking tank content indicating systems

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### Outcome

S8 Carry out three of the following tests on the aircraft water and waste systems:

- 8.1 leak test
- 8.2 reduced system test
- 8.3 pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 system charging
- 8.6 'special-to-type' tests

Using one of the following:

- 8.7 aircraft power source/ pumps
- 8.8 ground test rig

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### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

S10 Carry out maintenance on aircraft water and waste system components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft water and waste systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft waste and water systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)



- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft water and waste systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft water and waste systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft water and waste systems, and the use of system diagrams and associated symbols
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various types of pipe and component that make up the aircraft water and waste system (such as pipes; pumps; valves; water heaters; taps; toilet units; mechanical and electrical control devices)

- K31 Describe the basic principles of operation of the water and waste system being worked on, and the function of the various units that make up the system
- K32 Explain the techniques used to remove components from aircraft water and waste systems without damage to the components or surrounding structure (such as release of fluids, removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K33 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K36 Explain how to fit components into the system (such as ensuring the correct tightness of fastenings, fittings and pump connections; eliminating stress on pipework/connections; correctly making electrical connections; carrying out visual checks of all components)
- K37 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow settings, travel and working clearance)
- K38 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K39 Explain how to carry out routine checks and servicing of the aircraft water and waste system (including checking for leaks, checking and changing filters)
- K40 Explain the types of test to be carried out on the aircraft water and waste system, and the test equipment to be used
- K41 Explain the methods and procedures to be used to carry out the various tests on the water and waste system
- K42 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K43 Explain how to record the results of each individual test and the documentation that must be used
- K44 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft water and waste system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials and scrap components
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 520**

## **Maintaining and certifying aircraft water and waste systems (ATA 38)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 521

## Maintaining and certifying aircraft cabin systems (ATA 44)

<b>UAN:</b>	J/618/0241
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft cabin systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes units and components which provide a means of entertaining the passengers and providing communication within the aircraft, as applicable to the aircraft type. It also includes the means by which passengers and cabin crew can access communications equipment to exchange data and messages with other air or ground stations. It does not include the transmitting/receiving system itself such as SATCOM, HF, VHF and UHF which are covered in other standards/ATA chapters. The maintenance activities will include the removal, fitting and testing of a range of cabin system components. The cabin system will include units and components associated with in-flight entertainment systems, active noise control, passenger address, interphone, audio and video security monitoring, as applicable to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular</p>

intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft cabin systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft cabin system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft cabin systems, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 44 Cabin Systems.

2. To display competence in this standard, it is necessary to both remove and fit aircraft cabin system components. They must remove components; however, they may fit a replacement



component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft cabin systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on three of the following parts of the aircraft cabin systems:

- 4.1 cabin core system (such as active noise control)
- 4.2 in-flight entertainment (such as audio, video, information, games)
- 4.3 external communication (such as access to telecommunications, digital fax, Wi-Fi, mobile phones)
- 4.4 passenger address and interphone (such as internal communications)
- 4.5 cabin mass memory system (such as configuration data, multimedia programs)
- 4.6 cabin monitoring (such as surveillance cameras, passenger conversation/movement)

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## Outcome

S5 Remove and fit four different cabin system components (at least two must be from group A):

### Group A

- 5.1 control units
- 5.2 video equipment
- 5.3 keyboards
- 5.4 cameras
- 5.5 cabin control panels
- 5.6 telephones
- 5.7 media drives
- 5.8 monitors
- 5.9 radio units
- 5.10 modems
- 5.11 printers



- 5.12 display panels
- 5.13 audio equipment

#### Group B

- 5.14 batteries
- 5.15 headsets
- 5.16 instruments/gauges/indicators
- 5.17 switches
- 5.18 handsets
- 5.19 wires/cables
- 5.20 relays
- 5.21 electronic signs
- 5.22 plugs/sockets
- 5.23 circuit breakers
- 5.24 loudspeakers
- 5.25 transformers
- 5.26 other specific components

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### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up

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## Outcome

S7 Service/check aircraft cabin systems, to include carrying out three of the following:

- 7.1 checking operation of interphone system
- 7.2 checking operation of external communication system
- 7.3 checking operation of passenger address system
- 7.4 checking entertainment system
- 7.5 checking active noise control system
- 7.6 checking operation of audio and video monitoring system

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## Outcome

S8 Carry out three of the following types of test/check on aircraft cabin systems:

- 8.1 continuity check
- 8.2 built in test equipment BITE test
- 8.3 signal-to-noise checks
- 8.4 bonding tests
- 8.5 distortion checks
- 8.6 'special-to-type' tests
- 8.7 Power output

Using two of the following:

- 8.8 'special to type' test equipment
- 8.9 headset
- 8.10 multimeter
- 8.11 aircraft power source
- 8.12 bonding tester
- 8.13 external power source

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book

- 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
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## Outcome

S10 Carry out maintenance on aircraft cabin systems in compliance with **one** of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
  - 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 10.8 manufacturers standards and procedures
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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft cabin systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K3 Explain how to prioritise their own workload to ensure that targets are met
  - K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
  - K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
  - K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
  - K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
  - K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
  - K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
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- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft cabin systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft cabin system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft cabin systems, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft cabin systems, and the use of system diagrams and associated symbols
- K22 Explain the basic principles of operation of the cabin system being worked on, and the function of the various units that make up the system
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem

- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation, and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft cabin systems without damage to the components or surrounding structure (such as the need to protect the circuit integrity by covering and labelling exposed circuits)
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K44 Explain how to carry out routine checks and servicing of the aircraft cabin system equipment (including checking function of radios and passenger address system)
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K46 Explain the types of test to be carried out on the aircraft cabin systems and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the cabin systems

- K48 Explain how to record the results of each individual test and the documentation that must be used
- K49 Explain how to analyse the test results and how to make valid decisions about the acceptability of the cabin systems
- K50 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K51 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K52 Describe the procedure for the safe disposal of waste materials and scrap components
- K53 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 521                      Maintaining and certifying aircraft cabin systems (ATA 44)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 522

## Maintaining and certifying aircraft airborne-auxiliary power systems (ATA 49)

<b>UAN:</b>	L/618/0242
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft auxiliary power systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components of airborne auxiliary power units (APU) which are installed on the aircraft for the purpose of supplying a single type or combination of auxiliary electric, hydraulic, pneumatic or other power, as applicable to the aircraft type. It also includes the power and drive section, fuel, ignition and control systems, wiring, indicators, plumbing, valves and ducts up to the power unit, as applicable to the aircraft type. It does not include generators, alternators, hydraulic pumps or their connecting systems, which supply and deliver power to their respective aircraft systems, unless directly associated with the APU. The maintenance activities will include the removal, fitting and testing of a range of airborne auxiliary power system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular</p>



intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft airborne auxiliary power systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft airborne auxiliary power system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft airborne auxiliary power system, especially those for ensuring that the power system and its fuel supply, is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 49 Airborne Auxiliary Power.



2.To display competence in this standard, it is necessary to both remove and fit airborne auxiliary power system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

- S2 Carry out all of the following during the maintenance of the aircraft auxiliary power system:
- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
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- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on three of the following parts of the aircraft auxiliary power system:

- 4.1 cowling/containment
  - 4.2 starting and ignition
  - 4.3 indicating
  - 4.4 power plant
  - 4.5 exhaust
  - 4.6 bleed air system
  - 4.7 engine
  - 4.8 oil system
  - 4.9 APU hydraulic system
  - 4.10 fuel and control
  - 4.11 engine controls
  - 4.12 APU generating system and wiring
  - 4.13 fire detection
  - 4.14 anti surge/load control valve
  - 4.15 gearbox
- 

### Outcome

- S5 Remove and fit four different aircraft auxiliary power system components (at least two must be from group A):

Group A

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- 5.1 air Intake
- 5.2 pumps (fuel, oil)
- 5.3 valves/valve mechanisms
- 5.4 exhaust unit
- 5.5 fuel manifolds
- 5.6 actuators
- 5.7 exciter ignition unit
- 5.8 fuel control unit
- 5.9 torque converters
- 5.10 coolers (air, oil, fuel)
- 5.11 fuel flow divider
- 5.12 thermocouple
- 5.13 starter motor
- 5.14 fuel metering units
- 5.15 tacho generator/speed sensor
- 5.16 engine control units
- 5.17 fuel nozzle
- 5.18 data modules
- 5.19 starter clutch assembly
- 5.20 ignition unit (such as leads/plugs)
- 5.21 electronic control boxes
- 5.22 cooling fan
- 5.23 hydraulic pump
- 5.24 fire seals and shrouds
- 5.25 heat exchangers (oil, fuel)
- 5.26 generator

#### Group B

- 5.27 cowling/containment covers
- 5.28 cable harness/wiring/switches/plugs
- 5.29 engine mounts
- 5.30 indicators and warning devices
- 5.31 vibration dampers
- 5.32 solenoids
- 5.33 battery
- 5.34 fire detection units
- 5.35 rod assemblies/levers and linkages
- 5.36 fire wire
- 5.37 damper/connector arm
- 5.38 transducers
- 5.39 tube assemblies
- 5.40 fire bottle
- 5.41 attachment bolts
- 5.42 seals
- 5.43 igniters
- 5.44 filters (fuel, oil, air)
- 5.45 sensors
- 5.46 pressure switches
- 5.47 magnetic chip detectors

- 5.48 cables
  - 5.49 pipes and hoses
  - 5.50 thermostat
  - 5.51 relays
  - 5.52 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
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## Outcome

S7 Service/check aircraft airborne auxiliary power systems, to include carrying out five of the following:

- 7.1 visually checking the system for damage and leaks
  - 7.2 visually inspect APU bay for condition and damage
  - 7.3 inspecting hot section
  - 7.4 checking exhaust components for security of attachment
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- 7.5 inspecting magnetic chip indicators
- 7.6 changing filters (fuel, oil, air)
- 7.7 checking heat shields for damage and security
- 7.8 visually checking cable harnesses, pipe work and fittings for correct gaps/clearances and signs of chafing
- 7.9 checking indicating and warning systems
- 7.10 replacing the battery
- 7.11 servicing and replenishing the oil system
- 7.12 checking power take-off shaft(s) for correct connection and alignment
- 7.13 inspecting the intake door system

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## Outcome

S8 Carry out three of the following tests on the aircraft auxiliary power system:

- 8.1 checking that ground start mechanisms operate correctly
- 8.2 checking aux/APU battery condition prior to APU start up
- 8.3 checking that the APU cuts out at correct time (emergency shut down)
- 8.4 fuel flow is operating correctly
- 8.5 engine pressure ratios are within specification
- 8.6 engine temperature is within specification
- 8.7 the bleed air system functions correctly
- 8.8 hydraulic pressures are attained
- 8.9 electrical generation equipment functions correctly
- 8.10 normal operating RPM is achieved and maintained under load
- 8.11 fire detection and protection equipment is functioning

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft airborne auxiliary power systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft airborne auxiliary power systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)



- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Describe the knowledge to be able operate APUs installed in aircraft and the safety precautions required when operating
- K13 Explain how to use the APU to power up the various aircraft systems
- K14 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K15 Explain the importance of maintenance on aircraft auxiliary power systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K16 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K17 Describe the hazards associated with carrying out maintenance activities on aircraft airborne auxiliary power systems, and with the tools and equipment used (such as handling oils, aviation fuel, the safe release of fuel and other fluids, traps from moving parts, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K18 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K19 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K20 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K21 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K22 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in aircraft auxiliary power unit systems, and other documents needed in the maintenance activities
- K23 Explain how to carry out currency/issue checks on the specifications they are working with
- K24 Explain the terminology used in aircraft airborne auxiliary power systems, and the use of system diagrams and associated symbols
- K25 Describe the basic principles of operation of the airborne auxiliary power system being worked on, and the function of the units that make up the system (such as power plant, starting and ignition, fuel and control, oil, exhaust, engine control, indicating)
- K26 Explain the techniques used to remove components from aircraft auxiliary power system without damage to the components or surrounding structure (such as release of pressures/force, draining of fuel/fluids, removal of components, and the need to protect the system integrity by fitting blanking plugs and ensuring exposed components are correctly covered/protected)
- K27 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions

- K28 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K29 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K30 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K31 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K32 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K33 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K34 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K37 Explain how to fit auxiliary power unit components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K40 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K41 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K42 Explain how to carry out routine checks and servicing of the aircraft auxiliary power system
- K43 Explain the types of test to be carried out on the aircraft auxiliary power system, and the test equipment to be used
- K44 Explain the methods and procedures to be used to carry out the various tests on the auxiliary power system
- K45 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage

- K46 Explain how to record the results of each individual test, and the documentation that must be used
- K47 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft auxiliary power system
- K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K49 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K50 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K51 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 522**

## **Maintaining and certifying aircraft airborne auxiliary power systems (ATA 49)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 523

## Maintaining and certifying aircraft cargo and accessory compartments (ATA 50)

<b>UAN:</b>	R/618/0243
<b>Level:</b>	Level 4
<b>GLH:</b>	210
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft cargo and accessory compartments, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes equipment mounted on the aircraft and/or contained in the cargo and accessory compartments, as applicable to the aircraft type. The maintenance activities will include the removal and fitting a range of equipment. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the equipment to be removed or fitted. The aircraft equipment will include cargo/baggage handling equipment, cargo restraints, sound and heat insulation, removable and fixed cabinets, fire suppressant equipment and other similar equipment. They will remove the required components and fit approved replacements, as appropriate. They will then need to check and adjust the equipment to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the</p>

maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft cargo and accessory compartments and equipment. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft cargo and accessory compartments maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft cargo and accessory compartment equipment, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 50 Cargo and Accessory Compartments.

2. To display competence in this standard, it is necessary to both remove and fit aircraft cargo and accessory compartment



equipment/components. They must remove equipment/components; however, they may fit replacement equipment/components where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft cargo and accessory compartments:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities



- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on three of the following parts of aircraft cargo and accessory compartments:

- 4.1 cargo compartments
  - 4.2 cargo loading system
  - 4.3 insulation barriers
  - 4.4 accessory compartments
  - 4.5 cargo related systems
- 

### Outcome

- S5 Remove and fit four different aircraft cargo and accessory compartment equipment/components:

#### Group A

- 5.1 removable and fixed cabinets
  - 5.2 panels and fairings
  - 5.3 armour plating/Kevlar
  - 5.4 cargo/baggage handling rollers/drive equipment
  - 5.5 blow-out panels
  - 5.6 fire equipment
  - 5.7 cargo restraint equipment
  - 5.8 cargo restraint nets
  - 5.9 galley equipment
  - 5.10 sound proofing
-

- 5.11 insulation materials
  - 5.12 pallet locking system
  - 5.13 liner replacement
  - 5.14 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft cargo and accessory compartments, to include carrying out four of the following:

- 7.1 checking the associated structure for integrity
  - 7.2 checking for evidence of leakage or spills
  - 7.3 function check of cargo loading/movement system (such as rollers/drive equipment, locking mechanisms)
  - 7.4 function check of cargo restraint system (such as restraint nets, baggage restraints)
  - 7.5 examining panel systems for damage
-

- 7.6 examining insulation systems for damage
- 7.7 examining seating/stretchers equipment for security and damage
- 7.8 checking emergency equipment (such as axe/cutters)
- 7.9 security and condition of panels and fairings
- 7.10 security and condition of galley equipment
- 7.11 security and condition of fixed cabinets
- 7.12 checking placard and marking load requirements
- 7.13 checking lighting systems
- 7.14 fire and smoke detection and extinguishing systems
- 7.15 compartment sealing requirements to smother potential fire sources

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## Outcome

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following:

- 8.3 aircraft log book
- 8.4 aircraft cabin log
- 8.5 component log card
- 8.6 other record specified by the employer

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## Outcome

- S9 Carry out maintenance on aircraft cargo and accessory compartments in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 9.3 Ministry of Defence (MoD)
- 9.4 Military Aviation Authority (MAA)
- 9.5 Aerospace Quality Management Standards (AS)
- 9.6 Federal Aviation Authority (FAA)
- 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 9.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft cargo and accessory compartments (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft cargo and accessory compartments, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K13 Describe the hazards associated with removing and fitting aircraft cargo and accessory compartment equipment and components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K17 Explain how to extract and use information from aircraft manuals, log books, flight logs, and other documents needed in the maintenance process
- K18 Explain how to carry out currency/issue checks on the specifications they are working with
- K19 Describe the range of cargo and accessory compartment equipment that may need to be maintained/replaced
- K20 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K21 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K22 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K23 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K24 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K25 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K26 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K27 Describe the various mechanical fasteners that are used to hold the equipment in place, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K28 Explain the importance of using the specified fasteners for the particular installation and why they must not substitute others
- K29 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K30 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K31 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K32 Explain the need to take care when removing equipment so as not to cause damage to the equipment or surrounding structure
- K33 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K34 Explain the need to position, align, adjust and secure correctly the replaced equipment in the aircraft, without damage to the components or surrounding structure
- K35 Describe methods of lifting, handling and supporting the components/equipment during the maintenance activities

- K36 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K37 Explain how to carry out routine checks of the aircraft cargo and accessory compartments (such as checking the condition and security of cargo restraint equipment)
- K38 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K39 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K40 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K41 Describe the procedure for the safe disposal of waste materials and scrap components
- K42 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 523**

## **Maintaining and certifying aircraft cargo and accessory compartments (ATA 50)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 524

## Maintaining and certifying aircraft doors (ATA 52)

<b>UAN:</b>	Y/618/0244
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft doors, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes those removable units used for entrance or exit, and for enclosing other structure contained within the fuselage, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of doors/door equipment, and making repairs to primary and secondary airframe/door structures, as appropriate to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the door equipment to be removed or fitted. The aircraft doors will include those used for entrance and exit of passenger and crew to and from the aircraft, emergency exits that are not normally used and are there to facilitate evacuation of the aircraft, exterior doors used to gain access to cargo compartments and for servicing of the aircraft, interior doors inside the fuselage installed in fixed partitions, stairs which operate with but are not an integral part of entrance doors. It also includes the electrical and hydraulic systems associated with door control and warning systems. They will remove the required door components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p>



Their responsibilities will require them to plan all aspect of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft doors and door equipment. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft equipment maintenance requirements. They will know how the door equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft doors are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft door equipment, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 52 Doors.

2.To display competence in this standard, it is necessary to both remove and fit aircraft door equipment. They must remove the door components; however, they may fit replacement components where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

## S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft doors/door equipment:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times

- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

S4 Carry out maintenance on three of the following aircraft doors/door equipment:

- 4.1 passenger
  - 4.2 service
  - 4.3 door warning equipment
  - 4.4 crew
  - 4.5 gallery
  - 4.6 door wiring
  - 4.7 cargo/baggage
  - 4.8 accessory compartment
  - 4.9 escape equipment
  - 4.10 emergency exit
  - 4.11 auxiliary power unit (APU) doors
  - 4.12 door arming equipment
  - 4.13 tail cone
  - 4.14 entrance stairs
  - 4.15 power plant doors
  - 4.16 landing gear
  - 4.17 fixed interior doors
- 

### Outcome

S5 Undertake three of the following structural repair activities:

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- 5.1 insertion repair
  - 5.2 overlay patch repair
  - 5.3 primary structure repair
  - 5.4 composite repair
  - 5.5 secondary structure repair
  - 5.6 blend repair
  - 5.7 tertiary structure repair
  - 5.8 reworking of aluminium structures and limitations forming
  - 5.9 damage assessment and evaluation
  - 5.10 NDT inspection requirements (post damage removal)
- 

## Outcome

S6 Use six of the following during the structural repair activities:

- 6.1 marking out airframe materials
  - 6.2 profiling
  - 6.3 securing and locking components
  - 6.4 making holes in airframe materials
  - 6.5 countersinking
  - 6.6 using adhesives and sealants
  - 6.7 cutting/shaping airframe materials
  - 6.8 deburring
  - 6.9 anti-corrosive treatment
  - 6.10 bending and forming materials
  - 6.11 riveting
  - 6.12 blending out permissible damage to structural components
  - 6.13 drilling extremities of cracks
- 

## Outcome

S7 Remove and fit six different aircraft door equipment components (at least three must be from group A):

Group A

- 7.1 door structure
  - 7.2 escape slide
  - 7.3 actuating mechanisms (such as linear, rotary)
  - 7.4 door seals
  - 7.5 door mounted life rafts
  - 7.6 pneumatic cylinder
  - 7.7 handle assembly
  - 7.8 ramps
  - 7.9 hydraulic cylinder
-

- 7.10 lock assembly
- 7.11 lining
- 7.12 latching mechanisms and interlocks
- 7.13 integral steps
- 7.14 cargo door jack
- 7.15 pressure relief doors and gates
- 7.16 gearbox
- 7.17 controls
- 7.18 torque tubes (aircraft and door)
- 7.19 damper
- 7.20 electric power lift unit
- 7.21 door abutments
- 7.22 counter balance

#### Group B

- 7.23 insulation
- 7.24 door snubber/damper
- 7.25 attached fittings
- 7.26 trim
- 7.27 hand rails
- 7.28 security locking devices
- 7.29 handles
- 7.30 switches
- 7.31 warning devices (such as lights, bells horns)
- 7.32 brackets
- 7.33 sensors
- 7.34 cable harness/wiring/switches/plugs sensors
- 7.35 door hinges
- 7.36 interlock
- 7.37 viewing devices
- 7.38 levers/linkages
- 7.39 push rods
- 7.40 teleflex
- 7.41 other specific components

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### Outcome

S8 Carry out fifteen of the following maintenance activities:

- 8.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 8.2 removing access panels and covers to expose components to be removed
- 8.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 8.4 disconnecting electrical connections
- 8.5 replacing single use items (such as seals, filters, gaskets)
- 8.6 disconnecting/removing hoses and pipes

- 8.7 removing securing devices and mechanical fasteners
- 8.8 refitting components in the correct position, orientation and alignment
- 8.9 dismantling equipment to an appropriate level
- 8.10 setting, and adjusting replaced components (such as travel, working clearance)
- 8.11 ensuring that any part-dismantled components are secure/supported
- 8.12 making mechanical connections
- 8.13 covering (protecting) exposed components, wires, pipework or vents
- 8.14 making electrical connections
- 8.15 torque loading as required
- 8.16 checking components for serviceability
- 8.17 re-pressurising the system
- 8.18 replacing damaged/defective components
- 8.19 carrying out a system functional check
- 8.20 ensuring that replacement components have the correct part numbers
- 8.21 removal and refitting of door dams (ditching requirements on some aircraft)
- 8.22 labelling (and storing in the correct location) components that require repair or overhaul
- 8.23 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 8.24 carrying out area inspections prior to task close-up

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## Outcome

S9 Service/check aircraft doors to include carrying out four of the following:

- 9.1 checking door seals for damage
- 9.2 checking handles for correct operation
- 9.3 checking latching mechanisms for correct operation
- 9.4 rigging/adjusting the locking mechanism
- 9.5 adjusting air stair system
- 9.6 checking operation of emergency exits
- 9.7 checking door assemblies for deterioration, de-lamination, wear (mechanical or otherwise)
- 9.8 checking critical fastenings for security
- 9.9 lubricating door mechanisms
- 9.10 checking and adjustment of door abutments
- 9.11 checking of water drains
- 9.12 testing door warning system
- 9.13 check dents and scratches on door skin/structure against manufacturer's tolerances

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## Outcome

S10 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

10.1 job cards/work sheets

10.2 aircraft technical log

Plus one of the following:

10.3 aircraft log book

10.4 aircraft cabin log

10.5 component log card

10.6 other record specified by the employer

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## Outcome

S11 Carry out maintenance on aircraft doors in compliance with one of the following:

11.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

11.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

11.3 Ministry of Defence (MoD)

11.4 Military Aviation Authority (MAA)

11.5 Aerospace Quality Management Standards (AS)

11.6 Federal Aviation Authority (FAA)

11.7 aircraft maintenance manual/structural repair manual/approved change documentation (service bulletin)

11.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft doors (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified



- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft doors, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K13 Describe the hazards associated with removing and fitting aircraft doors and door components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Describe the range of door equipment and components that may need to be maintained/replaced/repared
- K22 Explain the preparations to be undertaken on the door structure, prior to maintenance/repair (including disarming of escape slides and door rafts)
- K23 Explain the interconnection between door systems and other emergency equipment (slides, rafts and door dams for ditching)
- K24 Explain the repair methods and procedures to be used, and the importance of adhering to these procedures
- K25 Explain the application of sealants and adhesives within the repair activities, and the precautions that must be taken when working with them
- K26 Explain how to conduct any necessary checks to ensure the accuracy and quality of the repair

- K27 Explain how to recognise defects (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)
- K28 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K29 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K30 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K31 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K32 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K33 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K34 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K35 Describe the various mechanical fasteners that are used to hold the equipment in place, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K36 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others
- K37 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K38 Explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
- K39 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K40 Explain the need to take care when removing doors, door equipment and furnishings so as not to cause damage to the equipment or surrounding structure
- K41 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K42 Explain the need to position, align, adjust and secure correctly the replaced door equipment on the aircraft, without damage to the components or surrounding structure
- K43 Explain the methods of lifting, handling and supporting the components/equipment during the removal and fitting activities
- K44 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

- K45 Explain how to carry out routine checks of the aircraft doors and door equipment (such as checking the condition of door seals, checking correct operation of air stairs and emergency exits, checking door warning devices)
- K46 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K47 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K48 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K49 Describe the procedure for the safe disposal of waste materials and scrap components
- K50 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 524                      Maintaining and certifying aircraft doors (ATA 52)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 525

## Maintaining and certifying aircraft fuselage, nacelles and pylons (ATA 53 & 54)

<b>UAN:</b>	D/618/0245
<b>Level:</b>	Level 4
<b>GLH:</b>	240
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft fuselage, nacelles and pylons, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes structural units and associated components which make up the compartments for equipment, passengers, crew and cargo/baggage, and structural units and associated components which provide a means of mounting and housing the power plant or rotor assembly, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of fuselage components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed or fitted. The fuselage maintenance activities will include removing the required components, fitting approved replacements, and making repairs to primary and secondary airframe structures, as appropriate to the aircraft type. They will then need to check and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan, communicate and allocate the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with</p>

the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to the aircraft fuselage, nacelles and pylons. They will understand the removal, refitting and repair methods and procedures, and their application, along with the fuselage maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the fuselage, nacelles and pylons is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft fuselage, nacelles and pylons, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 53 Fuselage and Chapter 54 Nacelles/Pylons.

2.To display competence in this standard, it is necessary to both remove and fit fuselage and nacelles/pylon components. They must remove fuselage and/or nacelles/pylon components;



however, they may fit replacement components where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

- S2 Carry out all of the following during the maintenance of the aircraft fuselage, nacelles and pylons
- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance/repairs on three of the following areas of the aircraft fuselage, nacelles and pylons:

- 4.1 fuselage sections
- 4.2 fin
- 4.3 pressure dome
- 4.4 engine nacelle
- 4.5 skins
- 4.6 nose
- 4.7 scuppers
- 4.8 pylons
- 4.9 floor beams
- 4.10 tail
- 4.11 hatches
- 4.12 box sections
- 4.13 floor
- 4.14 tail cone
- 4.15 bulkheads
- 4.16 avionics cabinets
- 4.17 stringers
- 4.18 cockpit/cabin
- 4.19 mission consoles
- 4.20 drains

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## Outcome

S5 Undertake three of the following structural repair activities:

- 5.1 insertion repair
  - 5.2 overlay patch repair
  - 5.3 primary structure repair
  - 5.4 composite repair
  - 5.5 secondary structure repair
  - 5.6 blend repair
  - 5.7 tertiary structure repair
  - 5.8 reworking of aluminium structures and limitations forming
  - 5.9 damage assessment and evaluation
  - 5.10 NDT inspection requirements (post damage removal)
- 

## Outcome

S6 Use **six** of the following during the structural repair activities:

- 6.1 marking out airframe materials
  - 6.2 profiling
  - 6.3 securing and locking components
  - 6.4 making holes in airframe materials
  - 6.5 countersinking
  - 6.6 using adhesives and sealants
  - 6.7 cutting/shaping airframe materials
  - 6.8 deburring
  - 6.9 anti-corrosive treatment
  - 6.10 bending and forming materials
  - 6.11 riveting
  - 6.12 blending out permissible damage to structural components
  - 6.13 drilling extremities of cracks
- 

## Outcome

S7 Carry out fifteen of the following maintenance activities:

- 7.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 7.2 removing access panels and covers to expose components to be removed
  - 7.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 7.4 disconnecting electrical connections
  - 7.5 replacing single use items (such as seals, filters, gaskets)
  - 7.6 disconnecting/removing hoses and pipes
  - 7.7 removing securing devices and mechanical fasteners
  - 7.8 refitting components in the correct position, orientation and alignment
  - 7.9 dismantling equipment to an appropriate level
  - 7.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 7.11 ensuring that any part-dismantled components are secure/supported
-

- 7.12 making mechanical connections
- 7.13 covering (protecting) exposed components, wires, pipework or vents
- 7.14 making electrical connections
- 7.15 torque loading as required
- 7.16 checking components for serviceability
- 7.17 re-pressurising the system
- 7.18 replacing damaged/defective components
- 7.19 carrying out a system functional check
- 7.20 ensuring that replacement components have the correct part numbers
- 7.21 labelling (and storing in the correct location) components that require repair or overhaul
- 7.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 7.23 carrying out area inspections prior to task close-up

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## Outcome

S8 Check aircraft fuselage components, to include carrying out three of the following:

- 8.1 checking structural components for signs of corrosion
- 8.2 checking components for fatigue cracks
- 8.3 checking for lightning strike damage
- 8.4 checking critical fastenings for security
- 8.5 checking hoses and looms for security and chafing
- 8.6 checking surface protection (such as paint finish, polish)
- 8.7 checking for de-bonding of aircraft structure
- 8.8 checking for oil canning
- 8.9 checking dents, scratches/scoring on skin/structure against manufacturers tolerances
- 8.10 checking aircraft structure for distortion (such as panting and quilting)
- 8.11 checking components for wear (mechanical or otherwise) or damage
- 8.12 checking for non-approved repairs
- 8.13 carrying out symmetry and rigging checks
- 8.14 other specific checks

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
- 

## Outcome

S10 Carry out maintenance/repairs on aircraft fuselage components in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
  - 10.7 aircraft maintenance manual/structural repair manual/approved change documentation (service bulletin)
  - 10.8 manufacturers standards and procedures
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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on the aircraft fuselage and nacelles/pylons (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K3 Explain how to prioritise their own workload to ensure that targets are met
  - K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
  - K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
  - K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
  - K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
  - K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
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- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft fuselage systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K13 Describe the hazards associated with repairing airframes, removing and fitting aircraft fuselage components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the preparations to be undertaken on the fuselage or nacelles/pylons, prior to repair
- K22 Explain the repair methods and procedures to be used, and the importance of adhering to these procedures
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem

- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various mechanical fasteners that are used to hold the equipment in place, and their methods of removal and replacement (such as threaded fasteners, open and blind rivets, special securing devices)
- K31 Explain the application of sealants and adhesives within the repair activities, and the precautions that must be taken when working with them
- K32 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K33 Explain the importance of using the specified fasteners for the particular repair, and why they must not substitute others
- K34 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K35 Explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
- K36 Explain the need to take care when removing fuselage components so as not to cause damage to the equipment or surrounding structure
- K37 Explain the need to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the need to position, align, adjust and secure correctly the replaced equipment in the aircraft, without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components during the maintenance activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Explain how to carry out routine checks of the fuselage (such as checking for corrosion, stress/fatigue cracks, torque on critical fastenings)
- K42 Explain how to conduct any necessary checks to ensure the accuracy and quality of the repair
- K43 Explain how to recognise defects (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)
- K44 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K45 Describe the problems that can occur with the maintenance/repair operations, and how these can be overcome
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials and scrap components
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 525**

## **Maintaining and certifying aircraft fuselage, nacelles and pylons (ATA 53 & 54)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 526

## Maintaining and certifying aircraft stabilisers (ATA 55)

<b>UAN:</b>	H/618/0246
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft stabilisers, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. The maintenance activities will include the removal, fitting and testing of a range of aircraft stabiliser components, and making repairs to primary and secondary airframe/stabiliser structures, as appropriate to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed, fitted and tested. The aircraft stabiliser components will include items such as horizontal stabiliser/stabilator or canard/fore planes, vertical stabiliser, elevator/elevon, rudder/ruddevator, and associated components. They will remove the required stabiliser components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft stabilisers. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft stabiliser maintenance requirements. They will know how the aircraft stabiliser functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft stabiliser systems, especially those for isolating the equipment, lifting and handling stabiliser components. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 55 Stabilisers.

2. To display competence in this standard, it is necessary to both remove and fit aircraft stabiliser components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a



system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft stabilisers:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on two of the following aircraft stabilisers:

- 4.1 horizontal stabilisers/stabilator/canards/fore planes
- 4.2 elevator/elevon
- 4.3 vertical stabiliser
- 4.4 rudder/yaw/ruddervator
- 4.5 trim tab
- 4.6 tailerons
- 4.7 other specific stabiliser

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### Outcome

S5 Undertake three of the following structural repair activities:

- 5.1 insertion repair
- 5.2 overlay patch repair
- 5.3 primary structure repair
- 5.4 composite repair
- 5.5 secondary structure repair
- 5.6 blend repair
- 5.7 tertiary structure repair
- 5.8 reworking of aluminium structures and limitations forming
- 5.9 damage assessment and evaluation
- 5.10 NDT inspection requirements (post damage removal)

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### Outcome

S6 Use six of the following during the structural repair activities:

- 6.1 marking out airframe materials
  - 6.2 profiling
  - 6.3 securing and locking components
  - 6.4 making holes in airframe materials
  - 6.5 countersinking
  - 6.6 anti-corrosive treatment
  - 6.7 deburring
  - 6.8 using adhesives and sealants
  - 6.9 cutting/shaping airframe materials
  - 6.10 riveting
  - 6.11 bending and forming materials
  - 6.12 drilling the extremities of cracks
  - 6.13 blending out permissible damage to structural components
- 

## Outcome

- S7 Remove and fit four different aircraft stabiliser components (at least two must be from group A):

### Group A

- 7.1 horizontal stabiliser
- 7.2 upper rudder
- 7.3 inboard elevator
- 7.4 vertical stabiliser
- 7.5 lower rudder
- 7.6 tailerons
- 7.7 stabiliser leading edge
- 7.8 splice ribs
- 7.9 outboard elevator
- 7.10 stabiliser tip
- 7.11 panel stiffeners
- 7.12 stabiliser screw jack
- 7.13 stabiliser seals
- 7.14 access doors/panels
- 7.15 attachment fittings

### Group B

- 7.16 pivot hinge assembly
- 7.17 pivot pin assembly
- 7.18 anti-rotation plate
- 7.19 bonding jumpers
- 7.20 bearing assemblies
- 7.21 static wick discharger
- 7.22 rudder skin panels
- 7.23 rudder trailing edge cap
- 7.24 rudder spar

- 7.25 fin tip
- 7.26 fin fairing
- 7.27 fin leading edge
- 7.28 fin spar box
- 7.29 foil protectors
- 7.30 rudder box doublers
- 7.31 other specific component

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## Outcome

S8 Carry out fifteen of the following maintenance activities:

- 8.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 8.2 removing access panels and covers to expose components to be removed
- 8.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 8.4 disconnecting electrical connections
- 8.5 replacing single use items (such as seals, filters, gaskets)
- 8.6 disconnecting/removing hoses and pipes
- 8.7 removing securing devices and mechanical fasteners
- 8.8 refitting components in the correct position, orientation and alignment
- 8.9 dismantling equipment to an appropriate level
- 8.10 setting, and adjusting replaced components (such as travel, working clearance)
- 8.11 ensuring that any part-dismantled components are secure/supported
- 8.12 making mechanical connections
- 8.13 covering (protecting) exposed components, wires, pipework or vents
- 8.14 making electrical connections
- 8.15 torque loading as required
- 8.16 checking components for serviceability
- 8.17 re-pressurising the system
- 8.18 replacing damaged/defective components
- 8.19 carrying out a system functional check
- 8.20 ensuring that replacement components have the correct part numbers
- 8.21 labelling (and storing in the correct location) components that require repair or overhaul
- 8.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 8.23 carrying out area inspections prior to task close-up

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## Outcome

S9 Carry out three of the following types of test/check on the aircraft stabilisers:

- 9.1 checking bonding jumpers for tightness, corrosion, melted strands, electrical resistance

- 9.2 checking ground leads for security and electrical continuity
- 9.3 checking components for wear (mechanical or otherwise) damage
- 9.4 check stabiliser skins for dents and scratches against manufacturer's tolerances
- 9.5 checking structural components for signs of cracking, corrosion or de-bonding
- 9.6 checking stabilisers for range and freedom of movement
- 9.7 checking critical fastenings for security
- 9.8 checking surface protection (such as paint finish, polish)
- 9.9 carrying out 'special-to-type' tests
- 9.10 carrying out rigging checks

Using two of the following:

- 9.11 mechanical measuring equipment
- 9.12 ground support equipment
- 9.13 'special-to-type' test equipment
- 9.14 electrical measuring equipment
- 9.15 use of safety locks

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## Outcome

- S10 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 10.1 job cards/work sheets
- 10.2 aircraft technical log

Plus one of the following

- 10.3 aircraft log book
- 10.4 aircraft cabin log
- 10.5 component log card
- 10.6 other record specified by the employer

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## Outcome

- S11 Carry out maintenance on aircraft stabilisers in compliance with one of the following:

- 11.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 11.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 11.3 Ministry of Defence (MoD)
- 11.4 Military Aviation Authority (MAA)
- 11.5 Aerospace Quality Management Standards (AS)
- 11.6 Federal Aviation Authority (FAA)
- 11.7 aircraft maintenance manual/structural repair manual/approved change documentation (service bulletin)
- 11.8 manufacturers standards and procedures



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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft stabilisers (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft stabiliser components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K17 Explain how to extract and use information from aircraft maintenance manuals, log books, flight logs, and other documents needed in the maintenance process

- K18 Explain how to carry out currency/issue checks on the specifications they are working with
- K19 Explain the terminology used in aircraft stabiliser systems, and the use of system diagrams and associated symbols
- K20 Describe the basic principles of operation of the aircraft stabiliser being worked on, and the function of the various units/components
- K21 Explain preparations to be undertaken on the aircraft stabilisers, prior to repair
- K22 Explain the repair methods and procedures to be used, and the importance of adhering to these procedures
- K23 Explain the application of sealants and adhesives within the repair activities, and the precautions that must be taken when working with them
- K24 Explain how to conduct any necessary checks to ensure the accuracy and quality of the repair
- K25 Explain how to recognise defects (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)
- K26 Explain the techniques used to remove components from aircraft stabilisers without damage to the components or surrounding structure (such as release of pressures/force, proof marking, extraction of components, and the need to protect the system integrity by fitting blanking plugs and ensuring exposed components are correctly covered/protected)
- K27 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K28 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K29 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K30 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K31 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K32 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K33 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K34 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections

- K36 Explain the methods of lifting, handling and supporting the components/equipment during the removal and fitting activities
- K37 Explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K38 Explain the need to replace items such as seals and gaskets
- K39 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K40 Explain how to replace and reconnect components into the system (such as ensuring correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K41 Explain how to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel)
- K42 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K43 Explain the purpose of symmetry and rigging checks; how they are carried out; how to locate the rigging points and faces; and the use of incidence boards
- K44 Explain how to carry out routine checks and servicing of the aircraft stabilisers
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before removing stabiliser components
- K46 Explain the types of test to be carried out on the aircraft stabiliser and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests
- K48 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the stabiliser system
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K53 Describe the problems that can occur with the aircraft stabiliser maintenance operations and how these can be overcome
- K54 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K55 Describe the procedure for the safe disposal of waste materials and scrap components
- K56 Describe the extent of their own authority, and to whom they should report if they have problems that they cannot resolve

## **Unit 526**

## **Maintaining and certifying aircraft stabilisers (ATA 55)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 527

## Maintaining and certifying aircraft windows (ATA 56)

<b>UAN:</b>	K/618/0247
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft windows, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes fuselage and crew compartment windows and windshields including windows installed in doors, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of windows. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to select the correct tools and equipment to use, based on the operations to be performed and the window equipment to be removed or fitted. The aircraft windows include items such as the transparent material and frame of sliding and fixed windows and windshields, frost shields, handles, latching mechanisms. They will remove the required window components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems</p>

with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft windows. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft window maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft windows are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft windows, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 56 Windows.

2. To display competence in this standard, it is necessary to both remove and fit aircraft windows. They must remove windows; however, they may fit a replacement where the original was previously removed by another person. They should also be aware of how to leave a system in a safe



condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft windows:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome



S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

---

### Outcome

S4 Carry out maintenance on two of the following aircraft windows:

- 4.1 flight compartment/front cockpit
- 4.2 door
- 4.3 window heating/wiring system
- 4.4 passenger/cargo compartment/rear cockpit
- 4.5 inspection and observation

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### Outcome

S5 Remove and fit four different aircraft window components (at least two must be from group A):

#### Group A

- 5.1 windshield
- 5.2 cabin window assembly
- 5.3 canopy
- 5.4 fixed windows
- 5.5 rear window
- 5.6 window seals
- 5.7 sliding windows
- 5.8 ice inspection window
- 5.9 landing gear and cargo bay inspection windows
- 5.10 environmental control systems (ECS) duct seal
- 5.11 transparency

#### Group B

- 5.12 handle assembly
- 5.13 trim
- 5.14 warning devices (such as lights, bells horns)
- 5.15 lock assembly

- 5.16 window blind
  - 5.17 cable harness/wiring/switches/plugs sensors
  - 5.18 window latching mechanisms
  - 5.19 lift block
  - 5.20 windscreen wiper blades
  - 5.21 window slide
  - 5.22 thermistor
  - 5.23 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
  - 6.24 repairing fine/small scratches
  - 6.25 carrying out sealant repairs
- 

## Outcome

S7 Service/check aircraft windows, to include carrying out three of the following:

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- 7.1 checking window seals for damage
  - 7.2 checking cleanliness
  - 7.3 applying rain repellent
  - 7.4 checking window condition (such as delamination, cracking, crazing, chips)
  - 7.5 checking latching mechanisms for correct operation
  - 7.6 checking critical fastenings for security
  - 7.7 rigging/adjusting the latching mechanism
  - 7.8 testing window heating elements
- 

## Outcome

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following

- 8.3 aircraft log book
  - 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
- 

## Outcome

- S9 Carry out maintenance on aircraft windows in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 9.3 Ministry of Defence (MoD)
  - 9.4 Military Aviation Authority (MAA)
  - 9.5 Aerospace Quality Management Standards (AS)
  - 9.6 Federal Aviation Authority (FAA)
  - 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 9.8 manufacturers standards and procedures
- 

## Outcome

- K Knowledge and understanding

The learner must be able to:

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- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft windows (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft windows, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K13 Describe the hazards associated with removing and fitting aircraft windows, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with

- K21 Describe the range of windows and window components that may need to be maintained/replaced
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the various mechanical fasteners that are used to hold the equipment in place, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K30 Explain the importance of using the specified fasteners for the particular installation and why they must not substitute others
- K31 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K32 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to take care when removing windows so as not to cause damage to the equipment or surrounding structure
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K36 Explain the need to position, align, adjust and secure correctly the replaced windows on the aircraft, without damage to the components or surrounding structure
- K37 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K38 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

- K39 Explain how to carry out routine checks of the aircraft windows (such as checking condition of seals, checking correct operation of sliding windows and window locking mechanisms, checking window warning devices)
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K42 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K43 Describe the procedure for the safe disposal of waste materials and scrap components
- K44 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 527**

## **Maintaining and certifying aircraft windows (ATA 56)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 528

## Maintaining and certifying aircraft wings (ATA 57)

<b>UAN:</b>	T/618/0249
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft wings, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of aircraft wing components, and making repairs to primary and secondary airframe/wing structures, as appropriate to the aircraft type. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed, fitted and tested. The aircraft wing components will include items such as centre wing and outer wing structural units and associated components and members that support the aircraft in flight, and covers flaps, slats, ailerons or elevons, tabs, spoilers and wing folding systems. They will remove the required wing components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>



bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft wings. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft wing maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft wings are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft wings, especially those for isolating the equipment, lifting and handling wing components. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 57 Wings.

2.To display competence in this standard, it is necessary to both remove and fit aircraft wing components. They must remove components; however, they may fit a replacement



component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft wing:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

---

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance/repairs on two of the following parts of the aircraft wing:

- 4.1 centre section
- 4.2 leading edge and leading edge devices
- 4.3 wing folding system
- 4.4 outer section
- 4.5 trailing edge and trailing edge devices
- 4.6 elevons
- 4.7 wing tip/winglets
- 4.8 inboard and outboard ailerons
- 4.9 spoilers
- 4.10 flaps
- 4.11 krueger flaps
- 4.12 slats
- 4.13 spars
- 4.14 ailerons
- 4.15 tabs
- 4.16 integral fuel tanks
- 4.17 spoilers
- 4.18 lift dumpers
- 4.19 external stores provisions

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## Outcome

S5 Undertake three of the following structural repair activities:

- 5.1 insertion repair
- 5.2 overlay patch repair

- 5.3 primary structure repair
  - 5.4 composite repair
  - 5.5 secondary structure repair
  - 5.6 blend repair
  - 5.7 tertiary structure repair
  - 5.8 reworking of aluminium structures and limitations forming
  - 5.9 damage assessment and evaluation
  - 5.10 NDT inspection requirements (post damage removal)
- 

## Outcome

S6 Use six of the following during the structural repair activities:

- 6.1 marking out airframe materials
  - 6.2 profiling
  - 6.3 securing and locking components
  - 6.4 making holes in airframe materials
  - 6.5 countersinking
  - 6.6 using adhesives and sealants
  - 6.7 cutting/shaping airframe materials
  - 6.8 deburring
  - 6.9 anti-corrosive treatment
  - 6.10 bending and forming materials
  - 6.11 riveting
  - 6.12 blending out permissible damage to structural components
  - 6.13 drilling the extremities of cracks
- 

## Outcome

S7 Remove and fit four different aircraft wing components (at least two must be from group A):

### Group A

- 7.1 wing tip/winglets
  - 7.2 spoilers
  - 7.3 Krueger flaps
  - 7.4 wing rib
  - 7.5 slats
  - 7.6 lift dumpers
  - 7.7 wing skin repair
  - 7.8 variable camber flaps
  - 7.9 airbrakes
  - 7.10 ailerons
  - 7.11 flaps (fore, mid, aft)
-

- 7.12 swing wing
- 7.13 spoilers
- 7.14 leading edge and leading edge devices
- 7.15 tabs
- 7.16 wing folding system
- 7.17 trailing edge and trailing edge devices
- 7.18 lift dumpers
- 7.19 elevons
- 7.20 inboard and outboard ailerons
- 7.21 flapperons
- 7.22 spars

#### Group B

- 7.23 wing attachment fittings
- 7.24 wing plates
- 7.25 nacelles/pylon attachment fittings
- 7.26 seals
- 7.27 landing gear attachment fittings
- 7.28 indicating/warning devices
- 7.29 actuators
- 7.30 locks
- 7.31 static dischargers
- 7.32 lever/linkage assemblies
- 7.33 flap track assembly
- 7.34 closure panels
- 7.35 spring assemblies
- 7.36 gearboxes
- 7.37 access panels
- 7.38 carriage assembly
- 7.39 shrouds
- 7.40 other specific components

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### Outcome

S8 Carry out fifteen of the following maintenance activities:

- 8.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 8.2 removing access panels and covers to expose components to be removed
- 8.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 8.4 disconnecting electrical connections
- 8.5 replacing single use items (such as seals, filters, gaskets)
- 8.6 disconnecting/removing hoses and pipes
- 8.7 removing securing devices and mechanical fasteners
- 8.8 refitting components in the correct position, orientation and alignment
- 8.9 dismantling equipment to an appropriate level
- 8.10 setting, and adjusting replaced components (such as travel, working clearance)

- 8.11 ensuring that any part-dismantled components are secure/supported
  - 8.12 making mechanical connections
  - 8.13 covering (protecting) exposed components, wires, pipework or vents
  - 8.14 making electrical connections
  - 8.15 torque loading as required
  - 8.16 checking components for serviceability
  - 8.17 re-pressurising the system
  - 8.18 replacing damaged/defective components
  - 8.19 carrying out a system functional check
  - 8.20 ensuring that replacement components have the correct part numbers
  - 8.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 8.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 8.23 carrying out area inspections prior to task close-up
- 

## Outcome

S9 Carry out three of the following types of test/check on the aircraft wings:

- 9.1 checking incidence rig
- 9.2 inspecting primary structure/spar
- 9.3 inspecting integral fuel tank
- 9.4 checking skins for cracking and distortion
- 9.5 checking control surface for range and freedom of movement
- 9.6 primary structural element (PSE) fastener inspection and replacement
- 9.7 checking wing skins for dents and scratches against manufacturer's tolerances/data
- 9.8 checking surface protection (such as paint finish, polish)
- 9.9 checking critical fastenings for security
- 9.10 checking for lightning strikes
- 9.11 heavy landing check
- 9.12 stress jacking
- 9.13 checking for dents
- 9.14 carrying out 'special-to-type' tests

Using two of the following:

- 9.15 mechanical measuring equipment
  - 9.16 ground support equipment
  - 9.17 'special-to-type' test equipment
  - 9.18 electrical measuring equipment
  - 9.19 use of safety locks
  - 9.20 incidence boards
- 

## Outcome

S10 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

10.1 job cards/work sheets

10.2 aircraft technical log

Plus one of the following:

10.3 aircraft log book

10.4 aircraft cabin log

10.5 component log card

10.6 other record specified by the employer

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### Outcome

S11 Carry out maintenance on aircraft wings in compliance with one of the following:

11.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

11.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)Ministry of Defence (MoD)

11.3 Military Aviation Authority (MAA)

11.4 Aerospace Quality Management Standards (AS)

11.5 Federal Aviation Authority (FAA)

11.6 aircraft maintenance manual/structural repair manual/approved change documentation (service bulletin)

11.7 manufacturers standards and procedures

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### Outcome

K Knowledge and understanding

The learner must be able to:

K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft wings (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

K3 Explain how to prioritise their own workload to ensure that targets are met

K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets

K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards



- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the requirements for working on wing fuel tanks (such as fuel tank training), and the importance of emergency procedures and safe systems of work (including permits to work, required air quantities (RAQs) and local exhaust ventilation (LEV)) to maintain safe conditions; the provision of adequate and safe lighting and avoidance of sources of ignition
- K13 Explain the importance of maintenance on aircraft wings, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with removing, fitting and testing aircraft wing components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft maintenance manuals, log books, flight logs, and other documents needed in the maintenance process
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft wings, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the aircraft wing components being worked on, and the function of the various units/components
- K24 Explain the preparations to be undertaken on the wing structure, prior to repair

- K25 Explain the repair methods and procedures to be used, and the importance of adhering to these procedures
- K26 Explain the application of sealants and adhesives within the repair activities, and the precautions that must be taken when working with them
- K27 Explain how to conduct any necessary checks to ensure the accuracy and quality of the repair
- K28 Explain how to recognising defects (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)
- K29 Explain the techniques used to remove components from aircraft wings without damage to the components or surrounding structure (such as release of pressures/force, proof marking, extraction of components) and the need to protect the system integrity by fitting blanking plugs and ensuring exposed components are correctly covered/protected)
- K30 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K31 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K32 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K33 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K34 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K35 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K36 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K37 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K38 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the removal and fitting activities
- K40 Explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K41 Explain the need to replace items such as seals and gaskets
- K42 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation

- K43 Explain how to replace and reconnect components onto the wing (such as ensuring correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K44 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel)
- K45 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K46 Explain the purpose of symmetry and rigging checks; how they are carried out; how to locate the rigging points and faces; and the use of incidence boards
- K47 Explain how to carry out routine checks and servicing of the aircraft wings
- K48 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before removing wing components
- K49 Explain the types of test to be carried out on the aircraft wing and the test equipment to be used
- K50 Explain the methods and procedures to be used to carry out the various tests
- K51 Explain the importance of carrying out the tests in the specified sequence, checking all readings/movements at each stage
- K52 Explain how to record the results of each individual test, and the documentation that must be used
- K53 Explain how to analyse the test results and make valid decisions about the acceptability of the wing components
- K54 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K55 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K56 Describe the problems that can occur with the aircraft wing maintenance operations and how these can be overcome
- K57 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K58 Describe the procedure for the safe disposal of waste materials and scrap components
- K59 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 528                      Maintaining and certifying aircraft wings (ATA 57)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 529

## Maintaining and certifying aircraft propeller/propulsor systems (ATA 61)

<b>UAN:</b>	K/618/0250
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft propeller/propulsor systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed and variable pitch mechanical or electrical propellers, pumps, motors, governor, alternators, and those units and components external to or integral with the engine that are used to control the propeller blade angle. It includes propeller spinner synchronizers. It also covers propulsor duct assemblies, including aerodynamic fairing of mechanical components, stators and vectoring systems, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of propeller/propulsor system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>

bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft propeller/propulsor systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft propeller/propulsor system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the propeller/propulsor system is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities


They will understand the safety precautions required when working on the aircraft propeller/propulsor system, especially those for ensuring that the power system, and its fuel supply, is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 61 Propellers/Propulsors.

2. To display competence in this standard, it is necessary to both remove and fit propeller/propulsor system components. They must remove components; however, they may fit a



replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out **all** of the following during the maintenance of the aircraft propeller/propulsor system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented



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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on **three** of the following parts of the aircraft propeller/propulsor system:

- 4.1 propeller assembly
- 4.2 controls
- 4.3 feathering/reversing
- 4.4 braking
- 4.5 indicating
- 4.6 propulsor duct

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## Outcome

S5 Remove and fit **six** different propeller/propulsor system components (at least two must be from group A):

### Group A

- 5.1 propeller/blades
- 5.2 spinner/governor synchronizers
- 5.3 gearboxes
- 5.4 dome
- 5.5 drive shafts
- 5.6 brake mechanisms
- 5.7 hub
- 5.8 synchronizing shafts
- 5.9 brush block assembly
- 5.10 spinner
- 5.11 pumps

- 5.12 counter weights
- 5.13 slip ring
- 5.14 motors
- 5.15 propulsor duct assemblies
- 5.16 de-icer devices
- 5.17 governor
- 5.18 vector drive attachments
- 5.19 distributor valve
- 5.20 alternators
- 5.21 stators

#### Group B

- 5.22 levers/linkages
- 5.23 fairings
- 5.24 cables/harness/wiring
- 5.25 pulleys
- 5.26 covers
- 5.27 switches/plugs
- 5.28 bearings
- 5.29 prop pitch control
- 5.30 indicators and warning devices
- 5.31 seals/gaskets
- 5.32 anti-ice heater mats
- 5.33 pipes and hoses
- 5.34 de-ice tank
- 5.35 other specific components

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### Outcome

S6 Carry out **fifteen** of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required

- 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S7 Service/check aircraft propeller/propulsor systems, to include carrying out five of the following:

### Group A

- 7.1 visually checking the system for damage and leaks
  - 7.2 checking and adjusting dome and unfeathering accumulators
  - 7.3 lubricating the propeller
  - 7.4 adjusting the governor
  - 7.5 checking propeller pitch control mechanisms and adjusting to establish blade angles
  - 7.6 performing static function checks
  - 7.7 checking the track
  - 7.8 checking propeller hub for cracks and/or debonding of blade leading edge cap
  - 7.9 performing a propeller runout check
  - 7.10 examining the propeller for damage and corrosion
  - 7.11 dynamically balancing the propeller
  - 7.12 dressing out blade damage
  - 7.13 checking indicating and warning systems
  - 7.14 examining the brush block assembly
  - 7.15 checking attachment of propeller and spinner for security
  - 7.16 measuring and adjusting synchro-phaser magnetic pickup gap
- 

## Outcome

- S8 Carry out **three** of the following tests on the aircraft propeller/propulsor system:

- 8.1 checking that ground start mechanisms operate correctly
- 8.2 checking accuracy of propeller RPM
- 8.3 verifying that low/high RPM is achieved
- 8.4 verifying take-off RPM
- 8.5 testing electric anti-icing system
- 8.6 built in test equipment (BITE) test
- 8.7 'special-to-type' tests

Using two of the following:

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- 8.8 stroboscope
  - 8.9 ground test rig
  - 8.10 `special-to-type' test equipment
  - 8.11 tachometer
  - 8.12 built in test equipment (BITE)
- 

### Outcome

- S9 Complete relevant documentation to include **both** the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
- 

### Outcome

- S10 Carry out maintenance on aircraft propeller/propulsor systems in compliance with **one** of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
  - 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 10.8 manufacturers standards and procedures
- 

### Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft propeller/propulsor systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft propeller systems, and impact upon (Extended Range Twin-Engine Operations Procedures) ETOPS systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft propeller/propulsor systems, and with the tools and equipment used (such as handling oils, greases, traps from moving parts, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in aircraft propeller/propulsor systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft propeller/propulsor systems, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the propeller/propulsor system being worked on, and the function of the units that make up the system (such as propeller assembly, blade, de-ice boot, spinner, hub, synchronizer section, braking and feathering, and propeller control and indicating)
- K24 Explain the techniques used to remove components from aircraft propeller/propulsor system without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)
- K25 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K26 Explain the procedures and process involved in ground running propeller driven aircraft
- K27 Explain the inspections required following an exceedance event such as over speed or blade strike
- K28 Explain the methods and processes involved with the inspection and repair of propeller blades (within the scope of the AMM)
- K29 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K30 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K31 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K32 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K33 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K34 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K35 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K36 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections

- K37 Explain the importance of ensuring that any exposed components or pipe ends are correctly covered/protected
- K38 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K39 Explain how to fit propeller/propulsor components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K40 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance)
- K41 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K42 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K43 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K44 Explain how to carry out routine checks and servicing of the aircraft propeller/propulsor system
- K45 Explain the types of test to be carried out on the aircraft propeller/propulsor system, and the test equipment to be used
- K46 Explain the methods and procedures to be used to carry out the various tests on the propeller/propulsor system
- K47 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K48 Explain how to record the results of each individual test, and the documentation that must be used
- K49 Explain how to analyse the test results, and make valid decisions about the acceptability of the propeller/propulsor system
- K50 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K51 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K52 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K53 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 529                      Maintaining and certifying aircraft propeller/propulsor systems (ATA 61)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 530

## Maintaining and certifying rotorcraft rotor systems (ATA 62 & 64)

<b>UAN:</b>	M/618/0251
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on rotorcraft main and/or tail rotor systems, in accordance with the rotorcraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers the main and tail rotor head assembly, rotor blades and blade folding system, swashplate assemblies, and the rotor shaft units if not an integral part of the gearbox. It also includes indicating systems which show operation or activation of the rotor systems, as applicable to the rotorcraft type. The maintenance activities will include the removal, fitting and testing of a range of main and/or tail rotor system components. They will be able to use a variety of diagnostic and information sources such as the rotorcraft maintenance manual, manufactures SMART trouble shooting software, rotorcraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the rotorcraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the rotorcraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to</p>

report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to rotorcraft main and/or tail rotor systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the rotor system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the main and tail rotor systems are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the rotor system, especially those for ensuring that the power system is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 62 Main Rotors and ATA Chapter 64 Tail Rotor.
2. To display competence in this standard, it is necessary to both remove and fit rotor system components. They must remove components; however, they may fit a replacement component where the original was previously removed by



another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the rotorcraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) rotorcraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out **all** of the following during the maintenance of the rotorcraft rotor system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

- 3.1 rotorcraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 rotorcraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on three of the following parts of the rotorcraft rotor system:

- 4.1 main rotor blades
- 4.2 rotor servos
- 4.3 swash plate assembly
- 4.4 tail rotor blades
- 4.5 blade folding system
- 4.6 indicating system
- 4.7 rotor heads
- 4.8 rotor shafts
- 4.9 pivoting and swivelling actuators
- 4.10 trim actuators

---

## Outcome

S5 Remove and fit six different rotor system components (at least two must be from group A):

### Group A

- 5.1 rotor blades
- 5.2 azimuth star assembly (collective pitch)
- 5.3 wobble ring
- 5.4 mast assembly
- 5.5 blade governor synchronizes
- 5.6 pitch control beam
- 5.7 clutch assembly
- 5.8 pitch change linkage

- 5.9 brake mechanisms
- 5.10 bumper/damper
- 5.11 rotor/drive shafts
- 5.12 wear/grip pads
- 5.13 coupling
- 5.14 speed governor
- 5.15 cams
- 5.16 rotor/rudder hub assembly
- 5.17 rudder blade plate
- 5.18 housings
- 5.19 rotor head
- 5.20 trunnion
- 5.21 scupper assembly
- 5.22 swash plate
- 5.23 main drive actuator
- 5.24 lead/lag damper

#### Group B

- 5.25 levers/linkages
- 5.26 folding hinge pin
- 5.27 anti-ice heater mats
- 5.28 pulleys
- 5.29 blade lock pin
- 5.30 fairing assemblies
- 5.31 bearings
- 5.32 control lock pin
- 5.33 balance weights
- 5.34 seals/gaskets
- 5.35 springs
- 5.36 de-icer boot
- 5.37 bolt assemblies
- 5.38 pipes and hoses
- 5.39 cable harness/wiring/switches/plugs
- 5.40 support brackets
- 5.41 rotor head fairings
- 5.42 indicators and warning devices
- 5.43 lubrication tank
- 5.44 covers
- 5.45 other specific components

---

### Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed

- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S7 Service/check rotorcraft main and tail rotor systems, to include carrying out **five** of the following:

- 7.1 visually checking the system for damage and leaks
- 7.2 adjusting main rotor trim tab
- 7.3 adjusting the governor
- 7.4 adjusting main/tail rotor pitch change linkage
- 7.5 performing static function checks
- 7.6 fitting and removing rigging pins
- 7.7 examining main and tail rotor blades for damage and corrosion
- 7.8 checking and adjusting main rotor control rigging
- 7.9 checking and adjusting tail rotor control rigging
- 7.10 carrying out blend repair to rotor blades
- 7.11 checking indicating and warning systems
- 7.12 replacing main rotor blade erosion tape
- 7.13 lubricating rotor mechanism
- 7.14 performing main rotor blade debonding check
- 7.15 checking spar integrity system
- 7.16 checking main/tail rotor pitch change mechanism
- 7.17 servicing lead/lag damper
- 7.18 tracking/balancing the main rotor

## 7.19 examining flapping hinge and droop stop

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### Outcome

S8 Carry out two of the following tests on the rotorcraft rotor system:

- 8.1 checking that ground start mechanisms operate correctly
- 8.2 testing electric anti-icing system
- 8.3 testing rotor braking system
- 8.4 built in test equipment (BITE) test
- 8.5 'special-to-type' tests
- 8.6 blade tracking

Using **two** of the following:

- 8.7 stroboscope
  - 8.8 ground test rig
  - 8.9 'special-to-type' test equipment
  - 8.10 tachometer
  - 8.11 built in test equipment (BITE)
- 

### Outcome

S9 Complete relevant documentation to include **both** the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus **one** of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
  - 9.5 component log card
  - 9.6 other record specified by the employer
- 

### Outcome

S10 Carry out maintenance on rotorcraft main and tail rotor systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Ministry of Defence (MoD)
  - 10.3 Military Aviation Authority (MAA)
  - 10.4 Aerospace Quality Management Standards (AS)
-



10.5 Federal Aviation Authority (FAA)

10.6 rotorcraft maintenance manual/approved change documentation (service bulletin)

10.7 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on rotorcraft main and tail rotor systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, rotorcraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on rotorcraft rotor systems, and impact upon legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on rotorcraft main and tail rotor systems, and with the tools and equipment used (such as handling

- oils, greases, traps from moving parts, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the rotorcraft
  - K17 Explain the importance of rotorcraft husbandry and of ensuring that, throughout the maintenance activity, the rotorcraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the rotorcraft
  - K18 Explain how to extract and use information from rotorcraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in rotorcraft main and tail rotor systems, and other documents needed in the maintenance activities
  - K19 Explain how to carry out currency/issue checks on the specifications they are working with
  - K20 Explain the terminology used in rotorcraft main rotor systems, and the use of system diagrams and associated symbols
  - K21 Describe the basic principles of operation of the main and/or tail rotor system being worked on, and the function of the units that make up the system (such as rotor blade, rotor heads, swash plate assemblies, blade folding mechanisms, de- ice boot, blade braking and blade control and indicating)
  - K22 Explain the techniques used to remove components from rotorcraft main and/or tail rotor systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)
  - K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
  - K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as rotorcraft maintenance manual , manufactures SMART troubleshooting guides, rotorcraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
  - K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
  - K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
  - K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
  - K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
  - K29 Explain the use of rotor track and balance equipment in carrying out main and tail rotor track and balancing including static balancing
  - K30 Explain the importance of procedures and process involved with ground running helicopters
  - K31 Explain the process for inspection of main and tail rotor blades to include 'coin tapping' and other similar process to locate defects

- K32 Explain the inspections and process required after a exceedance or event has been recorded i.e. over speed or bird strike
- K33 Explain the risk of running the rotorcraft with a fault, and the effects this could have on the rotorcraft performance and safety
- K34 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the importance of ensuring that any exposed components or pipe ends are correctly covered/protected
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to fit main rotor components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance)
- K40 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to carry out routine checks and servicing of the rotorcraft main and/or tail rotor system
- K44 Explain the types of test to be carried out on the rotorcraft main and/or tail rotor system, and the test equipment to be used
- K45 Explain the methods and procedures to be used to carry out the various tests on the rotor systems
- K46 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K47 Explain how to record the results of each individual test, and the documentation that must be used
- K48 Explain how to analyse the test results and how to make valid decisions about the acceptability of the rotor system
- K49 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K50 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K51 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K52 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 530**

## **Maintaining and certifying rotorcraft rotor systems (ATA 62 & 64)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 531

## Maintaining and certifying rotorcraft rotor drives systems (ATA 63 & 65)

<b>UAN:</b>	T/618/0252
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on rotorcraft main and/or tail drive systems, in accordance with the rotorcraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers the main and tail rotor drive, and includes all components transmitting power to the rotors, such as engine coupling components, drive shafts and bearings, drive supports, clutch and freewheel units, gearboxes and their components, accelerometers, vibration monitoring equipment and indicating systems which show operation or activation of the rotor systems, as applicable to the rotorcraft type. The maintenance activities will include the removal, fitting and testing of a range of main and/or tail rotor drive system components. They will be able to use a variety of diagnostic and information sources such as the rotorcraft maintenance manual, manufactures SMART trouble shooting software, rotorcraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the rotorcraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the rotorcraft manual,</p>

change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to rotorcraft main and/or tail rotor drive systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the rotor drive system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the main and tail rotor drive systems are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the rotor drive systems, especially those for ensuring that the power system is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 63 Main Rotor Drives and ATA Chapter 65 Tail Rotor Drive.



2.To display competence in this standard, it is necessary to both remove and fit rotor drive system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements



The learner must be able to:

S1 Undertake the rotorcraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) rotorcraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the rotorcraft rotor drive system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include **three** of the following:

- 3.1 rotorcraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 rotorcraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on three of the following parts of the rotorcraft rotor drive system:

- 4.1 main rotor gearbox/transmission
  - 4.2 aft vertical shaft
  - 4.3 rotor braking system
  - 4.4 intermediate gearbox/transmission
  - 4.5 drive shaft/high speed shaft
  - 4.6 rotorcraft cooling fan
  - 4.7 combining gearbox/transmission
  - 4.8 engine/gearbox couplings
  - 4.9 accelerometer
  - 4.10 nose gearbox/transmission
  - 4.11 clutch/freewheel units
  - 4.12 indicating system
  - 4.13 tail rotor gearbox
  - 4.14 other specific gearbox/transmission in the drive train
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### Outcome

- S5 Remove and fit six different rotor drive system components (at least two must be from group A):

#### Group A

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- 5.1 clutch assembly
- 5.2 bearings
- 5.3 control valves
- 5.4 freewheel units
- 5.5 dynamic seals
- 5.6 vibration bars
- 5.7 clutch operating mechanisms
- 5.8 housings
- 5.9 suspension units
- 5.10 flexible couplings
- 5.11 lubricating pumps
- 5.12 mounts/attachments
- 5.13 drive shaft support
- 5.14 brake mechanisms
- 5.15 accessory drive casing
- 5.16 drive shafts

#### Group B

- 5.17 levers/linkages
- 5.18 accelerometers
- 5.19 mechanical controls (plungers, springs, rollers)
- 5.20 static seals/gaskets
- 5.21 drive belts and pulleys
- 5.22 anti-ice heater mats
- 5.23 bolt assemblies
- 5.24 pipes and hoses
- 5.25 cable harness/wiring/switches/plugs
- 5.26 support brackets
- 5.27 rotor drive fairings
- 5.28 electrical controls (solenoids, motors, switches)
- 5.29 chip detectors
- 5.30 gearbox covers
- 5.31 indicators and warning devices
- 5.32 control units
- 5.33 locks and stops
- 5.34 sensors
- 5.35 other specific components

---

### Outcome

S6 Carry out **fifteen** of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections

- 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S7 Service/check rotorcraft main and tail rotor systems, to include carrying out three of the following:

- 7.1 visually checking the system for damage and leaks
  - 7.2 checking gearbox chip detectors
  - 7.3 carrying out oil drain rotor tune adjustments
  - 7.4 checking and adjusting clutch mechanisms
  - 7.5 checking indicating and warning systems
  - 7.6 checking and adjusting braking mechanisms
- 

## Outcome

- S8 Carry out three of the following tests on the rotorcraft rotor drive system:

- 8.1 visual inspection
  - 8.2 built in test equipment (BITE) test
  - 8.3 ground run tests
  - 8.4 gearbox alignment (main, tail, intermediate)
  - 8.5 timings
  - 8.6 leak test
  - 8.7 tension adjuster check
  - 8.8 vibration analysis
-

- 8.9 drive shaft/high speed shaft alignment
- 8.10 freedom and range of movement
- 8.11 phasing check
- 8.12 `special-to-type' tests
- 8.13 safety interlock test
- 8.14 checking gearboxes and drive systems for correct oil levels
- 8.15 static or dynamic balancing of drive shafts

Using three of the following:

- 8.16 built in test equipment (BITE)
- 8.17 use of safety locks
- 8.18 `special-to-type' test equipment
- 8.19 dial test indicator
- 8.20 plumb and bob
- 8.21 optical sight instruments
- 8.22 laser alignment
- 8.23 feeler/slip gauges
- 8.24 jigs/fixture
- 8.25 clinometers
- 8.26 `go/no go' gauge
- 8.27 wrenches/'special-to-type' appliances
- 8.28 lay straight wires
- 8.29 vibration analysis equipment

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### Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

- S10 Carry out maintenance on rotorcraft main and tail rotor systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Ministry of Defence (MoD)

- 10.3 Military Aviation Authority (MAA)
- 10.4 Aerospace Quality Management Standards (AS)
- 10.5 Federal Aviation Authority (FAA)
- 10.6 rotorcraft maintenance manual/approved change documentation (service bulletin)
- 10.7 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on rotorcraft main and tail rotor systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Explain the techniques required to communicate information using visual control systems (such as, rotorcraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on rotorcraft rotor drive systems, and impact upon legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

- K15 Describe the hazards associated with carrying out maintenance activities on rotorcraft main and tail rotor systems, and with the tools and equipment used (such as handling oils, greases, traps from moving parts, lifting and moving heavy and bulky components, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the rotorcraft
- K17 Explain the importance of rotorcraft husbandry and of ensuring that, throughout the maintenance activity, the rotorcraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the rotorcraft
- K18 Explain how to extract and use information from rotorcraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in rotorcraft main and tail rotor systems, and other documents needed in the maintenance activities
- K19 Explain how to carry out currency/issue checks on the specifications they are working with
- K20 Explain the terminology used in rotorcraft power transmission systems, and the use of system diagrams and associated symbols
- K21 Describe the basic principles of operation of the main and/or tail rotor drive system being worked on, and the function of the units that make up the system (such as main, intermediate, tail and nose gearboxes, clutch/freewheel mechanisms, braking equipment, couplings and drive shafts and indicating systems)
- K22 Explain the techniques used to remove components from rotorcraft main and/or tail rotor systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as rotorcraft maintenance manual , manufactures SMART troubleshooting guides, rotorcraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the use of oil analysis in the maintenance of helicopter drive systems
- K27 Explain the use of HUMs for identifying defects within the transmission drive system
- K28 Explain the tests required to prove serviceability following an exceedance or event i.e. filter contamination or over torque
- K29 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K30 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis

- K31 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K32 Explain the risk of running the rotorcraft with a fault, and the effects this could have on the rotorcraft performance and safety
- K33 Describe the various mechanical fasteners that will need to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K36 Explain the importance of ensuring that any exposed components or pipe ends are correctly covered/protected
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to replace and reconnect components into the rotor power transmission system (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K39 Explain how to make adjustments to components to ensure that they function correctly (such as travel, working clearance)
- K40 Explain why securing devices need to be correctly torque loaded, locked and labelled, and the different methods that are used
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to carry out routine checks and servicing of the rotorcraft main and/or tail rotor system
- K44 Explain the tests to be carried out on the rotorcraft power transmission system, and the test equipment to be used
- K45 Explain the methods and procedures to be used to carry out the various tests on the rotor power transmission systems
- K46 Explain the importance of carrying out the tests in the specified sequence, checking all readings/movements at each stage
- K47 Explain how to record the results of each individual test and the documentation that must be used
- K48 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the rotor power transmission system
- K49 Explain the procedures to be followed if the equipment or system fails to meet the test specification



- K50 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K51 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K52 Explain the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 531**

## **Maintaining and certifying rotorcraft rotor drives systems (ATA 63 & 65)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 532

## Maintaining and certifying rotorcraft rotor blade and tail pylon folding systems (ATA 66)

<b>UAN:</b>	A/618/0253
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on rotor blade and tail pylon folding systems, in accordance with the rotorcraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers the whole of the system for ensuring automatic or manual folding and spreading of the rotor blades and/or tail pylon, and includes the mechanical, hydraulic, electrical and indicating equipment and systems permanently fitted to the rotorcraft, as applicable to the rotorcraft type. The maintenance activities will include the removal, fitting and testing of a range of rotor blade and tail pylon folding system components. They will be able to use a variety of diagnostic and information sources such as the rotorcraft maintenance manual, manufactures SMART trouble shooting software, rotorcraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the rotorcraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the rotorcraft manual, change/service bulletin documentation and airworthiness</p>

requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to rotor blade and tail pylon folding systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the rotor blade and tail pylon folding system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the rotor blade and tail pylon folding systems are maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the rotor blade and tail pylon folding systems, especially those for ensuring that the power system is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 66 Rotor Blade and Tail Pylon Folding Systems.



2.To display competence in this standard, it is necessary to both remove and fit rotor blade and tail pylon folding system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

S1 Undertake the rotorcraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) rotorcraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the rotorcraft rotor blade and tail pylon folding system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 rotorcraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 rotorcraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on two of the following parts of the rotorcraft rotor blade and tail pylon folding system:

- 4.1 rotor blades
  - 4.2 tail pylon
  - 4.3 controls and indicating
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### Outcome

- S5 Remove and fit six different rotor blade and tail pylon folding system components from the following:

- 5.1 actuators
  - 5.2 mechanical controls (plungers, springs, rollers)
  - 5.3 sensors
  - 5.4 control valves
  - 5.5 electrical controls (solenoids, motors, switches)
  - 5.6 hinge mechanisms
  - 5.7 pipes and hoses
  - 5.8 flexible couplings
  - 5.9 fairings
  - 5.10 indicators and warning devices
  - 5.11 levers/linkages
  - 5.12 bearings
-

- 5.13 cable/harness/wiring
- 5.14 bolt assemblies
- 5.15 static seals/gaskets
- 5.16 switches/plugs
- 5.17 support brackets
- 5.18 dynamic seals
- 5.19 locks and stops
- 5.20 control units
- 5.21 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up

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## Outcome

S7 Service/check and test rotor blade and tail pylon folding systems, to include carrying out three of the following:



- 7.1 visually checking folding system for damage and leaks
  - 7.2 checking tracking/balance
  - 7.3 checking critical fastenings for security
  - 7.4 carrying out a safety interlock test
  - 7.5 checking for freedom and range of movement
  - 7.6 checking indicating and warning systems
  - 7.7 checking and adjusting folding mechanisms
  - 7.8 built in test equipment (BITE) test
  - 7.9 checking and adjusting locking mechanisms
  - 7.10 'special-to-type' test
  - 7.11 checking for vibration
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## Outcome

- S8 Complete relevant documentation to include **both** the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following:

- 8.3 aircraft log book
  - 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
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## Outcome

- S9 Carry out maintenance on rotorcraft rotor blade and tail pylon folding systems in compliance with one of the

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Ministry of Defence (MoD)
  - 9.3 Military Aviation Authority (MAA)
  - 9.4 Aerospace Quality Management Standards (AS)
  - 9.5 Federal Aviation Authority (FAA)
  - 9.6 rotorcraft maintenance manual/approved change documentation (service bulletin)
  - 9.7 manufacturers standards and procedures
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## Outcome

- K Knowledge and understanding
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The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on rotorcraft rotor blade and tail pylon folding systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel teams can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, rotorcraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on rotorcraft rotor blade and tail pylon folding systems, and impact upon legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on rotorcraft rotor blade and tail pylon folding systems, and with the tools and equipment used (such as handling oils, greases, traps from moving parts, lifting and moving heavy and bulky components, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the rotorcraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)

- K19 Explain the importance of rotorcraft husbandry and of ensuring that, throughout the maintenance activity, the rotorcraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the rotorcraft
- K20 Explain how to extract and use information from rotorcraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in rotorcraft rotor blade and tail pylon folding systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in rotorcraft rotor blade and tail pylon folding systems, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the rotor blade and tail pylon folding system being worked on, and the function of the units that make up the system (such as mechanisms, hydraulic actuators, electrical equipment and indicating systems)
- K24 Explain the techniques used to remove components from rotor blade and tail pylon folding systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, removal of components and the need to protect the system integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K25 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K26 Describe the types of data and information sources that can be used to aid fault diagnosis (such as rotorcraft maintenance manual , manufactures SMART troubleshooting guides, rotorcraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K27 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K28 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K29 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K30 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K31 Explain the risk of running the rotorcraft with a fault, and the effects this could have on the rotorcraft performance and safety
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities

- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K36 Explain how to replace and reconnect components into the rotor blade and tail pylon folding system (such as the use of gaskets/seals; ensuring the correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K37 Explain how to make adjustments to components to ensure that they function correctly (such as travel, freedom of movement and working clearance)
- K38 Explain why securing devices need to be correctly torque loaded, locked and labelled, and the different methods that are used
- K39 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Explain how to carry out routine checks and servicing of the rotorcraft rotor blade and tail pylon folding system
- K42 Explain the tests to be carried out on the rotor blade and tail pylon folding system, and the test equipment to be used
- K43 Explain the methods and procedures to be used to carry out the various tests on the rotor blade/tail pylon folding systems
- K44 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K45 Explain how to record the results of each individual test and the documentation that must be used
- K46 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the rotor blade and tail pylon folding system
- K47 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K48 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K49 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K50 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 532**

## **Maintaining and certifying rotorcraft rotor blade and tail pylon folding systems (ATA 66)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 533

## Maintaining and certifying rotorcraft flight control systems (ATA 67)

<b>UAN:</b>	F/618/0254
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on rotorcraft flight control systems, in accordance with the rotorcraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers units and components which manually control the flight attitude and characteristics of the rotorcraft, as applicable to the rotorcraft type. The maintenance activities will include the removal, fitting and testing of a range of rotorcraft flight control components. They will be required to select the correct tools and equipment to use, based on the operations to be performed and the components to be removed, fitted and tested. The rotorcraft flight control components will include items such as control linkage and control cables for collective pitch, cyclic pitch, directional control, servo controls and corresponding systems. They will be able to use a variety of diagnostic and information sources such as the rotorcraft maintenance manual, manufactures SMART trouble shooting software, rotorcraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the rotorcraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices</p>

and procedures identified in the rotorcraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to rotorcraft flight control systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the rotorcraft flight control system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the rotorcraft flight control systems, especially those for isolating the equipment, lifting and handling control components. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 67 Rotors Flight Controls.



2.To display competence in this standard, it is necessary to both remove and fit rotorcraft flight control system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements



The learner must be able to:

S1 Undertake the rotorcraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) rotorcraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the rotorcraft flight control systems:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures

- 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 rotorcraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 rotorcraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on two of the following rotorcraft flight control systems:

- 4.1 main rotor control
  - 4.2 tilt rotor flight control
  - 4.3 servo control
  - 4.4 tail rotor control
  - 4.5 anti-torque rotor control (yaw control)
  - 4.6 rotor flight control system wiring
- 

### Outcome

- S5 Remove and fit four different rotorcraft flight control system components (at least three must be from group A):

#### Group A:

- 5.1 collective pitch lever
  - 5.2 actuators
  - 5.3 gradient boxes
  - 5.4 cyclic pitch stick
  - 5.5 blade pitch change rods
  - 5.6 auxiliary servo equipment (ASE)
  - 5.7 rudder pedals
  - 5.8 mixer box/units
-

- 5.9 primary servo jack
- 5.10 swash plate
- 5.11 artificial feel units
- 5.12 primary flight computers
- 5.13 torque tubes
- 5.14 elevator
- 5.15 stability augmentation system (SAS)
- 5.16 magnetic brakes

Group B:

- 5.17 cables and pulleys
- 5.18 levers and linkages
- 5.19 turnbuckles
- 5.20 position transmitters
- 5.21 control rods
- 5.22 actuators/motors/servos
- 5.23 locks and stops
- 5.24 return springs
- 5.25 position transmitters
- 5.26 bell cranks/quadrants
- 5.27 sensors
- 5.28 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check

- 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out five of the following types of test/check on the rotorcraft flight control systems:

- 7.1 check collective system rigging
- 7.2 built in test equipment (BITE) test
- 7.3 pre- flight tests
- 7.4 check cyclic system rigging
- 7.5 check controls for operation and sense
- 7.6 check anti-torque system rigging
- 7.7 timings
- 7.8 static friction check
- 7.9 cable tension check
- 7.10 leak test
- 7.11 adjust blade trim tab
- 7.12 safety interlock test
- 7.13 'special-to-type' tests
- 7.14 check blade track/balance
- 7.15 adjust pitch links

Using two of the following:

- 7.16 built in test equipment (BITE)
  - 7.17 ground support equipment
  - 7.18 'special-to-type' test equipment
  - 7.19 rotorcraft power supply/displays and gauges
  - 7.20 use of safety locks
  - 7.21 measuring equipment
- 

## Outcome

S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following:

- 8.3 aircraft log book
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- 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
- 

## Outcome

S9 Carry out maintenance on rotorcraft flight control systems in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Ministry of Defence (MoD)
  - 9.3 Military Aviation Authority (MAA)
  - 9.4 Aerospace Quality Management Standards (AS)
  - 9.5 Federal Aviation Authority (FAA)
  - 9.6 rotorcraft maintenance manual/approved change documentation (service bulletin)
  - 9.7 manufacturers standards and procedures
- 

## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on rotorcraft flight control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K3 Explain how to prioritise their own workload to ensure that targets are met
  - K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
  - K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
  - K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
  - K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
  - K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
  - K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
-

- K10 Describe the techniques required to communicate information using visual control systems (such as, rotorcraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on rotorcraft flight control systems, and impact upon legislation and local procedures
- K13 Explain the hazards associated with removing, fitting and testing rotorcraft flight control system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the rotorcraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of rotorcraft husbandry and of ensuring that, throughout the maintenance activity, the rotorcraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the rotorcraft
- K19 Explain how to extract and use information from rotorcraft maintenance manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in rotorcraft flight control systems, and the use of system diagrams and associated symbols
- K22 Describe the basic principles of operation of the rotorcraft flight control system being worked on, and the function of the various units/components within the system
- K23 Explain the techniques used to remove components from rotorcraft flight control systems without damage to the components or surrounding structure (such as release of pressures/force, proof marking, extraction of components, and the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected)
- K24 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K25 Describe the types of data and information sources that can be used to aid fault diagnosis (such as rotorcraft maintenance manual, manufacturers SMART troubleshooting guides, rotorcraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K26 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects

- K27 Describe the different types of measuring equipment used to carry out helicopter flight control rigging
- K28 Explain the different types of locking systems used on helicopter flight control hardware
- K29 Explain the procedures and process involved with carry out check flights to prove flight control serviceability i.e. auto rotation checks
- K30 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K31 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K32 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K33 Explain the risk of running the rotorcraft with a fault, and the effects this could have on the rotorcraft performance and safety
- K34 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K38 Explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K39 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K40 Explain how to replace and reconnect components into the system (such as ensuring the correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K41 Explain how to make adjustments to components/assemblies to ensure that they function correctly
- K42 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K43 Explain the purpose of symmetry and rigging checks; how they are carried out; how to locate the rigging points and faces; and the use of incidence boards
- K44 Explain how to carry out routine checks and servicing of the rotorcraft flight control system
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic)

- K46 Explain the types of test to be carried out on the rotorcraft flight control system, and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the rotorcraft flight control system
- K48 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K49 Explain how to record the results of each individual test, and the documentation that must be used
- K50 Explain how to analyse the test results and make valid decisions about the acceptability of the flight control systems
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K53 Describe the problems that can occur with the flight control system maintenance operations and how these can be overcome
- K54 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K55 Describe the procedure for the safe disposal of waste materials and scrap components
- K56 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 533**

## **Maintaining and certifying rotorcraft flight control systems (ATA 67)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 534

## Maintaining and certifying aircraft power plant (ATA 71)

<b>UAN:</b>	L/618/0256
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft power plant, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the overall power package/engine dressing, inclusive of engine air intakes, engine mounts, cowling, scoops and cowl flaps, as applicable to the aircraft type. It does not cover engine strip down and maintenance activities, which are covered in other standards/ATA chapters. The maintenance activities will include the removal, fitting and testing of a range of power plant components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft power plant. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft power plant maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft turbine engine is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities


They will understand the safety precautions required when working on the aircraft power plant, especially those for ensuring that the power plant, and its fuel supply, is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 71 Aircraft Power Plant.

2. To display competence in this standard, it is necessary to both remove and fit aircraft power plant components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a



system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

---

## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

---

## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft power plant

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

---

### Outcome

S4 Carry out both of the following activities:

- 4.1 contribute significantly to an engine removal
- 4.2 contribute significantly to an engine installation

Plus: Carry out maintenance (dress/undress) on three of the following parts of the aircraft power plant:

- 4.3 cowling/containment
- 4.4 fireseals and shrouds
- 4.5 engine air intakes
- 4.6 engine mounts
- 4.7 electrical harness
- 4.8 engine drains
- 4.9 attached fittings
- 4.10 nozzles and jet pipes
- 4.11 reverse thrust
- 4.12 exhaust components

---

### Outcome

S5 Remove and fit four different aircraft power plant components (at least two must be from group A):

Group A:

- 5.1 accessory section cowls
- 5.2 scoops
- 5.3 flame arrestors vents
- 5.4 nose ring cowls
- 5.5 actuators
- 5.6 fire wire
- 5.7 compressor fan cowls/compressor module

- 5.8 engine mounts
- 5.9 fire detection units
- 5.10 buried engine ducts
- 5.11 vibration dampers
- 5.12 fire bottle
- 5.13 vortex generators
- 5.14 drain lines
- 5.15 electrical plugs/sockets
- 5.16 cowl flaps
- 5.17 manifolds
- 5.18 conduits
- 5.19 cowling supports
- 5.20 tanks
- 5.21 position indicators
- 5.22 hydraulic pump
- 5.23 integrated drive generator (IDG)
- 5.24 starter
- 5.25 nozzle exhaust
- 5.26 air intake
- 5.27 fan blades
- 5.28 casings
- 5.29 variable inlet guide vane module
- 5.30 combustion system modules
- 5.31 turbine rotor module
- 5.32 gearbox module

Group B:

- 5.33 attachment and locking mechanisms
- 5.34 fittings and brackets
- 5.35 cable harness/wiring/switches/plugs
- 5.36 cables
- 5.37 indicators and warning devices
- 5.38 rod assemblies/levers and linkages
- 5.39 engine mounting bolts
- 5.40 support links
- 5.41 seals
- 5.42 bearing support module
- 5.43 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)

- 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check aircraft power plant, to include carrying out four of the following:

- 7.1 visually checking power plant for damage and leaks
  - 7.2 checking cowl flap rigging
  - 7.3 checking fastenings/security of all power plant access panels/cowls
  - 7.4 checking indicating and warning systems
  - 7.5 carrying out nozzle rigging
  - 7.6 examining engine mounting bolt assemblies
  - 7.7 checking the starting system
- 

## Outcome

S8 Assist in carrying out an engine ground run test, to include carrying out all of the following:

- 8.1 checking that the aircraft is correctly parked in authorised position for a ground run
  - 8.2 positioning all required safety equipment prior to ground run
  - 8.3 carrying out prescribed pre-start and start procedures
  - 8.4 ground running an engine in accordance with maintenance manual and local authority requirements/regulations
  - 8.5 checking and recording all specified parameters
-



## 8.6 shutting down the engine in accordance with specified procedures

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### Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus one of the following:

9.3 aircraft log book

9.4 aircraft cabin log

9.5 component log card

9.6 other record specified by the employer

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### Outcome

- S10 Carry out maintenance on aircraft power plant in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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### Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft power plant (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
-

- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft power plant, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft power plant, and with the tools and equipment used (such as handling oils, greases, aviation fuel, the safe release of fuel and other fluids, traps from moving parts, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain the use of HUMs where applicable to monitor engine performance
- K17 Explain the use of oil analysis in the maintenance of turbine engines and how the results are displayed
- K18 Explain the procedures and process required following an exceedance or event i.e. over temperature or bird strike
- K19 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K20 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K21 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K22 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K23 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in aircraft power plant, and other documents in the maintenance activities
- K24 Explain how to carry out currency/issue checks on the specifications they are working with
- K25 Explain the terminology used in aircraft power plant, and the use of system diagrams and associated symbols
- K26 Describe the basic principles of operation of the power plant being worked on, and the function of the units that make up the system
- K27 Explain the techniques used to remove power plant and power plant components without damage to the components or surrounding structure (such as release of pressures/force, draining of fuel/fluids, removal of components and the need to protect the system integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K28 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K29 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K30 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K31 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K32 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K33 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K34 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K35 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K36 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to remove and refit aircraft power plant components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)

- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as travel and working clearance)
- K40 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain the routine checks and tests to be carried out on the aircraft power plant
- K44 Explain how to conduct engine ground runs and the engine data/parameters to be recorded during the ground run including the use of test equipment
- K45 Explain the importance of carrying out the engine ground run in accordance with the aircraft / engine manual and regulations
- K46 Explain how to record the results of the engine ground run and the documentation that must be used
- K47 Explain how to analyse the ground run results and how to make valid decisions about the acceptability of the aircraft power unit under test to include power assurance checks and power margins
- K48 Explain the procedures to be followed if the power plant fails to meet the ground run specification
- K49 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K50 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 534                      Maintaining and certifying aircraft power plant (ATA 71)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 535

## Maintaining and certifying aircraft turbine engines (ATA 72)

<b>UAN:</b>	R/618/0257
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft turbine engines, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the general maintenance requirements, as applicable to the aircraft type. It does not cover complete engine overhaul, for which other standards are available. The maintenance activities will include the removal, fitting and testing of a range of turbine engine components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used</p>

are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft turbine engines. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft turbine engine maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft turbine engine is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft turbine engines, especially those for ensuring that the engine, and its fuel supply, is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 72 Aircraft Turbine Engines.

2. To display competence in this standard, it is necessary to both remove and fit aircraft turbine engine components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken



- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft turbine engine:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on one of the following types of aircraft turbine engine:

- 4.1 turbo prop
- 4.2 un-ducted fan
- 4.3 turbo-shaft
- 4.4 ducted fan
- 4.5 turbo jet
- 4.6 turbo-fan

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## Outcome

S5 Carry out maintenance on two of the following parts of the aircraft turbine engine:

- 5.1 air intake section
- 5.2 turbine section
- 5.3 reverse thrust
- 5.4 air inlet section
- 5.5 fan section
- 5.6 propulsor section (rear mounted)
- 5.7 compressor section
- 5.8 accessory drives
- 5.9 nozzles and jet pipes
- 5.10 combustion section
- 5.11 by-pass section
- 5.12 reduction gear and shaft section (turboprop or front-mounted driven propulsor)

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## Outcome

S6 Remove and fit six different aircraft turbine engine components (at least two must be from group A):

## Group A

- 6.1 drive shafts
- 6.2 gearboxes/gearbox housing
- 6.3 annulus fillers/sealing strips
- 6.4 reduction gears
- 6.5 drive tubs/shafts
- 6.6 attrition linings
- 6.7 propulsor blades
- 6.8 oil pump assembly
- 6.9 compressor support structural fairings
- 6.10 guide vanes
- 6.11 compressor spinners
- 6.12 shrouds
- 6.13 curvic couplings
- 6.14 bearing housing end cover
- 6.15 rotor/stator fan blades
- 6.16 nose cone support rings
- 6.17 bearings
- 6.18 burner cans
- 6.19 front and rear blade root chocking pads
- 6.20 cooling air manifold
- 6.21 turbine nozzles
- 6.22 bearing support assembly
- 6.23 valves (such as oil tank check)
- 6.24 hydraulic pump
- 6.25 integrated drive generator (IDG)
- 6.26 starter
- 6.27 nozzle exhaust
- 6.28 fuel control/meter unit (FCU/FMU)
- 6.29 air intake

## Group B

- 6.30 attachment and locking mechanisms
- 6.31 fittings and brackets
- 6.32 fairings
- 6.33 rod assemblies/levers and linkages
- 6.34 cables
- 6.35 cable harness/wiring/switches/plugs
- 6.36 support links
- 6.37 nose cowl
- 6.38 indicators and warning devices
- 6.39 mounting bolts
- 6.40 seals
- 6.41 other specific components

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## Outcome

S7 Carry out fifteen of the following maintenance activities:

- 7.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 7.2 removing access panels and covers to expose components to be removed
- 7.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 7.4 disconnecting electrical connections
- 7.5 replacing single use items (such as seals, filters, gaskets)
- 7.6 disconnecting/removing hoses and pipes
- 7.7 removing securing devices and mechanical fasteners
- 7.8 refitting components in the correct position, orientation and alignment
- 7.9 dismantling equipment to an appropriate level
- 7.10 setting, and adjusting replaced components (such as travel, working clearance)
- 7.11 ensuring that any part-dismantled components are secure/supported
- 7.12 making mechanical connections
- 7.13 covering (protecting) exposed components, wires, pipework or vents
- 7.14 making electrical connections
- 7.15 torque loading as required
- 7.16 checking components for serviceability
- 7.17 re-pressurising the system
- 7.18 replacing damaged/defective components
- 7.19 carrying out a system functional check
- 7.20 ensuring that replacement components have the correct part numbers
- 7.21 labelling (and storing in the correct location) components that require repair or overhaul
- 7.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 7.23 carrying out area inspections prior to task close-up

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### Outcome

S8 Service/check aircraft turbine engines, to include carrying out four of the following:

- 8.1 visually checking the system for damage and leaks
- 8.2 checking fastenings/security of all engine access panels/cowls
- 8.3 checking and cleaning rotor and compressor blades (compressor washing)
- 8.4 oil replenishment
- 8.5 carrying out vibration checks
- 8.6 carrying out blade tip clearance checks
- 8.7 carrying out transient acoustic propagation (TAP) test of rotor/compressor blades

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### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus one of the following:

9.3 aircraft log book

9.4 aircraft cabin log

9.5 component log card

9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft turbine engines in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft turbine engines (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified

- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft turbine engines, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft turbine engines, and with the tools and equipment used (such as handling oils, greases, the safe release of fuel and other fluids, traps from moving parts, hot parts of engines, misuse of tools) and how to minimise them and reduce any risk
- K16 Explain what protective equipment need to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in aircraft turbine engines, and other documents in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft turbine engines, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the turbine engine being worked on, and the function of the units that make up the system
- K24 Explain how to remove and refit engines into the airframe, why the correct lifting equipment is used and how this is checked
- K25 Explain how to carry out internal inspections on turbine engines and what defects may be seen during the inspection (bore scope inspections)

- K26 Explain the techniques used to remove turbine engine components without damage to the components or surrounding structure (such as release of pressures/force, draining of fuel/fluids, removal of components and the need to protect the system integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K27 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K28 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K29 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K30 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K31 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K32 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K33 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K34 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K37 Explain how to remove and refit aircraft turbine engine components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as blade tip clearance)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K40 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K41 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K42 Explain the routine checks and tests to be carried out on the aircraft turbine engine

- K43 Explain how to record the results of the checks and tests, and the documentation that must be used
- K44 Explain how to analyse the checks and tests, and make valid decisions about the acceptability of the aircraft turbine engine
- K45 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K46 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 535**

## **Maintaining and certifying aircraft turbine engines (ATA 72)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 536

## Maintaining and certifying aircraft reciprocating engines (ATA 72)

<b>UAN:</b>	Y/618/0258
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft reciprocating engines, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements.</p> <p>It covers both fixed wing and rotary winged aircraft, and covers the general maintenance requirements, as applicable to the aircraft type. It does not cover complete engine overhaul, for which other standards are available. The maintenance activities will include the removal, fitting and testing of a range of reciprocating engine components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.</p>

They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft reciprocating engines. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft reciprocating engines maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the aircraft reciprocating engine is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.


They will understand the safety precautions required when working on the aircraft reciprocating engines, especially those for ensuring that the engine, and its fuel supply, is safely and correctly isolated. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 72 Aircraft Reciprocating Engines.

2. To display competence in this standard, it is necessary to both remove and fit aircraft reciprocating engine components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how



to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft reciprocating engine:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on one of the following types of aircraft reciprocating engine:

- 4.1 in-line engine
- 4.2 vee engine
- 4.3 rotary engine
- 4.4 horizontally-opposed engine

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## Outcome

S5 Carry out maintenance on three of the following parts of the aircraft reciprocating engine:

- 5.1 front section (drive)
- 5.2 cylinder section
- 5.3 lubrication system
- 5.4 power section
- 5.5 supercharger section
- 5.6 power recovery section

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## Outcome

S6 Remove and fit six different aircraft reciprocating engine components (at least three must be from group A):

### Group A

- 6.1 cylinder heads

- 6.2 oil pump assembly
- 6.3 pushrods
- 6.4 carburettor systems
- 6.5 cylinder liners
- 6.6 reduction gear
- 6.7 timing mechanisms
- 6.8 valve mechanisms
- 6.9 fly wheel
- 6.10 piston assemblies
- 6.11 shell bearings
- 6.12 bearing housing end cover
- 6.13 torque converter
- 6.14 camshaft assemblies
- 6.15 injector mechanisms
- 6.16 ball/roller bearings
- 6.17 gearbox
- 6.18 crank shafts
- 6.19 turbo/supercharger
- 6.20 manifolds

#### Group B

- 6.21 attachment and locking mechanisms
- 6.22 cables
- 6.23 fairings
- 6.24 rod assemblies/levers and linkages
- 6.25 springs
- 6.26 pipes and unions
- 6.27 fittings and brackets
- 6.28 sump pans
- 6.29 filters/strainers
- 6.30 pulleys and sprockets
- 6.31 seals and gaskets
- 6.32 belts and chains
- 6.33 other specific components

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### Outcome

S7 Carry out fifteen of the following maintenance activities:

- 7.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 7.2 removing access panels and covers to expose components to be removed
- 7.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 7.4 disconnecting electrical connections
- 7.5 replacing single use items (such as seals, filters, gaskets)
- 7.6 disconnecting/removing hoses and pipes
- 7.7 removing securing devices and mechanical fasteners

- 7.8 refitting components in the correct position, orientation and alignment
  - 7.9 dismantling equipment to an appropriate level
  - 7.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 7.11 ensuring that any part-dismantled components are secure/supported
  - 7.12 making mechanical connections
  - 7.13 covering (protecting) exposed components, wires, pipework or vents
  - 7.14 making electrical connections
  - 7.15 torque loading as required
  - 7.16 checking components for serviceability
  - 7.17 re-pressurising the system
  - 7.18 replacing damaged/defective components
  - 7.19 carrying out a system functional check
  - 7.20 ensuring that replacement components have the correct part numbers
  - 7.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 7.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 7.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S8 Service/check aircraft reciprocating engines, to include carrying out five of the following:

- 8.1 visually checking the system for damage and leaks
  - 8.2 checking fastenings/security of all engine access panels/cowls
  - 8.3 testing and, where appropriate, changing ignition plugs
  - 8.4 carrying out compression checks
  - 8.5 checking and adjusting fuel and ignition timing
  - 8.6 checking and adjusting valve clearance
  - 8.7 checking reference RPM
  - 8.8 checking magnetic chip detectors/filters, and examining foreign matter
  - 8.9 checking and, where appropriate, changing high tension leads
  - 8.10 checking and replenishing oil levels
- 

## Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
  - 9.4 aircraft cabin log
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9.5 component log card

9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft reciprocating engines in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 10.3 Ministry of Defence (MoD)
  - 10.4 Military Aviation Authority (MAA)
  - 10.5 Aerospace Quality Management Standards (AS)
  - 10.6 Federal Aviation Authority (FAA)
  - 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 10.8 manufacturers standards and procedures
- 

## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft reciprocating engines (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
  - K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
  - K3 Explain how to prioritise their own workload to ensure that targets are met
  - K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
  - K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
  - K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
  - K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
  - K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
  - K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
-

- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft reciprocating engines and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft reciprocating engines, and with the tools and equipment used (such as handling oils, greases, the safe release of fuel and other fluids, traps from moving parts, hot parts of engines, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, system and physical layouts, specifications, symbols used in aircraft reciprocating engines, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft reciprocating engines, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the reciprocating engine being worked on, and the function of the units that make up the system
- K24 Explain the techniques used to remove reciprocating engine components without damage to the components or surrounding structure (such as release of pressures/force, draining of fuel/fluids, removal of components and the need to protect the system integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K25 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K26 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufacturers SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)

- K27 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K28 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K29 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K30 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K31 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K35 Explain how to remove and refit aircraft reciprocating engine components safely and correctly (such as use of lifting and handling equipment; ensuring the correct tightness of connections; eliminating stress on pipework/connections; carrying out visual checks of all components)
- K36 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as valve clearance, ignition timing, belt/chain tension)
- K37 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K38 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K39 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K40 Explain the routine checks and tests to be carried out on the aircraft reciprocating engine
- K41 Explain how to record the results of the checks and tests, and the documentation that must be used
- K42 Explain how to analyse the checks and tests, and how to make valid decisions about the acceptability of the aircraft reciprocating engine
- K43 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K44 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 536**

## **Maintaining and certifying aircraft reciprocating engines (ATA 72)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 537

## Maintaining and certifying aircraft engine fuel and control systems (ATA 73)

<b>UAN:</b>	D/618/0259
<b>Level:</b>	Level 4
<b>GLH:</b>	210
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft engine fuel and control systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers fixed wing and rotary winged aircraft, and includes both turbine and reciprocating engines, as applicable to the aircraft type. For turbine engines, it covers those units and components and associated mechanical systems or electrical circuits which deliver or control fuel to the engine beyond the main fuel quick disconnect. This includes engine driven fuel pumps and filter assembly, main and thrust augmentation fuel controls, electronic temperature datum control, temperature datum valve, fuel manifold, fuel nozzles, fuel enrichment system, speed sensitivity switch, relay box assembly and solenoid drip valves. For reciprocating engines, it covers those units and components which deliver metered fuel and air to the engine, and includes the carburettor master control from the inlet side to the discharge nozzles, injection pumps, carburettor, injection nozzles and fuel primer. The air portion includes units and components from the scoop inlet to the vapour return and impeller chamber. The maintenance activities will include the removal, fitting and testing of a range of engine fuel system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p>

Their responsibilities will require them to plan, communicate and allocate the maintenance activities to the team. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft engine fuel and control systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft the engine fuel and control system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the aircraft engine fuel and control systems, especially those for ensuring the system cleanliness and the avoidance of spillage, fire and explosion. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

## Notes:

1.This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 73 Engine Fuel and Control

2.To display competence in this standard, it is necessary to both remove and fit aircraft engine fuel and control system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity
- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
- 1.4 support maintenance activities within the team, taking into account
  - a) their existing workloads
  - b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
- 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
- 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
- 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
- 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
- 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

#### S2 Carry out all of the following during the maintenance of the aircraft engine fuel and control system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)



- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

### Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software
  - 3.3 aircraft/equipment self-diagnostics/computer downloads
  - 3.4 troubleshooting guides/charts
  - 3.5 approved sensory checks (such as sight, sound, smell, touch)
  - 3.6 reports (such as pilot or operator)
- 

### Outcome

- S4 Carry out maintenance on two of the following parts of the aircraft engine fuel and control system:

- 4.1 distribution
  - 4.2 controlling and governing
  - 4.3 indicating/gauging
- 

### Outcome

- S5 Remove and fit six different aircraft engine fuel and control system components (at least two must be from group A):

#### Group A:

- 5.1 control valves (such as fuel return, temperature datum, solenoid drip, burner staging)
  - 5.2 engine driven pump
  - 5.3 rotor alternator
  - 5.4 hydro-mechanical units
  - 5.5 fuel nozzles
-

- 5.6 fuel manifold
- 5.7 servo fuel heater
- 5.8 injector nozzles
- 5.9 fuel primer
- 5.10 relay box assembly
- 5.11 turbine governor
- 5.12 carburettor
- 5.13 valves
- 5.14 fuel flow divider
- 5.15 injector pump
- 5.16 solenoids
- 5.17 stator alternator
- 5.18 engine fuel/oil cooler
- 5.19 electronic control unit
- 5.20 engine control unit
- 5.21 engine interface unit
- 5.22 inflight fuelling probe
- 5.23 fuel detection device

Group B:

- 5.24 pipes/hose assemblies
- 5.25 fuel pressure indicating devices
- 5.26 levers and linkages
- 5.27 differential fuel switch
- 5.28 cables and pulleys
- 5.29 fuel flow indicating devices
- 5.30 actuators
- 5.31 safety devices
- 5.32 fuel filters
- 5.33 fuel flow sensor/transmitter
- 5.34 temperature regulator
- 5.35 gaskets and seals
- 5.36 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment

- 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S7 Service/check the aircraft engine fuel and control system, to include carrying out three of the following:

- 7.1 checking the system for leaks
- 7.2 checking and cleaning/replacing filters
- 7.3 cleaning injector nozzles
- 7.4 checking carburettor float setting
- 7.5 checking fuel/meter control unit (FCU/FMU)
- 7.6 adjust/rigging throttle box
- 7.7 cleaning/testing fuel nozzles
- 7.8 adjusting automatic mixture control (AMC)
- 7.9 adjusting ABC
- 7.10 checking indicating systems (such as fuel flow, fuel pressure and temperature warning)

- S8 Carry out two of the following tests on the aircraft engine fuel and control system:

- 8.1 leak test
- 8.2 built in test equipment (BITE) test
- 8.3 fuel pressure test
- 8.4 'special-to-type' tests
- 8.5 fuel flow test
- 8.6 engine run

Using **one** of the following:

- 8.7 aircraft power source/system
- 8.8 ground test rig

## 8.9 'special to type' test equipment

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### Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

9.1 job cards/work sheets

9.2 aircraft technical log

Plus one of the following:

9.3 aircraft log book

9.4 aircraft cabin log

9.5 component log card

9.6 other record specified by the employer

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### Outcome

- S10 Carry out maintenance on aircraft engine fuel and control systems in compliance with one of the following:

10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

10.3 Ministry of Defence (MoD)

10.4 Military Aviation Authority (MAA)

10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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### Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft engine fuel and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft engine fuel and control systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Explain the safety procedures that must be carried out before work is started on removing the engine fuel and control system components (such as displaying warning notices, ensuring adequate firefighting equipment)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with removing aircraft engine fuel and control system components, and with the tools and equipment used (such as handling fluids, flammable fluids, fire and explosion, misuse of tools) and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft

- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft engine fuel and control systems, and other documents needed in the maintenance process
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft engine fuel and control systems
- K23 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K24 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K25 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K26 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K27 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K28 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K29 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K30 Describe the various types of pipe and component that make up the aircraft engine fuel and control system (such as rigid pipes; flexible hoses; valves, pumps, injector nozzles, governor, fuel heater, fuel and oil cooler, mechanical and electrical control and indicating devices)
- K31 Describe the basic principles of operation of the aircraft engine fuel and control system being worked on, and the function of the various units/components within the system
- K32 Explain the techniques used to remove components from aircraft engine fuel and control systems without damage to the components or surrounding structure (such as release of pressures/force, draining of fluids, proof marking, and the protecting circuit integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K33 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the methods of lifting and supporting the components/equipment during the maintenance activities
- K36 Explain how to recognise contaminants, and the problems they can create; the effects and likely symptoms of contamination in the engine fuel system

- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to fit components into the circuit (such as the use of gaskets/seals; ensuring the correct tightness of pipe fittings and connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking the security of joints and that the system is safe to refuel)
- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow and pressure settings and their effect on the engine fuel system)
- K40 Explain why electrical bonding is critical and why it must be both mechanically and electrically secure
- K41 Explain why securing devices need to be correctly torque loaded, locked and labelled, and the different methods used
- K42 Explain how to carry out routine checks and servicing of the aircraft engine fuel and control system (including checking for leaks, checking and changing filters, checking and cleaning injectors and fuel nozzles)
- K43 Explain the types of test to be carried out on the aircraft engine fuel system and the test equipment to be used
- K44 Explain the methods and procedures to be used to carry out the various tests on the engine fuel and control system
- K45 Explain the importance of carrying out tests in the specified sequence and checking/recording the results at each stage
- K46 Explain how to record the results of each individual test and the documentation that must be used
- K47 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft engine fuel and control system
- K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K49 Explain the types of tests and functional checks that are required after replacement of fuel system components (ground running checks)
- K50 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K51 Describe the procedure for the safe disposal of waste materials, scrap components and waste fuel
- K52 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 537                      Maintaining and certifying aircraft engine fuel and control systems (ATA 73)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 538

## Maintaining and certifying aircraft ignition systems (ATA 74)

<b>UAN:</b>	R/618/0260
<b>Level:</b>	Level 4
<b>GLH:</b>	240
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft ignition systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes units and components which generate the electrical power, control and provide or distribute high and low voltage electrical current to ignite the fuel air mixture in the cylinders of reciprocating engines or in the combustion chambers or thrust augmentation of turbine engines. The maintenance activities will include the removal, fitting and testing of a range of ignition system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft ignition systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft ignition system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the aircraft xxxxx, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 74 Ignition.
2. To display competence in this standard, it is necessary to both remove and fit aircraft ignition system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be

completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

**S2** Carry out all of the following during the maintenance of the aircraft ignition system

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

**S3** Use a variety of diagnostic aids and information sources, to include three of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft ignition system:

- 4.1 generation of high and low voltage electrical power supply
- 4.2 distribution of the power supply (ignition harness)
- 4.3 ignition switching/isolation

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## Outcome

S5 Remove and fit six different ignition system components (at least two must be from group A):

Group A:

- 5.1 magneto
- 5.2 high energy ignition units
- 5.3 exciters
- 5.4 ignition switches
- 5.5 distributor
- 5.6 low tension coil
- 5.7 transformers
- 5.8 capacitors
- 5.9 ignition/induction vibrator
- 5.10 ignition relays
- 5.11 ignition harness
- 5.12 booster coils

Group B:

- 5.13 spark plugs
- 5.14 low tension leads
- 5.15 transducers/sensors
- 5.16 glow plugs
- 5.17 electrical plugs/sockets
- 5.18 wires/cables
- 5.19 high tension leads

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up

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## Outcome

S7 Carry out two of the following types of check/test on the aircraft ignition system:

- 7.1 test spark plugs
- 7.2 check HT leads
- 7.3 built in test equipment BITE test
- 7.4 test glow plugs
- 7.5 ignition timing
- 7.6 'special-to-type' tests
- 7.7 check ignition unit
- 7.8 test igniters

Using **one** of the following:

- 7.9 stroboscope
- 7.10 aircraft power source
- 7.11 'special-to-type' test sets
- 7.12 measuring equipment (such as gap gauges)

S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Using **one** of the following:

- 8.3 aircraft log book
- 8.4 aircraft cabin log
- 8.5 component log card
- 8.6 other record specified by the employer

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## Outcome

S9 Carry out maintenance on aircraft ignition systems in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 9.3 Ministry of Defence (MoD)
- 9.4 Military Aviation Authority (MAA)
- 9.5 Aerospace Quality Management Standards (AS)
- 9.6 Federal Aviation Authority (FAA)
- 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 9.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft engine fuel and control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft ignition systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft ignition system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft ignition systems, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with



- K21 Explain the terminology used in aircraft ignition systems, and the use of system diagrams and associated symbols
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the basic principles of operation of the ignition system being worked on, and the function of the various units within the system
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft ignition systems without damage to the components or surrounding structure
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components without damage to the components or surrounding structure
- K39 Explain procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

- K40 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K41 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K42 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K43 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K44 Describe the problems that can occur with the maintenance operations, and how these can be overcome
- K45 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K46 Explain how to carry out routine checks and servicing of the aircraft ignition system (including adjusting plug gaps and checking ignition timing)
- K47 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before working on the ignition system
- K48 Explain the types of test to be carried out on the aircraft ignition system and the test equipment to be used
- K49 Explain the methods and procedures to be used to carry out the various tests on the ignition system
- K50 Explain how to record the results of each individual test and the documentation that must be used
- K51 Explain how to analyse the test results and how to make valid decisions about the acceptability of the ignition system
- K52 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K53 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K55 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 538**

## **Maintaining and certifying aircraft ignition systems (ATA 74)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 539

## Maintaining and certifying aircraft bleed air systems (ATA 75)

<b>UAN:</b>	Y/618/0261
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft bleed air systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which go together to conduct air to the extension shaft and torque meter assembly. It includes compressor bleed systems used to control flow of air through the engine, cooling air systems and heated air systems for engine anti-icing. It does not include aircraft anti-icing, engine starting systems, or exhaust supplementary air systems, which are covered in other standards/ATA chapters. The maintenance activities will include the removal, fitting and testing of a range of aircraft air bleed system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>

bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft air bleed systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the air bleed system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft air bleed system, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 75 Bleed Air.

2. To display competence in this standard, it is necessary to both remove and fit aircraft engine bleed air system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if

maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft air bleed system

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

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- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft engine bleed air system:

- 4.1 engine anti-icing
- 4.2 compressor bleed valve
- 4.3 engine cooling
- 4.4 bleed air indicating
- 4.5 compressor bleed control
- 4.6 bleed air system wiring
- 4.7 compressor bleed governor
- 4.8 nozzle control system

---

## Outcome

S5 Remove and fit four different aircraft engine bleed air system components (at least one must be from group A):

Group A:

- 5.1 jet pump
- 5.2 valves
- 5.3 vortex spoiler
- 5.4 compressor
- 5.5 actuators
- 5.6 air motor servo units (AMSU)
- 5.7 governor
- 5.8 regulator

Group B:

- 5.9 levers and linkages
- 5.10 air filters
- 5.11 cables/harness/wiring
- 5.12 control mechanisms
- 5.13 sensors/transmitters



- 5.14 plugs/sockets/switches
  - 5.15 ducting
  - 5.16 warning devices (temperature, pressure)
  - 5.17 pipes and hoses
  - 5.18 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft bleed air system, to include carrying out **four** of the following:

- 7.1 inspecting engine anti-icing system
  - 7.2 inspecting variable stator blades
  - 7.3 checking and adjusting compressor bleed governor
  - 7.4 checking and adjusting pressure regulator
-

- 7.5 checking bleed air indicating systems (such as pressure, temperature, control positions)
- 7.6 checking blow-off valve (BOV)
- 7.7 checking compressor control bleed valves/mechanisms

S8 Carry out two of the following tests on the aircraft bleed air system:

- 8.1 leak test
- 8.2 reduced system test
- 8.3 pressure test
- 8.4 movement tests (such as range, timing, sequencing)
- 8.5 'special-to-type' tests
- 8.6 built in test equipment (BITE) test

Using one of the following:

- 8.7 aircraft power source/system
- 8.8 ground test rig

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### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

S10 Carry out maintenance on aircraft air bleed systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)

## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft bleed air systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft bleed air systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

- K15 Describe the hazards associated with carrying out maintenance activities on aircraft bleed air systems, and with the tools and equipment used (such as hot parts of engines, traps from moving parts, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pneumatic systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain the terminology used in aircraft bleed air systems, and the use of system diagrams and associated symbols
- K30 Describe the basic principles of operation of the aircraft bleed air system being worked on (such as system layout, engine cooling, engine anti-icing, compressor control and indication and warning)
- K31 Explain the techniques used to remove components from aircraft bleed air systems without damage to the components or surrounding structure (such as release of pressures/force, removal of components and the need to protect the circuit integrity by ensuring that exposed components and pipe ends are correctly covered/protected)

- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K35 Explain how to fit components into the circuit (such as ensuring correct position and orientation; correct the tightness of fittings and connections; eliminating stress on pipework, cables and connections; carrying out visual checks of all components)
- K36 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K37 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting travel and freedom of movement; governor settings and their effect on the bleed air system)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K40 Explain how to carry out routine checks and servicing of the aircraft bleed air system (including checking the engine anti-icing system, the compressor bleed governor and the variable stator blades)
- K41 Explain the types of test to be carried out on the aircraft bleed air system and the test equipment to be used
- K42 Explain the methods and procedures to be used to carry out the various tests on the bleed air system
- K43 Explain how to record the results of the tests and the documentation that must be used
- K44 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft bleed air system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 539**

## **Maintaining and certifying aircraft bleed air systems (ATA 75)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 540

## Maintaining and certifying aircraft engine control systems (ATA 76)

<b>UAN:</b>	D/618/0262
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft engine control systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It includes units and components which govern operation of the engine, and includes units and components that are interconnected for emergency shutdown. The maintenance activities will include the removal, fitting and testing of a range of aircraft engine control system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used</p>

are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft engine control systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft engine control system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the aircraft engine control system, and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace. They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1 This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 76 Engine Controls.

2. To display competence in this standard, it is necessary to both remove and fit aircraft engine control system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.



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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads

- b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

- S2 Carry out all of the following during the maintenance of the aircraft engine control system:
- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:
- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software

- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

- S4 Carry out maintenance on two of the following parts of the aircraft engine control systems:

- 4.1 engine synchronizing
- 4.2 emergency shutdown
- 4.3 mixture control
- 4.4 engine control system wiring
- 4.5 power control
- 4.6 variable air intake
- 4.7 throttles
- 4.8 nozzle control system
- 4.9 start system
- 4.10 fuel/air control
- 4.11 reverse thrust
- 4.12 engine monitoring unit
- 4.13 digital engine control
- 4.14 engine bypass

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## Outcome

- S5 Remove and fit four different aircraft engine control system components from the following:

- 5.1 cables and pulleys
- 5.2 levers and linkages
- 5.3 turnbuckles
- 5.4 sensors
- 5.5 connecting rods
- 5.6 actuators
- 5.7 jack screws
- 5.8 cables/harness/wiring
- 5.9 position transmitters
- 5.10 motors
- 5.11 locks and stops
- 5.12 plugs/sockets/switches
- 5.13 start valve
- 5.14 servos

- 5.15 bell cranks
  - 5.16 fuel control/meter unit (FCU/FMU/DECU)
  - 5.17 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out three of the following types of test/check on the aircraft engine control systems:

- 7.1 rig thrust lever
  - 7.2 rig/check reverse thrust
  - 7.3 rig RPM control
  - 7.4 rig/check bypass
  - 7.5 rig mixture high pressure cock lever
  - 7.6 check cable tension
-

- 7.7 rig power lever
- 7.8 adjust pedestal micro switches
- 7.9 check control synchronization (multi-engine)
- 7.10 check range and sense of operation of controls
- 7.11 engine run
- 7.12 'special-to-type' tests
- 7.13 rig/check variable intake
- 7.14 built in test equipment (BITE) test

Using two of the following:

- 7.15 built in test equipment (BITE)
- 7.16 ground support equipment
- 7.17 'special-to-type' test equipment
- 7.18 aircraft power supply/displays and gauges
- 7.19 use of safety locks
- 7.20 measuring equipment

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following:

- 8.3 aircraft log book
- 8.4 aircraft cabin log
- 8.5 component log card
- 8.6 other record specified by the employer

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## Outcome

- S9 Carry out maintenance on aircraft engine control systems in compliance with one of the following:

- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 9.3 Ministry of Defence (MoD)
- 9.4 Military Aviation Authority (MAA)
- 9.5 Aerospace Quality Management Standards (AS)
- 9.6 Federal Aviation Authority (FAA)
- 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 9.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft engine control systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft engine controls, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft engine control system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock

- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft maintenance manuals, log books, flight logs, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft engine control systems, and the use of system diagrams and associated symbols
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the basic principles of operation of the aircraft engine control system being worked on, and the function of the various units/components within the system
- K30 Explain the techniques used to remove components from aircraft engine control systems without damage to the components or surrounding structure (such as proof marking, extraction of components and the need to protect the system integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K31 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K32 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K33 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K34 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities

- K35 Explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
- K36 Explain the need to replace items such as seals and gaskets
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to replace and reconnect components into the system (such as ensuring the correct orientation, position and alignment; tightening securing devices to the required torque; replacing locking and securing devices; eliminating stress on pipework/connections; ensuring that pipework and cables are correctly supported at suitable intervals; carrying out visual checks of all components)
- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel)
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Explain how to carry out routine checks and servicing of the aircraft engine control system
- K42 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K43 Explain the types of test to be carried out on the aircraft engine control system, and the test equipment to be used
- K44 Explain the methods and procedures to be used to carry out the various tests on the engine control system
- K45 Explain the importance of carrying out the tests in the specified sequence, checking all readings and movements at each stage
- K46 Explain how to record the results of the checks and tests, and the documentation that must be used
- K47 Explain how to analyse the test results and make valid decisions about the acceptability of the engine control systems
- K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K49 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K50 Describe the problems that can occur with the aircraft engine control system maintenance operations and how these can be overcome
- K51 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K52 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K53 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve



## **Unit 540**

## **Maintaining and certifying aircraft engine control systems (ATA 76)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 541

## Maintaining and certifying aircraft engine indicating systems (ATA 77)

<b>UAN:</b>	H/618/0263
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft engine indicating systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft and covers the units and components which provide a means of pressurising, heating, cooling, moisture controlling, filtering and treating air used to ventilate the areas of the fuselage within the pressure zone, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of aircraft engine indicating systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft engine indicating systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft engine indicating systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities

They will understand the safety precautions required when working on the aircraft engine indicating systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 77 Engine Indicating Systems.

2. To display competence in this standard, it is necessary to both remove and fit aircraft engine indicating system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if

maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal logbook with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out **all** the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft engine indicating system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on four of the following parts of the aircraft engine indicating systems:

- 4.1 power indicating system
- 4.2 engine revs per minute (RPM)
- 4.3 inter turbine temperature
- 4.4 engine pressure ratio (EPR)
- 4.5 cylinder head temperature
- 4.6 chip detection
- 4.7 engine brake mean effective pressure/torque
- 4.8 engine exhaust gas temperature
- 4.9 bleed air
- 4.10 turbine inlet temperature
- 4.11 ignition analyzer
- 4.12 manifold pressure (MP)
- 4.13 turbine blade temperature
- 4.14 vibration analyser
- 4.15 oil pressure indication
- 4.16 Nf tacho
- 4.17 integrated instrument systems
- 4.18 fuel flow indication
- 4.19 Ng tacho
- 4.20 engine temperature
- 4.21 engine oil pressure/ temperature/quantity
- 4.22 system wiring

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### Outcome

S5 Remove and fit four different aircraft indicating/recording system components (at least two must be from group A):

Group A:

- 5.1 display units
- 5.2 amplifiers
- 5.3 analysers
- 5.4 computers
- 5.5 generators (such as pulse, speed/tacho, tone)
- 5.6 phase detectors
- 5.7 instruments/gauges
- 5.8 thermocouples

Group B:

- 5.9 transmitters (such as temperature, flow, pressure, vibration)
- 5.10 relays
- 5.11 wires/cables
- 5.12 capacitance units
- 5.13 plugs/sockets
- 5.14 receivers
- 5.15 transducers/sensors
- 5.16 switches (such as micro, proximity)
- 5.17 circuit breakers
- 5.18 input and follow-up devices
- 5.19 other specific components

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Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check

- 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out two of the following tests on the aircraft engine indicating systems:

- 7.1 continuity check
- 7.2 leak test
- 7.3 voltage check
- 7.4 engine run
- 7.5 comparison check
- 7.6 built in test equipment BITE test
- 7.7 vibration analysis
- 7.8 'special-to-type' tests
- 7.9 functional test

Using two of the following:

- 7.10 measuring equipment
- 7.11 'special-to-type' test sets
- 7.12 external power source (such as electrical/hydraulic)
- 7.13 aircraft power source (such as electrical/hydraulic)
- 7.14 pitot/static pump/digital air data test equipment

S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 8.1 job cards/work sheets
- 8.2 aircraft technical log

Plus one of the following:

- 8.3 aircraft log book
  - 8.4 aircraft cabin log
  - 8.5 component log card
  - 8.6 other record specified by the employer
- 

## Outcome

S9 Carry out maintenance on aircraft engine indicating systems in compliance with one of the following:

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- 9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
  - 9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
  - 9.3 Ministry of Defence (MoD)
  - 9.4 Military Aviation Authority (MAA)
  - 9.5 Aerospace Quality Management Standards (AS)
  - 9.6 Federal Aviation Authority (FAA)
  - 9.7 aircraft maintenance manual/approved change documentation (service bulletin)
  - 9.8 manufacturers standards and procedures
- 

## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft indication and recording systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)

- K13 Explain the importance of maintenance on aircraft engine indicating systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft engine indication systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft indication and recording systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain the terminology used in aircraft engine indication systems, and the use of system diagrams and associated symbols

- K30 Describe the basic principles of operation of the engine indicating system being worked on, and the function of the various units that make up the system
- K31 Explain the techniques used to remove components from the aircraft engine indicating systems without damage to the components or surrounding structure (such as removal of components and the need to protect the circuit integrity by labelling and covering exposed circuits)
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K35 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K36 Explain how to fit equipment and components into the system (such as ensuring the correct position and orientation; ensuring the correct tightness of fastenings; eliminating stress on cables; correctly making electrical connections; carrying out visual checks of all components)
- K37 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as zero, range, travel and working clearance)
- K38 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K39 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K40 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K41 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K42 Explain how to carry out routine checks and servicing of the aircraft engine indicating system (including checking for security of equipment)
- K43 Explain the types of test to be carried out on the aircraft engine indicating system (such as continuity, voltage) and the test equipment to be used
- K44 Explain the methods and procedures to be used to carry out the various tests on the engine indicating system
- K45 Explain how to record the results of each individual test and the documentation that must be used
- K46 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft engine indicating systems
- K47 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K48 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

- K49 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K50 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 541                      Maintaining and certifying aircraft engine indicating systems (ATA 77)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 542

## Maintaining and certifying aircraft engine exhaust systems (ATA 78)

<b>UAN:</b>	K/618/0264
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft engine exhaust systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide a means of pressurising, heating, cooling, moisture controlling, filtering and treating air used to ventilate the areas of the fuselage within the pressure zone, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of aircraft engine exhaust systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>

that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft engine exhaust systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft engine exhaust systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft engine exhaust systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 78 Engine Exhaust.
2. To display competence in this standard, it is necessary to both remove and fit aircraft engine exhaust system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if

maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken



- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft engine exhaust system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

---

### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft engine exhaust system:

- 4.1 collector/tailpipe/nozzle
- 4.2 supplementary air
- 4.3 noise suppressor
- 4.4 engine exhaust system wiring
- 4.5 thrust reverser
- 4.6 thrust augmentation

---

### Outcome

S5 Remove and fit four different aircraft engine exhaust system components (at least one must be from group A):

Group A:

- 5.1 collector rings
- 5.2 actuators
- 5.3 jet pipe
- 5.4 exhaust mixer ducts
- 5.5 clamshells
- 5.6 exhaust cone
- 5.7 thrust augmentation ducts
- 5.8 tertiary air doors
- 5.9 shroud assembly
- 5.10 variable nozzles
- 5.11 service panels/fairings
- 5.12 trimmers
- 5.13 integrated nozzle assembly

Group B:

- 5.14 levers and linkages
  - 5.15 pipes and hoses
  - 5.16 cables/harness/wiring
  - 5.17 control mechanisms
  - 5.18 air filters
  - 5.19 plugs/sockets/switches
  - 5.20 ducting
  - 5.21 springs
  - 5.22 position indicators/warning devices
  - 5.23 baffles
  - 5.24 shields
  - 5.25 seals
  - 5.26 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
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## Outcome

S7 Service/check the aircraft engine exhaust system, to include carrying out three of the following:

- 7.1 inspecting the integrated nozzle assembly (INA) (such as for cracks, distortion, dents/damage to acoustical lining)
- 7.2 inspecting the collector nozzle system
- 7.3 inspecting the exhaust cone (such as cracks, dents, nicks or scores, distortion)
- 7.4 inspecting the exhaust gasket
- 7.5 checking and adjusting trimmers
- 7.6 carrying out a pressure check of the cabin heater muff
- 7.7 checking exhaust indicating systems (such as control positions)

S8 Carry out two of the following tests on the aircraft engine exhaust system:

- 8.1 leak test
- 8.2 movement tests (such as range, timing, sequencing)
- 8.3 pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 'special-to-type' tests

Using one of the following:

- 8.6 aircraft power supply/systems
- 8.7 ground test rig

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft engine exhaust systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft engine exhaust systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)

- K13 Explain the importance of maintenance on aircraft engine exhaust systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft engine exhaust systems, and with the tools and equipment used (such as hot parts of engines, traps from moving parts, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft engine exhaust systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain the terminology used in aircraft engine exhaust systems, and the use of system diagrams and associated symbols

- K30 Describe the basic principles of operation of the aircraft engine exhaust system being worked on (such as system layout, noise suppression, thrust reverser, supplementary air control, and indication and warning)
- K31 Explain the techniques used to remove components from aircraft engine exhaust systems without damage to the components or surrounding structure (such as release of pressures/force, removal of components and the need to protect the circuit integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K35 Explain how to fit components into the system (such as ensuring the correct position and orientation; correct tightness of fittings and connections; eliminating stress on pipework, cables and connections; carrying out visual checks of all components)
- K36 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K37 Explain why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting travel and freedom of movement)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K40 Explain how to carry out routine checks and servicing of the aircraft engine exhaust system (including checking the security of critical fasteners, checking the condition of the exhaust gasket, pressure checking the cabin heater muff)
- K41 Explain the types of test to be carried out on the aircraft engine exhaust system, and the test equipment to be used
- K42 Explain the methods and procedures to be used to carry out the various tests on the exhaust system
- K43 Explain how to record the results of the tests, and the documentation that must be used
- K44 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft exhaust system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 542**

## **Maintaining and certifying aircraft engine exhaust systems (ATA 78)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.



## Unit 543

## Maintaining and certifying aircraft lubricating oil systems (ATA 79)

<b>UAN:</b>	M/618/0265
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft lubricating oil systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components external to the engine, which store and deliver lubricating oil to and from the engine. It includes units and components from the lubricating oil engine outlet to the inlet, including the inlet and outlet fittings, tanks, radiators, valves, and the auxiliary oil systems. The maintenance activities will include the removal, fitting and testing of a range of aircraft lubricating oil systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufacturers SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems</p>

with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft lubricating oil systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft lubricating oil system maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft lubricating oil systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 79 Lubricating Oil.
2. To display competence in this standard, it is necessary to both remove and fit aircraft lubricating oil system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks

cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken

- 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

- S2 Carry out all of the following during the maintenance of the aircraft lubricating oil system
- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on two of the following parts of the aircraft lubricating oil system:

- 4.1 oil storage
- 4.2 oil cooling
- 4.3 oil indicating
- 4.4 distribution
- 4.5 oil pressure/regulation
- 4.6 system wiring

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### Outcome

S5 Remove and fit four different aircraft lubricating oil system components (at least one must be from group A):

Group A:

- 5.1 control valves (such as drain, bleed, change over, fire wall, dump)
- 5.2 main oil tanks
- 5.3 scavenge pump
- 5.4 regulators (temperature, flow)
- 5.5 auxiliary oil tank
- 5.6 oil cooling units
- 5.7 tank interconnectors
- 5.8 primary or secondary pressure pump
- 5.9 radiator
- 5.10 oil transmitter units (such as pressure, temperature, quantity)
- 5.11 oil distribution block/manifold
- 5.12 valves (such as oil pressure relief, shut-off)
- 5.13 oil tubes and connectors

Group B:

- 5.14 pipes/hoses
  - 5.15 pressure switches
  - 5.16 ventilating components
  - 5.17 oil filler necks and caps
  - 5.18 safety devices
  - 5.19 sensors
  - 5.20 magnetic chip detectors (MCD)
  - 5.21 wires/cables
  - 5.22 solenoids
  - 5.23 gaskets and seals
  - 5.24 plugs/sockets
  - 5.25 oil filters
  - 5.26 MCD housings
  - 5.27 strainer (pressure pump)
  - 5.28 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required
- 6.16 checking components for serviceability
- 6.17 re-pressurising the system
- 6.18 replacing damaged/defective components
- 6.19 carrying out a system functional check
- 6.20 ensuring that replacement components have the correct part numbers
- 6.21 labelling (and storing in the correct location) components that require repair or overhaul
- 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
- 6.23 carrying out area inspections prior to task close-up

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## Outcome

S7 Service/check the aircraft lubricating oil system, to include carrying out three of the following:

- 7.1 checking the system for leaks
- 7.2 checking and cleaning/replacing filters/strainers
- 7.3 flushing out the oil system
- 7.4 checking and replenishing the oil system
- 7.5 examining engine oil tubes for damage or leaks
- 7.6 checking calibration of oil quantity gauges (labelling or other methods)
- 7.7 checking, and where applicable, adjusting pressure relief valve
- 7.8 checking indicating systems (such as temperature warning, oil level, oil pressure)

S8 Carry out three of the following tests on the aircraft lubricating oil system:

- 8.1 leak test
- 8.2 checking contents of magnetic chip indicators against specification
- 8.3 oil level/contents check
- 8.4 oil sampling/check
- 8.5 'special-to-type' tests
- 8.6 built in test equipment (BITE) test

Using one of the following:

- 8.7 oil sampling devices
- 8.8 MCD particle analysis equipment
- 8.9 aircraft power source/system
- 8.10 ground test rig (such as air flow)

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## Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

S10 Carry out maintenance on aircraft lubricating oil systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when carrying out maintenance activities on aircraft lubricating oil systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process



- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft lubricating oil systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with removing aircraft engine lubrication system components, and with the tools and equipment used (such as handling oils and fluids, misuse of tools), and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft lubricating oil systems, and other documents in the maintenance process
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual, manufacturers SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis

- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain the terminology used in aircraft lubricating oil systems, and the use of system diagrams and associated symbols
- K30 Describe the various types of pipe and component that make up the aircraft lubricating oil system (such as rigid pipes; flexible hoses; pipe connectors; pipe sealing and supporting devices; valves used for flow, pressure control and bypass; oil pumps (such as main pressure, secondary and scavenger); oil coolers and radiators; mechanical and electrical control devices)
- K31 Describe the basic principles of operation of the aircraft lubricating oil system being worked on, and the function of the various units/components within the system
- K32 Explain the techniques used to remove components from aircraft lubricating oil systems without damage to the components or surrounding structure (such as release of pressures, draining of fluids, proof marking, extraction of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K33 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the methods of lifting, and supporting the components/equipment during the removal and replacement activities
- K36 Explain how to recognise contaminants, and the problems they can create; the effects and likely symptoms of contamination in the lubricating oil system
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K38 Explain how to fit components into the circuit (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and connections; eliminating stress on pipework/connections; carrying out visual checks of all components; checking the security of joints and that the system is safe to refill)
- K39 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow and pressure settings, and their effect on the system, travel and working clearance)
- K40 Explain why bonding is critical, and why it must be both mechanically and electrically secure
- K41 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the methods to be used
- K42 Explain how to carry out routine checks and servicing of the aircraft lubricating oil system (including checking for leaks, checking and changing filters, checking the calibration of oil quantity gauges)
- K43 Explain the types of test to be carried out on the aircraft lubricating oil system, and the test equipment to be used

- K44 Explain the methods and procedures to be used to carry out the various tests on the lubricating oil system
- K45 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K46 Explain how to record the results of each individual test and the documentation that must be used
- K47 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft lubricating oil system
- K48 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K49 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K50 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K51 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 543**

## **Maintaining and certifying aircraft lubricating oil systems (ATA 79)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 544

## Maintaining engine and certifying aircraft starting systems (ATA 80)

<b>UAN:</b>	T/618/0266
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft starting systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers units and components used for starting the engine, including electrical, inertia air or other starter systems. It does not include ignition systems, which are covered in other standards/ATA chapters. The maintenance activities will include the removal, fitting and testing of a range of aircraft starting systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people.</p>

They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft starting systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft starting systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft starting systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 80 Starting.

2. To display competence in this standard, it is necessary to both remove and fit aircraft starter system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads

- b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

S2 Carry out all of the following during the maintenance of the aircraft starting systems

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads



- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on three of the following parts of the aircraft starting system:

- 4.1 engine cranking
- 4.2 engine starter
- 4.3 start valves/controls
- 4.4 starter system wiring

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## Outcome

S5 Remove and fit four different starter system components (at least two must be from group A):

Group A:

- 5.1 starter
- 5.2 actuator
- 5.3 solenoid
- 5.4 starter quick attach-detach adapter (QAD)
- 5.5 solenoid valve
- 5.6 electrical/electronic modules
- 5.7 starter control valve
- 5.8 cluster gear assembly
- 5.9 air/hydraulic modules
- 5.10 butterfly valve
- 5.11 clutch mechanism
- 5.12 starter harness
- 5.13 pistons
- 5.14 ring gear
- 5.15 starter switch
- 5.16 cartridge start
- 5.17 starter relay

Group B:

- 5.18 static or dynamic seals
- 5.19 springs
- 5.20 wires/cables
- 5.21 coupling clamps
- 5.22 start valve filter
- 5.23 electrical plugs/sockets

- 5.24 transducers/sensors
  - 5.25 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Carry out three of the following types of check/test on the aircraft starter system:

- 7.1 visually check the starter system for leaks/damage
- 7.2 operational test of the starter
- 7.3 check cranking speed
- 7.4 check operation of starter indication
- 7.5 carry out built in test equipment BITE test
- 7.6 carry out 'special-to-type' tests

Using one of the following:

- 7.7 ground test rig
-

7.8 aircraft power source/system

7.9 'special-to-type' test sets

- S8 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

8.1 job cards/work sheets

8.2 aircraft technical log

Plus one of the following:

8.3 aircraft log book

8.4 aircraft cabin log

8.5 component log card

8.6 other record specified by the employer

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## Outcome

- S9 Carry out maintenance on aircraft ignition systems in compliance with one of the following:

9.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)

9.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)

9.3 Ministry of Defence (MoD)

9.4 Military Aviation Authority (MAA)

9.5 Aerospace Quality Management Standards (AS)

9.6 Federal Aviation Authority (FAA)

9.7 aircraft maintenance manual/approved change documentation (service bulletin)

9.8 manufacturers standards and procedures

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## Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft starting systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to

- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft engine starting systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft starting system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft starting systems, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft starting systems, and the use of system diagrams and associated symbols

- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the basic principles of operation of the starting system being worked on, and the function of the various units within the system
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved
- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft starting systems without damage to the components or surrounding structure
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components without damage to the components or surrounding structure
- K39 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
- K40 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities

- K41 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K42 Describe the tools and equipment used in the maintenance activities and their calibration/care and control procedures
- K43 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the act
- K44 Describe the problems that can occur with the maintenance operations and how these can be overcome
- K45 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K46 Explain how to carry out routine checks and servicing of the aircraft starting system (including checking operation of the starters)
- K47 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before working on the starter system
- K48 Explain the types of test to be carried out on the aircraft starter system and the test equipment to be used
- K49 Explain the methods and procedures to be used to carry out the various tests on the starter system
- K50 Explain how to record the results of each individual test and the documentation that must be used
- K51 Explain how to analyse the test results and how to make valid decisions about the acceptability of the starter system
- K52 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K53 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K55 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 544**

## **Maintaining engine and certifying aircraft starting systems (ATA 80)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 545

### Maintaining and certifying aircraft reciprocating engine turbo-supercharging systems (ATA 81)

<b>UAN:</b>	A/618/0267
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft reciprocating engine turbo-supercharging systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes power recovery turbine assemblies and turbo-supercharging units when external to the engine. The maintenance activities will include the removal, fitting and testing of a range of aircraft reciprocating engine turbo-supercharging system components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the system before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or</p>



that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft reciprocating engine turbo-supercharging systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft reciprocating engine turbo-supercharging systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft reciprocating engine turbo-supercharging systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 81 Reciprocating Engine Turbines.
2. To display competence in this standard, it is necessary to both remove and fit aircraft engine turbo-supercharging system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be

aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity

- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft reciprocating engine turbo-supercharging system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
- 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
- 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
- 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
- 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
- 2.6 use approved removal, fitting and testing techniques and procedures at all times
- 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
- 2.8 return tools and equipment to the correct storage location on completion of the activities
- 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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## Outcome

S4 Carry out maintenance on two of the following parts of the aircraft engine turbo-supercharging system:

- 4.1 power recovery turbine
- 4.2 supercharger
- 4.3 exhaust turbocharger
- 4.4 turbo-supercharger system wiring

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## Outcome

S5 Remove and fit four different aircraft engine turbo-supercharger system components (at least one must be from group A):

Group A:

- 5.1 turbo blower
- 5.2 density controller
- 5.3 supercharger unit
- 5.4 actuators
- 5.5 waste gate
- 5.6 cables/harness/wiring

Group B:

- 5.7 levers and linkages
- 5.8 service panels/fairings
- 5.9 plugs/sockets/switches
- 5.10 control mechanisms
- 5.11 air filters
- 5.12 position indicators/warning devices

- 5.13 seals
  - 5.14 springs
  - 5.15 pipes and hoses
  - 5.16 heat shields
  - 5.17 other specific components
- 

## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

S7 Service/check the aircraft engine turbo-supercharging system, to include carrying out three of the following:

- 7.1 inspecting the turbo-supercharger units (such as for cracks, signs of leakage or damage)
  - 7.2 inspecting heat shields for damage/deterioration
  - 7.3 checking and adjusting density controller
  - 7.4 checking turbo-supercharging indicating systems
-

S8 Carry out three of the following tests on the aircraft engine turbo-supercharging system:

- 8.1 leak test
- 8.2 movement tests (such as range, timing, sequencing)
- 8.3 pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 'special-to-type' tests
- 8.6 leak test

Using one of the following:

- 8.7 aircraft power source/systems
- 8.8 ground test rig

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### Outcome

S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

S10 Carry out maintenance on aircraft reciprocating engine turbo-supercharging system in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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## Outcome

### K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft engine turbo- supercharging systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K13 Explain the importance of maintenance on aircraft engine turbo-supercharging systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft engine turbo-supercharging systems, and with the tools and equipment used (such as hot parts of engines, traps from moving parts, misuse of tools) and how to minimise them and reduce any risk

- K16 Explain what protective equipment needs to be used for both personal protection and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft engine turbo-supercharging systems, and other documents needed in the maintenance activities
- K21 Explain how to carry out currency/issue checks on the specifications they are working with
- K22 Explain the terminology used in aircraft engine turbo-supercharging systems, and the use of system diagrams and associated symbols
- K23 Describe the basic principles of operation of the aircraft engine turbo-supercharging system being worked on (such as system layout, and indication and warning)
- K24 Explain the techniques used to remove components from aircraft engine turbo-supercharging systems without damage to the components or surrounding structure (such as release of pressures/force, removal of components and the need to protect the circuit integrity by ensuring that exposed components and pipe ends are correctly covered/protected)
- K25 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K26 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K27 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K28 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K29 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K30 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K31 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K32 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)



- K33 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K34 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K35 Explain how to fit components into the system (such as ensuring the correct position and orientation; correct tightness of fittings and connections; eliminating stress on pipework, cables and connections; carrying out visual checks of all components)
- K36 Describe the tools and equipment used in the maintenance activities and their calibration/care and control procedures
- K37 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as adjusting density controller)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K40 Explain how to carry out routine checks and servicing of the aircraft engine turbo-supercharging system (including checking the security of critical fasteners, checking condition of gaskets)
- K41 Explain the types of test to be carried out on the aircraft engine turbo-supercharging system and the test equipment to be used
- K42 Explain the methods and procedures to be used to carry out the various tests on the turbo-supercharging system
- K43 Explain how to record the results of the tests and the documentation that must be used
- K44 Explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft turbo- supercharging system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 545**

## **Maintaining and certifying aircraft reciprocating engine turbo-supercharging systems (ATA 81)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 546

## Maintaining and certifying aircraft engine water injection systems (ATA 82)

<b>UAN:</b>	J/618/0269
<b>Level:</b>	Level 4
<b>GLH:</b>	250
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft engine water injection systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and covers the units and components which provide, deliver and inject water or water mixtures into the induction system. The maintenance activities will include the removal, fitting and testing of a range of aircraft engine water injection systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used</p>

are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.

Their underpinning knowledge will provide a good understanding of their work and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft engine water injection systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft engine water injection systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft engine water injection system and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

#### Notes:

1. This standard is designed to cover the practical experience requirements of the Airline Transport Association (ATA) Chapter 82 Water Injection.

2. To display competence in this standard, it is necessary to both remove and fit aircraft engine water injection system components. They must remove components; however, they may fit a replacement component where the original was previously removed by another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

- S1 Undertake the aircraft maintenance activity by carrying out all the following:
  - 1.1 provide regular communication on the progress of the maintenance activity
  - 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads

- b) aircraft specific skills, knowledge and understanding
  - c) opportunities for training and development
- 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible

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## Outcome

- S2 Carry out all of the following during the maintenance of the aircraft engine water injection system:
- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented

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## Outcome

- S3 Use a variety of diagnostic aids and information sources, to include three of the following:
- 3.1 aircraft maintenance manual
  - 3.2 manufactures SMART trouble shooting software

- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

- S4 Carry out maintenance on two of the following parts of the aircraft engine water injection system:

- 4.1 water storage
- 4.2 distribution
- 4.3 dumping and purging
- 4.4 indicating

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### Outcome

- S5 Remove and fit four different engine water injection system components (at least two must be from group A):

Group A:

- 5.1 water pump
- 5.2 water tanks/bladder cells
- 5.3 filling system components
- 5.4 valves
- 5.5 interconnectors
- 5.6 ventilating components
- 5.7 water pressure regulator
- 5.8 solenoids
- 5.9 control unit

Group B:

- 5.10 sensors/transmitters
- 5.11 wiring/switches/plugs
- 5.12 temperature probes
- 5.13 water pipes and hoses
- 5.14 other specific components

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### Outcome

- S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
  - 6.2 removing access panels and covers to expose components to be removed
  - 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
  - 6.4 disconnecting electrical connections
  - 6.5 replacing single use items (such as seals, filters, gaskets)
  - 6.6 disconnecting/removing hoses and pipes
  - 6.7 removing securing devices and mechanical fasteners
  - 6.8 refitting components in the correct position, orientation and alignment
  - 6.9 dismantling equipment to an appropriate level
  - 6.10 setting, and adjusting replaced components (such as travel, working clearance)
  - 6.11 ensuring that any part-dismantled components are secure/supported
  - 6.12 making mechanical connections
  - 6.13 covering (protecting) exposed components, wires, pipework or vents
  - 6.14 making electrical connections
  - 6.15 torque loading as required
  - 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
- 

## Outcome

- S7 Service/check the aircraft engine water injection system, to include carrying out four of the following:

- 7.1 checking the system for leaks
- 7.2 checking and adjusting the water/methanol control unit
- 7.3 checking fluid for quality/correct mixture
- 7.4 checking tank content indicating systems
- 7.5 checking jettison systems

- S8 Carry out three of the following tests on the aircraft engine water injection system:

- 8.1 leak test
- 8.2 flow test
- 8.3 pressure test
- 8.4 built in test equipment (BITE) test
- 8.5 system charging
- 8.6 'special-to-type' tests

Using one of the following:



- 8.7 aircraft power source/pumps
- 8.8 ground test rig

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### Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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### Outcome

- S10 Carry out maintenance on aircraft engine water injection systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)
- 10.6 Federal Aviation Authority (FAA)
- 10.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 10.8 manufacturers standards and procedures

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### Outcome

- K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft engine water injection systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft engine water injection systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
- K15 Describe the hazards associated with carrying out maintenance activities on aircraft engine water injection systems, and with the tools and equipment used, and how to minimise them and reduce any risk
- K16 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K17 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K18 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K19 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K20 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft engine water injection systems, and other documents needed in the maintenance activities

- K21 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Explain how to carry out currency/issue checks on the specifications they are working with
- K30 Explain the terminology used in aircraft engine water injection systems, and the use of system diagrams and associated symbols
- K31 Describe the various types of pipe and component that make up the aircraft engine water injection system (such as tanks/bladder cells; pipes; pumps; valves; mechanical and electrical control devices)
- K32 Describe the basic principles of operation of the engine water injection system being worked on and the function of the various units that make up the system
- K33 Explain the techniques used to remove components from aircraft engine water injection systems without damage to the components or surrounding structure (such as release of fluids, removal of components and the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)
- K34 Describe the various mechanical fasteners to be removed and replaced, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K35 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K36 Explain the need to label and store correctly components that require repair or overhaul, and to check that replacement components have the correct part/identification markings and accompanying release documentation
- K37 Explain how to fit components into the system (such as ensuring the correct tightness of fastenings, fittings and pump connections; eliminating stress on pipework/connections; correctly making electrical connections; carrying out visual checks of all components)

- K38 Explain how to make adjustments to components/assemblies to ensure that they function correctly (such as flow settings, travel and working clearance)
- K39 Explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
- K40 Explain how to carry out routine checks and servicing of the aircraft engine water injection system (including checking for leaks, checking quality of water mixture)
- K41 Explain the types of test to be carried out on the aircraft engine water injection system and the test equipment to be used
- K42 Explain the methods and procedures to be used to carry out the various tests
- K43 Explain how to record the results of each individual test and the documentation that must be used
- K44 Explain how to analyse the test results and how to make valid decisions about the acceptability of the aircraft engine water injection system
- K45 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K46 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K47 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids
- K48 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 546**

## **Maintaining and certifying aircraft engine water injection systems (ATA 82)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 547

## Maintaining and certifying aircraft radar systems (ATA 34)

<b>UAN:</b>	A/618/0270
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Engineering Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to undertake maintenance activities on aircraft radar systems, in accordance with the aircraft maintenance manual, approved change documentation (service bulletin) and airworthiness requirements. It covers both fixed wing and rotary winged aircraft, and includes units and components associated with surveillance radar (including supplementary surveillance radar), weather radar, and obstacle warning systems (such as enhanced ground proximity warning systems - EGPWS), traffic collision and avoidance systems (TCAS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), identification friend or foe (IFF), Doppler, and radar jamming devices, as applicable to the aircraft type. The maintenance activities will include the removal, fitting and testing of a range of aircraft radar systems components. They will be able to use a variety of diagnostic and information sources such as the aircraft maintenance manual, manufactures SMART trouble shooting software, aircraft self-diagnostics. They will be expected to use the approved procedure for correctly isolating the equipment before breaking into the system circuit. They will remove the required components and fit approved replacements, as appropriate. They will then need to test and adjust the completed system to meet the aircraft maintenance manual, change documentation (service bulletin) and airworthiness requirements.</p> <p>Their responsibilities will require them to plan all aspects of the maintenance activity. They will also be required to check the progress and quality of the maintenance activity at regular intervals against the specified standards and quality requirements. They must comply with the specific practices and procedures identified in the aircraft manual, change/service</p>

bulletin documentation and airworthiness requirements for the maintenance activities undertaken, and to report any problems with these requirements that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They must ensure that all tools, equipment and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed thoroughly, accurately and legibly. They will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the maintenance that they carry out.


Their underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate maintenance techniques and procedures to aircraft radar systems. They will understand the removal, fitting and testing methods and procedures, and their application, along with the aircraft radar systems maintenance requirements. They will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the maintenance activities, correcting faults and for ensuring that the equipment is maintained to the required quality standards. They will also need to have a detailed knowledge of the documentation and recording requirements that must be completed on completion of the maintenance activities.

They will understand the safety precautions required when working on the aircraft radar systems and when using the associated tools and equipment. They will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

**Notes:**

1. This standard is designed to cover the requirements of military aircraft radar systems and will cover some of the practical experience requirements of the Airline Transport Association (ATA) Chapter 34 Navigation
2. To display competence in this standard, it is necessary to both remove and fit aircraft radar system components. They must remove components; however, they may fit a replacement component where the original was previously removed by



another person. They should also be aware of how to leave a system in a safe condition if maintenance tasks cannot be completed. This covers both the physical systems and the job documentation.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 plan the maintenance activity in line with the overall aircraft maintenance programme
- P4 use the correct maintenance documentation (such as job instructions, technical instructions, aircraft manuals and maintenance documentation)
- P5 ensure that appropriate authorisation to work on the aircraft is obtained, and observe all relevant isolation and safety procedures
- P6 ensure oversight of the maintenance activity by monitoring and checking that their work has been completed correctly and in the specified sequence, schedule and timescales
- P7 take prompt action to resolve any problems, keeping all relevant people informed of progress/outcomes
- P8 sign off the maintenance activity confirming that it has been completed to the required specification and quality standards
- P9 leave the aircraft and equipment in a safe and appropriate condition, and ensure that components and surrounding structures are free from damage and foreign object debris
- P10 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- P11 complete all relevant aircraft maintenance documentation legibly and accurately
- P12 update aircraft personal log book with details of the maintenance activities completed

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## Outcome

### S Skills requirements

The learner must be able to:

#### S1 Undertake the aircraft maintenance activity by carrying out all the following:

- 1.1 provide regular communication on the progress of the maintenance activity



- 1.2 contribute to the overarching planning on how the maintenance activity will be undertaken
  - 1.3 plan how to undertake the specific maintenance activity to maximise the efficient use of resource, taking into account departmental work priorities and current work loading
  - 1.4 support maintenance activities within the team, taking into account
    - a) their existing workloads
    - b) aircraft specific skills, knowledge and understanding
    - c) opportunities for training and development
  - 1.5 identify potential improvements that could be made to the maintenance process and/or procedures
  - 1.6 review and communicate the progress and quality of the maintenance activity at frequent intervals against the specified standards and quality requirements
  - 1.7 where applicable provide clear, prompt and specific feedback on any issues relating to the schedule, progress and/or quality of the maintenance activity
  - 1.8 support colleagues in identifying and dealing with problems and/or unforeseen events
  - 1.9 provide any additional support to the team in order for the work to be completed on time and to the required quality standards
  - 1.10 ensure that the maintenance documentation completed by the team is complete, accurate and legible
- 

## Outcome

S2 Carry out all of the following during the maintenance of the aircraft radar system:

- 2.1 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition and within current calibration dates
  - 2.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
  - 2.3 ensure the safe isolation of equipment before disconnecting any part of the system
  - 2.4 ensure that relevant safety devices and mechanical/physical locks are in place (where appropriate)
  - 2.5 the intent to change any aircraft settings or status is communicated to all relevant personnel involved in the maintenance activity
  - 2.6 use approved removal, fitting and testing techniques and procedures at all times
  - 2.7 dispose of waste materials in accordance with safe working practices and approved procedures
  - 2.8 return tools and equipment to the correct storage location on completion of the activities
  - 2.9 ensure that any outstanding tests and inspections including critical tasks and independent inspections are correctly documented
- 

## Outcome

S3 Use a variety of diagnostic aids and information sources, to include three of the following:

- 3.1 aircraft maintenance manual
- 3.2 manufactures SMART trouble shooting software
- 3.3 aircraft/equipment self-diagnostics/computer downloads
- 3.4 troubleshooting guides/charts
- 3.5 approved sensory checks (such as sight, sound, smell, touch)
- 3.6 reports (such as pilot or operator)

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### Outcome

S4 Carry out maintenance on the following aircraft radar systems to include either one of the following:

- 4.1 surveillance/attack radar
- 4.2 radar jamming

Or three of the following:

- 4.3 towed radar decoys
- 4.4 Doppler
- 4.5 identification friend or foe (IFF)
- 4.6 radar (radio) altimeter
- 4.7 obstacle warning systems
- 4.8 tactical air navigation (TACAN)
- 4.9 supplementary surveillance radar
- 4.10 weather radar/predictive wind shear
- 4.11 traffic collision avoidance system (TCAS)
- 4.12 enhanced ground proximity warning system (EGPWS)

---

### Outcome

S5 Remove and fit six different aircraft radar system components (at least three must be from group A):

Group A:

- 5.1 scanners
- 5.2 radar displays
- 5.3 satellite beacons
- 5.4 aerials
- 5.5 receiver units
- 5.6 power supply units (PSU)
- 5.7 transformers

- 5.8 processors
- 5.9 waveguides
- 5.10 transmitter units
- 5.11 control units
- 5.12 radar packs
- 5.13 computers
- 5.14 microwave generators
- 5.15 coolant units
- 5.16 transponders
- 5.17 intermediate frequency unit (IFU)
- 5.18 interface units
- 5.19 analogue/digital converters (A-D/D-A)
- 5.20 line replacement units (LRU)

Group B:

- 5.21 batteries
- 5.22 instruments/gauges/indicators
- 5.23 plugs/sockets
- 5.24 switches
- 5.25 desiccant units
- 5.26 coolant
- 5.27 relays
- 5.28 unit trays
- 5.29 circuit breakers
- 5.30 wires/cables
- 5.31 other specific components

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## Outcome

S6 Carry out fifteen of the following maintenance activities:

- 6.1 visually check for any damage/faults (such as corrosion, leaks, splits, fraying or dents)
- 6.2 removing access panels and covers to expose components to be removed
- 6.3 preparing the system for maintenance (such as isolating, de-pressurising, draining and flushing of fluids)
- 6.4 disconnecting electrical connections
- 6.5 replacing single use items (such as seals, filters, gaskets)
- 6.6 disconnecting/removing hoses and pipes
- 6.7 removing securing devices and mechanical fasteners
- 6.8 refitting components in the correct position, orientation and alignment
- 6.9 dismantling equipment to an appropriate level
- 6.10 setting, and adjusting replaced components (such as travel, working clearance)
- 6.11 ensuring that any part-dismantled components are secure/supported
- 6.12 making mechanical connections
- 6.13 covering (protecting) exposed components, wires, pipework or vents
- 6.14 making electrical connections
- 6.15 torque loading as required

- 6.16 checking components for serviceability
  - 6.17 re-pressurising the system
  - 6.18 replacing damaged/defective components
  - 6.19 carrying out a system functional check
  - 6.20 ensuring that replacement components have the correct part numbers
  - 6.21 labelling (and storing in the correct location) components that require repair or overhaul
  - 6.22 applying bolt locking methods (such as split pins, wire locking, lock nuts)
  - 6.23 carrying out area inspections prior to task close-up
  - 6.24 load operational software
- 

## Outcome

S7 Service/check the aircraft radar systems, to include carrying out three of the following:

- 7.1 functional check surveillance/attack radar
- 7.2 functional check doppler
- 7.3 functional check towed radar decoys
- 7.4 functional check radar jamming
- 7.5 functional check radar (radio) altimeter
- 7.6 functional check obstacle warning systems
- 7.7 functional check supplementary surveillance radar
- 7.8 functional check identification friend or foe (IFF)
- 7.9 functional check tactical air navigation (TACAN)
- 7.10 functional check weather radar/predictive wind shear
- 7.11 functional check traffic collision avoidance system (TCAS)
- 7.12 functional check enhanced ground proximity warning system (EGPWS)

S8 Carry out four of the following types of test/check on aircraft radar systems:

- 8.1 standard serviceability checks of all equipment
- 8.2 distortion checks
- 8.3 receiver sensitivity
- 8.4 continuity check
- 8.5 voltage standing wave ratio (VSWR) checks
- 8.6 signal-to-noise checks
- 8.7 bonding tests
- 8.8 TDR checks
- 8.9 applying a dummy load
- 8.10 range checks
- 8.11 'special-to-type' tests
- 8.12 Built in test equipment BITE test
- 8.13 power output
- 8.14 signal injection tests
- 8.15 distant object test
- 8.16 leak test

- 8.17 operational check
- 8.18 software load update

Using four of the following:

- 8.19 multimeter
- 8.20 dummy load
- 8.21 bonding tester
- 8.22 modulation analyser
- 8.23 'special to type' test equipment
- 8.24 Oscilloscope
- 8.25 radio frequency (RF) signal generators
- 8.26 delay lines
- 8.27 external power source (electrical/hydraulic)
- 8.28 time-domain reflectometer (TDR) equipment
- 8.29 aircraft power source (electrical/hydraulic)
- 8.30 voltage standing wave ratio (VSWR) equipment
- 8.31 pressure tester (hydraulic, pneumatic, coolant)
- 8.32 ground loading units
- 8.33 secure code loading equipment

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## Outcome

- S9 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 9.1 job cards/work sheets
- 9.2 aircraft technical log

Plus one of the following:

- 9.3 aircraft log book
- 9.4 aircraft cabin log
- 9.5 component log card
- 9.6 other record specified by the employer

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## Outcome

- S10 Carry out maintenance on aircraft engine water injection systems in compliance with one of the following:

- 10.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 10.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 10.3 Ministry of Defence (MoD)
- 10.4 Military Aviation Authority (MAA)
- 10.5 Aerospace Quality Management Standards (AS)

10.6 Federal Aviation Authority (FAA)

10.7 aircraft maintenance manual/approved change documentation (service bulletin)

10.8 manufacturers standards and procedures

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## Outcome

K Knowledge and understanding

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working with aircraft radar systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K4 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K5 Explain the importance of ensuring that maintenance personnel have the required skills, knowledge and understanding in order to maintain equipment to the required standards
- K6 Explain how maintenance personnel can access the appropriate training and development programmes once a training need has been identified
- K7 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem solving
- K8 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K9 Explain how improvements are achieved by engaging the knowledge and experience of the people working on the process
- K10 Describe the techniques required to communicate information using visual control systems (such as, aircraft zoning, card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K11 Explain the importance of having a flexible and adaptable approach in order to deal with changes to work schedules and departmental priorities
- K12 Explain the importance of maintenance on aircraft radar systems, and impact upon Extended Range Twin-Engine Operations Procedures (ETOPS) systems, Electrical Wiring Interconnect Systems (EWIS), legislation and local procedures
- K13 Describe the hazards associated with removing, fitting and testing aircraft radar system components, and with the tools and equipment used, and how to minimise them and reduce any risk
- K14 Describe the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to

- K15 Explain what protective equipment needs to be used for both personal protection (PPE) and protection of the aircraft
- K16 Explain what constitutes a hazardous voltage and how to recognise victims of electric shock
- K17 Describe how to reduce the risks of a phase to earth shock (such as insulated tools, rubber matting and isolating transformers)
- K18 Explain the importance of aircraft husbandry and of ensuring that, throughout the maintenance activity, the aircraft and work area are maintained free from foreign objects, and the implications of FOD to the safety of the aircraft
- K19 Explain how to extract and use information from aircraft manuals, log books, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft radar systems, and other documents needed in the maintenance process
- K20 Explain how to carry out currency/issue checks on the specifications they are working with
- K21 Explain the terminology used in aircraft radar systems, and the use of system diagrams and associated symbols
- K22 Explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions
- K23 Describe the types of data and information sources that can be used to aid fault diagnosis (such as aircraft maintenance manual , manufactures SMART troubleshooting guides, aircraft/equipment self-diagnostics/computer downloads, troubleshooting guides/charts, pilot reports)
- K24 Describe the types of equipment that can be used to aid fault diagnosis (such as built in test equipment, mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices), how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects
- K25 Explain the application of specific fault diagnostic methods and techniques and how to determine the ones to use that are best suited to the problem
- K26 Explain how to use the various diagnostic aids, equipment and information sources that are available for fault diagnosis
- K27 Explain how to analyse and evaluate the characteristics and possible causes of specific faults/problems and how this information can be used to prevent the reoccurrences
- K28 Explain the risk of running the aircraft with a fault, and the effects this could have on the aircraft performance and safety
- K29 Describe the basic principles of operation of the aircraft radar system being worked on, and the function of the various units within the system
- K30 Describe the various mechanical fasteners that are used, and their methods of removal and replacement (such as threaded fasteners, special securing devices)
- K31 Explain the importance of using the specified fasteners for the installation and why they must not substitute others
- K32 Explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
- K33 Explain the torque loading requirements on the fasteners and what to do if these loadings are exceeded or not achieved

- K34 Describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking-in of the connections
- K35 Explain the techniques used to remove components from aircraft radar systems without damage to the components or surrounding structure (such as proof marking, the need to protect the circuit integrity by covering and labelling exposed circuits)
- K36 Explain the importance of applying electrostatic discharge (ESD) avoidance procedures when working on sensitive equipment or devices
- K37 Explain the need to label and store correctly components that require repair or overhaul, and to check that replaced components have the correct part/identification markings and accompanying release documentation
- K38 Explain the techniques used to position, align, adjust and secure the replaced components to the aircraft without damage to the components or surrounding structure
- K39 Explain the methods of lifting, handling and supporting the components/equipment during the maintenance activities
- K40 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
- K41 Describe the tools and equipment used in the maintenance activities, and their calibration/care and control procedures
- K42 Explain why tool/equipment control is critical and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
- K43 Explain how to recognise defects (such as incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)
- K44 Explain how to carry out routine checks and servicing of the aircraft radar system
- K45 Explain the need to check that cabin/cockpit switches, selectors and circuit breakers are in the correct position before applying any form of external power (such as electrical, hydraulic, air or vacuum)
- K46 Explain the types of test to be carried out on the aircraft radar system and the test equipment to be used
- K47 Explain the methods and procedures to be used to carry out the various tests on the radar system
- K48 Explain the importance of carrying out the tests in the specified sequence, checking readings/movements at each stage
- K49 Explain how to record the results of each individual test and the documentation that must be used
- K50 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft radar systems
- K51 Explain the procedures to be followed if the equipment or system fails to meet the test specification
- K52 Describe the problems that can occur with the aircraft radar system maintenance operations and how these can be overcome
- K53 Explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
- K54 Describe the procedure for the safe disposal of waste materials, scrap components and fuel/fluids



K55 Describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve

## **Unit 547                      Maintaining and certifying aircraft radar systems (ATA 34)**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

Assessment requirements have been developed by employers for the occupational competency units and qualifications for Advanced Manufacturing and Engineering Sector. These assessment requirements are set down in the relevant Qualification Assessment Strategies available from Semta. Please contact [Customer.Services@semta.org.uk](mailto:Customer.Services@semta.org.uk) quoting Advanced Manufacturing and Engineering Trailblazer Qualification Assessment Strategy and specifying the title of the relevant Trailblazer Standard.

##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

## Unit 548

## Leading the oversight of aircraft maintenance activities

<b>UAN:</b>	F/618/0271
<b>Level:</b>	Level 4
<b>GLH:</b>	248
<b>Unit aim:</b>	<p>This Employer Unit of Competence (EUC) has been developed by employers in the Aerospace and Aviation Sector and is part of an overall development programme designed to meet the requirements of the Sector, the published Apprenticeship Standard and Employer Occupational Brief.</p> <p>This EUC identifies the training and development required in order that the apprentice can demonstrate that they are competent in being able to lead an aircraft maintenance team, including carrying out the oversight of maintenance activities, developing and updating maintenance schedules such as preventive, corrective, predictive and reactive programmes in accordance with approved procedures and policies. Working with either in - company and/or contract maintenance staff, they will also be responsible for checking that maintenance personnel have the appropriate approvals and the specific skills knowledge and understanding required to maintain the aircraft safely.</p> <p>They will also be required to identify and implement a systematic approach to improving the aircraft maintenance activities undertaken. They may also be involved in agreeing and monitoring aircraft maintenance budgets</p> <p>Their responsibilities will require them to comply with organisational policy and procedures for the aircraft maintenance undertaken, and to report any problems with the maintenance activities that they cannot personally resolve or that are outside their permitted authority, to the relevant people. They must ensure that that all necessary data, documentation is completed accurately and legibly and stored in the correct location and format. They will be expected to work with minimal supervision, taking personal responsibility for their own actions, and for the quality and accuracy of the work carried out by the maintenance team.</p> <p>Their underpinning knowledge will provide an in depth understanding of their work and will provide an informed</p>

approach to applying a range of aircraft maintenance schedules and programmes. They will know how the system and equipment functions and the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for leading the maintenance oversight activities, correcting faults and ensuring the maintained/repaired equipment functions to the required specification and remains compliant with all national and international aircraft maintenance standards and regulations. In addition, they will have sufficient knowledge on how to develop maintenance teams and how to identify and implement a systematic approach to improving the maintenance activities undertaken.

They will understand the safety precautions required when carrying out the maintenance activities. They will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

They will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as strong work ethic, positive attitude, team player, dependability, responsibility, honesty, integrity, motivation and commitment.

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## Outcome

### P Performance requirements

The learner must be able to:

- P1 work safely at all times, complying with health and safety and other relevant aircraft maintenance national and international regulations, directives and guidelines
- P2 demonstrate the required behaviours in line with the job role and company objectives
- P3 produce, agree and update maintenance procedures, schedules and plans
- P4 produce and maintain a departmental competency skills matrix of team members
- P5 ensure that schedules and plans are capable of meeting all relevant outputs required
- P6 lead maintenance activities within the department
- P7 complete and store relevant maintenance data and documentation accurately
- P8 identify and lead on making improvements to maintenance processes and procedures
- P9 ensure maintenance activities are carried out correctly in line with agreed company processes and procedures
- P10 create and update visual management documentation and systems to support the activities of the maintenance department

- P11 report and evaluate the impact of maintenance programmes and improvement activities
- P12 develop, gain agreement and review maintenance budgets
- 

### Outcome

#### S Skills requirements

The learner must be able to:

- S1 Lead an aircraft maintenance team by carrying out all the following:
- 1.1 communicate the maintenance activities to the team
  - 1.2 involve the team in planning how the maintenance activities will be undertaken
  - 1.3 allocate specific maintenance activities to each team member
  - 1.4 motivate the team to present their own ideas on improvements that could be made to the maintenance process and procedures
  - 1.5 encourage the team and/or individuals to take the lead where appropriate
- 

### Outcome

- S2 Lead maintenance activities on two of the following:
- 2.1 piston or turbine engine maintenance
  - 2.2 fixed wing airframe maintenance including work within flight controls, structural work and systems such as hydraulic and pneumatic
  - 2.3 rotary wing airframe maintenance including transmissions drive , main rotor systems. flight controls and other associated systems
  - 2.4 installed avionics systems
  - 2.5 installed instrumentation equipment
  - 2.6 scheduled inspections on airframe and or engines
  - 2.7 troubleshooting and defect rectification
  - 2.8 engine running
  - 2.9 helicopter vibration analysis
  - 2.10 piston engine set up and adjustment
  - 2.11 turbine engine set up and adjustment
  - 2.12 component replacement
  - 2.13 other to be specified by the employer
- 

### Outcome

- S3 Develop and update maintenance procedures, schedules and plans to include three of the following:
-

- 3.1 preventive maintenance (routine inspections and adjustments)
- 3.2 corrective maintenance (activities identified from preventative maintenance activities)
- 3.3 predictive maintenance (analysis of the equipment's condition)
- 3.4 reactive maintenance (unexpected equipment/component failure)
- 3.5 maintenance prevention (equipment/component design and development)

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### Outcome

S4 Plan, schedule and carry out maintenance activities using one of the following resources:

- 4.1 complete in-house staff
- 4.2 combined in-house/contract staff
- 4.3 complete contract maintenance staff

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### Outcome

S5 Create and maintain handover records to include three of the following:

- 5.1 scheduled maintenance (routine inspections, and adjustments)
- 5.2 troubleshooting
- 5.3 defect rectification
- 5.4 aircraft / helicopter functional tests
- 5.5 Resources (such as spare parts used/ordered/remaining and consumables ordered and remaining)
- 5.6 any work issues that have occurred during a maintenance shift

Plus supporting documentation associated with **four** of the following:

- 5.7 man hour performance
- 5.8 maintenance costs
- 5.9 health and safety
- 5.10 staff development and training
- 5.11 maintenance procedures/instructions
- 5.12 regulatory compliance

---

### Outcome

S6 Identify and implement improvements in the services provided by the maintenance team to include four of the following:

- 6.1 downtime during maintenance against quoted time

- 6.2 performance monitoring systems (man hour control)
  - 6.3 maintenance procedures
  - 6.4 customer instructions
  - 6.5 task cards and documentation
  - 6.6 resource planning
  - 6.7 costs
  - 6.8 staff development and training
  - 6.9 health and safety
  - 6.10 parts availability
  - 6.11 effective human factors
  - 6.12 other specific improvement
- 

## Outcome

- S7 Complete relevant documentation to include both the following and ensure that it is stored/saved in the correct location and/or passed to the appropriate personnel/department:

- 7.1 job cards/work sheets
- 7.2 aircraft technical log

Plus one of the following:

- 7.3 aircraft log book
- 7.4 aircraft cabin log
- 7.5 component log card
- 7.6 other record specified by the employer

- S8 Ensure aircraft maintenance has been completed in compliance with one of the following:

- 8.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- 8.2 Extended Range Twin-Engine Operations Procedures (ETOPS) (where appropriate)
- 8.3 Ministry of Defence (MoD)
- 8.4 Military Aviation Authority (MAA)
- 8.5 Aerospace Quality Management Standards (AS)
- 8.6 Federal Aviation Authority (FAA)
- 8.7 aircraft maintenance manual/approved change documentation (service bulletin)
- 8.8 manufacturers standards and procedures

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## Outcome

- K Knowledge and understanding
-

The learner must be able to:

- K1 Explain the specific safety practices and procedures that they need to observe when working on aircraft including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
- K2 Explain the importance of applying the appropriate behaviours in the workplace and the implications for both the apprentice and the business if these are not adhered to
- K3 Explain the importance of human factors in aircraft maintenance and how it is applied when leading the oversight of maintenance teams
- K4 Explain the information systems that are in use within their organisation, and how to record data to the system
- K5 Explain how to obtain and interpret national and international legislative and regulatory documentation relevant to the aircraft being maintained
- K6 Explain how to obtain and interpret company policies and procedures
- K7 Explain how to prioritise their own and their team's workload to ensure that targets are met
- K8 Explain the importance of regularly monitoring departmental budgets and the implications for the business if this is not carried out
- K9 Explain how to communicate effectively, listen, question, support and coach others to work towards the departmental targets
- K10 Explain the importance of ensuring that teams have the required approvals, skills, knowledge and understanding in order to maintain aircraft to the required standards
- K11 Explain how maintenance personnel access training and development programmes once a training need has been identified
- K12 Explain how to complete and review risk assessments relevant to the aircraft maintenance activity
- K13 Describe the hazards associated with carrying out aircraft maintenance activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures) and how to minimise these and reduce any risks
- K14 Explain the importance of ensuring maintenance personnel wear protective clothing and other appropriate safety equipment (PPE) during the aircraft maintenance process
- K15 Explain the importance of having access to up to date data and information such as drawings, specifications, manufacturers' manuals and other documents needed in the aircraft maintenance process
- K16 Explain the importance of implementing an effective maintenance strategy to reduce the amount of equipment/component failures/downtime
- K17 Explain how to deal with changes requested to the aircraft maintenance schedules
- K18 Explain who to contact for clarification of the aircraft maintenance requirements or problem
- K19 Explain who should be involved in authorising any changes required to aircraft maintenance activities
- K20 Explain the principles of the different types of aircraft maintenance programmes such as preventive, corrective and predictive and their benefits



- K21 Explain the procedure for purchasing/obtaining replacement parts, materials and other consumables necessary for the maintenance activities
- K22 Explain how to determine the resources that are required to undertake the aircraft maintenance activities
- K23 Explain the methods and parameters used to calculate how long it should take to complete specific aircraft maintenance activities
- K24 Explain the company policy on repair/replacement of equipment or components during the maintenance process
- K25 Explain the procedures to be adopted for the dismantling/re-assembly of various types of aircraft assemblies/systems
- K26 Explain the process to determine if products or services are fit for purpose
- K27 Describe the basic principles of how the equipment/system functions, operation sequence, the working purpose of individual units/components and how they interact
- K28 Explain the importance of keeping up to date with new technologies, maintenance processes and systems
- K29 Explain the applications of mechanical and electrical measuring and testing equipment
- K30 Explain the importance of keeping up to date aircraft maintenance documentation and/or reports
- K31 Explain the equipment operating and control procedures to be applied during the aircraft maintenance activity
- K32 Describe the problems associated with the aircraft maintenance activity, and how they can be overcome
- K33 Describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
- K34 Explain how to conduct a systematic plan, do, check, act (PDCA) approach to problem-solving and business improvement
- K35 Explain how to use “root cause” problem solving analysis using the 5 whys/how technique
- K36 Explain how to evaluate improvement ideas in order to select those that are to be pursued
- K37 Explain how improvements to the process are achieved by engaging the knowledge and experience of the people working on the process
- K38 Explain how to create/update Standard Operating Procedures (SOP's) and correlate work activities into them.
- K39 Describe the techniques required to communicate information using visual control systems (such as card systems, colour coding, floor footprints, graphs and charts, team boards, tool/equipment shadow boards)
- K40 Describe the extent of their own authority and to whom they should report if they have a problem that they cannot resolve

## **Unit 548**

## **Leading the oversight of aircraft maintenance activities**

### **Supporting Information**

#### **Unit guidance**

##### **Assessment requirements**

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##### **Additional information**

Although all of the content and assessment requirements must be met in full employers can tailor the training outcomes to ensure that the content of the programme is specific to their requirements in terms of products, processes, procedures, tools, equipment, materials, documentation and information systems.

This will allow each organisation to develop their own specific and tailored apprentice training programme that meets their own business requirements whilst at the same time ensuring that the overall generic content is to a high standard in terms of depth and breadth to enable progression and/or transferability to other employers.

# Appendix 1                      Relationships to other qualifications

## **Links to other qualifications**

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

## **Literacy, language, numeracy and ICT skills development**

This [these] qualification[s] can develop skills that can be used in the following qualifications:

- Functional Skills
- Essential Skills

See [www.cityandguilds.com](http://www.cityandguilds.com)

## Appendix 2 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](http://www.cityandguilds.com) on [www.cityandguilds.com](http://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](http://www.cityandguilds.com) also contains useful information on such things as:

- conducting examinations
- registering learners
- appeals and malpractice.

### **Useful contacts**

Please visit the [Contact us](http://www.cityandguilds.com) 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.

The City & Guilds community of brands includes Gen2, ILM, Intertrain, Kineo and The Oxford Group.

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City and Guilds reviews its qualifications on a regular basis to ensure they remain current, relevant, and meet industry and learner needs.

This Qualification Handbook however may contain references to historic information, such as former organisations, obsolete frameworks, codes or standards, or retired units and qualifications. This information is included for reference purposes only.

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