QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Aeronautical Engineering (Aircraft Mechanical Maintenance) (1789-31)

September 2018 version 1.2

City & Guilds

Qualification at a glance

Subject area	**Engineering**
City & Guilds number	1789
Age group approved	16-18, 19+
Entry requirements	Level 3
Assessment	Portfolio
Fast track	Available
Support materials	Centre handbook
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Level 3 NVQ Diploma in Aeronautical Engineering (Aircraft Mechanical Maintenance)	1789-31	600/1575/5

Version and date	Change detail	Section
1.1 November 2012	• Formatting (not allowing sentences to split between two pages) • Formatting (word 'Including' put to lower case)	• Units 001, 403, 404 • Units 555-560
1.2 September 2018	• Changed from a seven to a nine	• Unit 001 assessment criteria 2.3

Contents

1 Introduction

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

Area	Description
Who is the qualification for?	It is for candidates who work or want to work in the engineering sector
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the engineering sector.
Is the qualification part of a framework or initiative?	It serves as a technical certificate, in the engineering Apprenticeship framework.

Structure

To achieve the **Level 3 Diploma in Aeronautical Engineering (Aircraft Mechanical Maintenance)**, learners must achieve **20** credits from Mandatory Units 1, **93** credits from Mandatory Units 2, **122** credits from Optional 1 and **106** credits from Optional 2.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Mandatory	**Group 1**		
A/601/5013	001	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	002	Using and interpreting engineering drawings and documents	5
K/601/5055	403	Working efficiently and effectively in engineering	5
K/601/4228	404	Reinstating the work area on completion of activities	5
Mandatory	**Group 2**		
Y/601/4807	541	Carrying out fault diagnosis on aircraft airframe, mechanical components and systems	53
H/601/4809	542	Undertaking scheduled maintenance of aircraft airframe and mechanical equipment	40
Optional	**Group 1**		
A/601/4380	413	Repairing airframes and structures	62
F/601/4381	414	Modifying airframes	60

Unit accreditation number	City & Guilds unit	Unit title	Credit value
H/601/4812	543	Removing and replacing aircraft power plant and components	89
M/601/4814	544	Removing and replacing components of aircraft control systems	89
A/601/4816	545	Removing and replacing components of aircraft fuel and lubrication systems	89
J/601/4818	546	Removing and replacing components of aircraft hydraulic systems	89
J/601/4821	547	Removing and replacing components of aircraft pneumatic and vacuum systems	89
R/601/4823	548	Removing and replacing components of aircraft environmental systems	89
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M/601/4828	550	Removing and replacing components of aircraft cabin systems, equipment and furnishings	77
M/601/4831	551	Removing and replacing major assemblies of aircraft airframes	89
T/601/4832	552	Modifying aircraft propulsion equipment and systems	77
Optional	**Group 2**		
L/601/4836	553	Carrying out tests on aircraft engines and systems	55
Y/601/4841	554	Carrying out tests on aircraft control systems	53
H/601/4857	555	Carrying out tests on aircraft fuel and storage systems	55
L/601/4870	556	Carrying out tests on aircraft hydraulic systems	55
Y/601/4872	557	Carrying out tests on aircraft pneumatic and vacuum systems	55
A/601/4878	558	Carrying out tests on aircraft environmental systems	55
J/6014883	559	Carrying out tests on aircraft power transmission systems	55
H/601/4888	560	Carrying out checks and tests on replaced airframe major assemblies	53
K/601/4889	561	Carrying out test bed runs on aircraft engines (uninstalled)	150

2 Centre requirements

Approval

Centres currently offering the City & Guilds NVQ in Aeronautical Engineering (1689) will be automatically approved to run this new qualification.

To offer this qualification new centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information.

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

Resource requirements

Physical resources and site agreements

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

Centre staffing

Staff delivering this qualification 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.

Assessors and internal verifier

Assessor requirements to demonstrate effective assessment practice

Assessment must be carried out by competent Assessors that as a minimum must hold the QCF Level 3 Award in Assessing Competence in the Work Environment**.** Current and operational assessors that hold units

D32 and/or D33 or A1 and/or A2 as appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS)

Assessor technical requirements

Assessors must be able to demonstrate that they have verifiable, relevant and sufficient technical competence to evaluate and judge performance and knowledge evidence requirements as set out in the relevant QCF unit learning outcomes and associated assessment criteria.

This will be demonstrated either by holding a relevant technical qualification or by proven industrial experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the learner(s) in the units being assessed.

Assessors must also be:

- Fully conversant with the Awarding Organisation's assessment recording documentation used for the QCF NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier requirements (internal and external)

Internal quality assurance (Internal Verification) must be carried out by competent Verifiers that as a minimum must hold the QCF Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practices. Current and operational Internal Verifiers that hold internal verification units V1 or D34 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment.

External quality assurance **(external verification)** must be carried out by competent External Verifiers that as a minimum must hold the QCF Level 4 Award in the External Quality Assurance of Assessment Processes and Practices**.** Current and operational External Verifiers that hold external verification units V2 or D35 will not be required to achieve the QCF Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the QCF Level 3 Award in Assessing Competence in the Work Environment.

External and Internal Verifiers will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace Quality Assurance (verification) of Assessment Processes and Practices to the most up to date National Occupational Standards (NOS) Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the QCF NVQ units against which

the assessments and verification are to be carried out, the appropriate Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation.

Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.

Candidate entry requirements

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

The Semta Engineering Manufacture apprenticeship framework suggests that:

- Employers would be interested in candidates that:
    - Are keen and motivated to work in an engineering environment
    - Are willing to undertake a course of training both on-the-job and off-the-job and apply this learning in the workplace
    - Have previous work experience or employment in the sector
    - Have completed a 14 to 19 Diploma in Engineering or Manufacturing
    - Have completed a Young Apprenticeship in Engineering or other related area
    - Have GCSEs in English, Maths and Science
    - Have completed tests in basic numeracy, literacy and communication skills and have spatial awareness.

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

Assessment environment (extract from Semta QCF Unit Assessment Strategy 1 January 2011)

The evidence put forward for this qualification can only be regarded valid, reliable, sufficient and authentic if achieved and obtained in the working environment and be clearly attributable to the learner. However, in certain circumstances, simulation/replication of work activities may be acceptable.

The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:

- rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work;
- the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence;
- aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence.

Simulations/replications will require prior approval from centres City & Guilds external verifier/qualification consultant and should be designed in relation to the following parameters:

- the environment in which simulations take place must be designed to match the characteristics of the working environment
- competencies achieved via simulation/replication must be transferable to the working environment
- simulations which are designed to assess competence in dealing with emergencies, accidents and incidents must be verified as complying with relevant health, safety and environmental legislation by a competent health and safety/environmental control officer before being used
- simulated activities should place learners under the same pressures of time, access to resources and access to information as would be expected if the activity was real
- simulated activities should require learners to demonstrate their competence using plant and/or equipment used in the working environment
- simulated activities which require interaction with colleagues and contacts should require the learner to use the communication media that would be expected at the workplace
- for health and safety reason simulations need not involve the use of genuine substances/materials. Any simulations which require the learner to handle or otherwise deal with materials substances/should ensure that the substitute take the same form as in the workplace.

Age restrictions

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

3 Delivering the qualification

Initial assessment and induction

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

- if the candidate 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 candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Support materials

The following resources are available for this these qualifications

Description	How to access
Personal Learning and Thinking skills (required for apprenticeship)	**www.cityandguilds.com**, 1789 product documentation pages
Centre approval forms	**www.cityandguilds.com**
Semta QCF Assessment Strategy	**www.cityandguilds.com**
Unit assessment guidance	**www.cityandguilds.com**, 1789 product documentation pages

Recording documents

Candidates 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 learners' progress towards achieving qualifications. Further details are available at: **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 verifier, 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.

4 Assessment

Assessment of the qualification (extract from Semta QCF Unit Assessment Strategy 1 January 2011)

Carrying out assessments

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learner's choice of 'bulleted items' listed in the unit assessment criteria.

Where the assessment criteria gives a choice of bulleted items (for example 'any three from five'), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum performance evidence requirements

Performance evidence must be the main form of evidence gathered. In order to demonstrate consistent, competent performance for a unit, a minimum of 3 different examples of performance must be provided, and must be sufficient to show that the assessment criteria have been achieved to the prescribed standards. It is possible that some of the bulleted items in the assessment criteria may be covered more than once. The assessor and learner need to devise an assessment plan to ensure that performance evidence is sufficient to cover all the specified assessment criteria and which maximises the opportunities to gather evidence. Where applicable, performance evidence may be used for more than one unit.

The most effective way of assessing competence, is through direct observation of the learner. Assessors must make sure that the evidence provided reflects the learner's competence and not just the achievement of a training programme.

Evidence that has been produced from team activities, for example, maintenance or installation activities is only valid when it clearly relates to the learners specific and individual contribution to the activity, and not to the general outcome(s).

Each example of performance evidence will often contain features that apply to more than one unit, and can be used as evidence in any unit where appropriate.

Performance evidence must be a combination of:

- outputs of the learner's work, such as items that have been manufactured, installed, maintained, designed, planned or quality assured, and documents produced as part of a work activity together with:
- evidence of the way the learner carried out the activities such as witness testimonies, assessor observations or authenticated learner reports, records or photographs of the work/activity carried out, etc.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the learner to provide evidence that proves they are capable of combining the various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and will not, therefore, be acceptable as demonstrating competent performance.

If there is any doubt as to what constitutes valid, authentic and reliable evidence, the internal and/or external verifier (qualifications consultant) should be consulted.

Assessing knowledge and understanding

Knowledge and understanding are key components of competent performance, but it is unlikely that performance evidence alone will provide enough evidence in this area. Where the learner's knowledge and understanding (and the handling of contingency situations) is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways. Semta (the Sector Skills Council) expects oral questioning and practical demonstrations to be used, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the learner has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.

The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit. Where oral questioning is used the assessor must retain a record of the questions asked, together with the learner's answers.

Witness testimony

Where observation is used to obtain performance evidence, this must be carried out against the unit assessment criteria. Best practice would require that such observation is carried out by a qualified Assessor. If this is not practicable, then alternative sources of evidence may be used.

For example, the observation may be carried out against the assessment criteria by someone else that is in close contact with the learner. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the learner's competency. However, the witness must be technically competent in the process or skills that they are providing testimony for, to at least the same level of expertise as that required of the learner. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the learner's competency are reliable, auditable and technically valid.

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 allowed and is also sector specific.

5 Units

Availability of units

Below is a list of the learning outcomes for all the units. If you want to download a complete set of units, go to **www.cityandguilds.com**

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

Unit 001 Complying with statutory regulations and organisational safety requirements

UAN:	**A/601/5013**
Level:	2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment. The learner will be expected 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. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and 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. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises. The learner will also 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, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual

lifting and carrying techniques.

The learner's responsibilities will require them to comply with all relevant statutory and organisational policy and procedures for health and safety in the workplace. The learner must act in a responsible and safe manner at all times, and present themselves in the workplace suitably prepared for the activities to be undertaken. The learner will be expected to report any problems with health and safety issues, to the relevant authority.

The learner's knowledge will provide a good understanding of the relevant statutory regulations and organisational requirements associated with their work, and will provide an informed approach to the procedures used. The learner will need to understand their organisation's health and safety requirements and their application, in adequate depth to provide a sound basis for carrying out their activities in a safe and competent manner.

Learning outcome
The learner will: 1. Be able to comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 1.1 comply with their duties and obligations as defined in the Health and Safety at Work Act 1.2 demonstrate their understanding of their duties and obligations to health and safety by: • applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act • identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: o eye protection and personal protective equipment (PPE) o COSHH regulations o Risk assessments • identifying the warning signs and labels of the main groups of hazardous or dangerous substances • complying with the appropriate statutory regulations at all times 1.3 present themselves in the workplace suitably prepared for the activities to be undertaken 1.4 follow organisational accident and emergency procedures 1.5 comply with emergency requirements, to include: • identifying the appropriate qualified first aiders and the location of first aid facilities • identifying the procedures to be followed in the event of injury to themselves or others

- following organisational procedures in the event of fire and the evacuation of premises
- identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment

1.6 recognise and control hazards in the workplace

1.7 Identify the hazards and risks that are associated with the following:

- their working environment
- the equipment that they use
- materials and substances (where appropriate) that they use
- working practices that do not follow laid-down procedures

1.8 use correct manual lifting and carrying techniques

1.9 demonstrate one of the following methods of manual lifting and carrying:

- lifting alone
- with assistance of others
- with mechanical assistance

1.10 apply safe working practices and procedures to include:

- maintaining a tidy workplace, with exits and gangways free from obstruction
- using equipment safely and only for the purpose intended
- observing organisational safety rules, signs and hazard warnings
- taking measures to protect others from any harm resulting from the work that they are carrying out.

Learning outcome
The learner will: 2. Know how to comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 2.1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act, and other current legislation 2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities 2.3 describe the warning signs for the nine main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations 2.4 explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed 2.5 explain what constitutes a hazard in the workplace 2.6 describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace 2.7 describe the risks associated with their working environment 2.8 describe the processes and procedures that are used to identify and rate the level of risk

2.9	describe the first aid facilities that exist within their work area and within the organisation in general; the procedures to be followed in the case of accidents involving injury
2.10	explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured
2.11	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
2.12	describe the organisational policy with regard to fire fighting procedures; the common causes of fire and what they can do to help prevent them
2.13	describe the protective clothing and equipment that is available for their areas of activity
2.14	explain how to safely lift and carry loads, and the manual and mechanical aids available
2.15	explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping
2.16	describe the importance of safe storage of tools, equipment, materials and products
2.17	describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve.

Unit 001 Complying with statutory regulations and organisational safety requirements

Supporting information

Guidance

2.1 (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, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations)

2.5 (such as moving parts of machinery, electricity, slippery and uneven surfaces, poorly placed equipment, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile, flammable or toxic materials, unshielded processes, working in confined spaces)

2.7 (such as the tools, materials and equipment that they use, spillages of oil, chemicals and other substances, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures)

2.8 (such as safety inspections, the use of hazard checklists, carrying out risk assessments, COSHH assessments)

Unit 002 Using and interpreting engineering data and documentation

UAN:	**Y/601/5102**
Level:	2
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard: Using and interpreting engineering data and documentation (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted. The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team, and take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out. The learner's underpinning knowledge will provide a good understanding of the types of documentation used, and will provide an

informed approach to applying instructions and procedures. They will be able to read and interpret the documentation used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

Learning outcome
The learner will: 1. Be able to use and interpret engineering data and documentation
Assessment criteria
The learner can: 1.1 use the approved source to obtain the required data and documentation 1.2 use the data and documentation and carry out all of the following: • check the currency and validity of the data and documentation used • exercise care and control over the documents at all times • correctly extract all necessary data in order to carry out the required tasks • seek out additional information where there are gaps or deficiencies in the information obtained • deal with or report any problems found with the data and documentation • make valid decisions based on the evaluation of the engineering information extracted from the documents • return all documents to the approved location on completion of the work • complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation 1.3 correctly identify, interpret and extract the required information 1.4 extract information that includes three of the following: • materials or components required • dimensions • tolerances • build quality • installation requirements • customer requirements • time scales • financial information • operating parameters • surface texture requirements • location/orientation of parts • process or treatments required • dismantling/assembly sequence • inspection/testing requirements • number/volumes required

- repair/service methods
- method of manufacture
- weld type and size
- operations required
- connections to be made
- surface finish required
- shape or profiles
- fault finding procedures
- safety/risk factors
- environmental controls
- specific data (such as component data, maintenance data, electrical data, fluid data)
- resources (such as tools, equipment, personnel)
- utility supply details (such as electricity, water, gas, air)
- location of services, including standby and emergency backup systems
- circuit characteristics (such as pressure, flow, current, voltage, speed)
- protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
- other specific related information

1.5 use the information obtained to ensure that work output meets the specification

1.6 use information extracted from documents to include one from the following:

- drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
- diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
- manufacturers manuals/drawings
- approved sketches
- technical illustrations
- photographic representations
- visual display screen information
- technical sales/marketing documentation
- contractual documentation
- other specific drawings/documents

1.7 use information extracted from related documentation, to include two from the following:

- instructions (such as job instructions, drawing instructions, manufacturers instructions)
- specifications (such as material, finish, process, contractual, calibration)
- reference materials (such as manuals, tables, charts, guides, notes)
- schedules

- operation sheets
- service/test information
- planning documentation
- quality control documents
- company specific technical instructions
- national, international and organisational standards
- health and safety standards relating to the activity (such as COSHH)
- other specific related documentation

1.8 deal promptly and effectively with any problems within their control and report those which cannot be solved

1.9 report any inaccuracies or discrepancies in documentation and specifications.

Learning outcome
The learner will: 2. Know how to use and interpret engineering data and documentation
Assessment criteria
The learner can: 2.1 explain what information sources are used for the data and documentation that they use in their work activities 2.2 explain how documents are obtained, and how to check that they are current and valid 2.3 explain the basic principles of confidentiality (including what information should be available and to whom) 2.4 describe the different ways/formats that data and documentation can be presented 2.5 explain how to use other sources of information to support the data 2.6 describe the importance of differentiating fact from opinion when reviewing data and documentation 2.7 describe the importance of analysing all available data and documentation before decisions are made 2.8 describe the different ways of storing and organising data and documentation to ensure easy access 2.9 describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents 2.10 describe the importance of keeping all data and documentation up to date during the work activity, and the implications of this not being done 2.11 explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work 2.12 explain the importance of returning documents to the designated location on completion of the work activities 2.13 explain what basic drawing conventions are used and why there needs to be different types of drawings (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams 2.14 explain what types of documentation are used and how they interrelate 2.15 explain the imperial and metric systems of measurement; tolerancing and fixed reference points

2.16	describe the meaning of the different symbols and abbreviations found on the documents that they use
2.17	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 002 Using and interpreting engineering data and documentation

Supporting information

Guidance

2.4 (such as such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)

2.5 (such as electronic component pin configuration specifications, reference charts, standards, bend allowances required for material thickness, electrical conditions required for specific welding rods, mixing ratios for bonding and finishing materials, metal specifications and inspection requirements, health and safety documentation)

2.14 (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)

2.16 (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)

Unit 403 Working efficiently and effectively in engineering

UAN:	**K/601/5055**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard: working efficiently and effectively in engineering (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner 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. On completion of the engineering activity, the learner 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. In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management. The learner will also be expected to review objectives and targets for their personal development and make recommendations to, and communicate any

opportunities for, improvements that could be made to working practices and procedures.

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas 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.

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

Learning outcome
The learner will: 1. Be able to work efficiently and effectively in engineering
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the work area to carry out the engineering activity 1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken: • the work area is free from hazards and is suitably prepared for the activities to be undertaken • any required safety procedures are implemented • any necessary personal protection equipment is obtained and is in a usable condition

- tools and equipment required are obtained and checked that they are in a safe and useable condition
- all necessary drawings, specifications and associated documentation is obtained
- job instructions are obtained and understood
- the correct materials or components are obtained
- storage arrangements for work are appropriate
- appropriate authorisation to carry out the work is obtained

1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements

1.5 ensure that completed products or resources are stored in the appropriate location on completion of the activities

1.6 complete work activities, to include all of the following:

- completing all necessary documentation accurately and legibly
- returning tools and equipment
- returning drawings and work instructions
- identifying, where appropriate, any unusable tools, equipment or components
- arranging for disposal of waste materials

1.7 tidy up the work area on completion of the engineering activity

1.8 deal promptly and effectively with problems within their control and report those that cannot be resolved

1.9 deal with problems affecting the engineering process, to include two of the following:

- materials
- tools and equipment
- drawings
- job specification
- quality
- people
- timescales
- safety
- activities or procedures

1.10 contribute to and communicate opportunities for improvement to working practices and procedures

1.11 make recommendations for improving to two of the following:

- working practices
- working methods
- quality
- safety
- tools and equipment
- supplier relationships
- internal communication
- customer service
- training and development
- teamwork
- other

1.12 maintain effective working relationships with colleagues to include two of the following:
- colleagues within own working group
- colleagues outside normal working group
- line management
- external contacts

1.13 review personal training and development as appropriate to the job role

1.14 review personal development objectives and targets to include one of the following:
- dual or multi-skilling
- training on new equipment / technology
- increased responsibility
- understanding of company working practices, procedures, plans and policies
- other specific requirements.

Learning outcome
The learner will: 2. Know how to work efficiently and effectively in engineering
Assessment criteria
The learner can: 2.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work area 2.2 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues 2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity 2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect 2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity 2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity 2.7 describe the action that should be taken if tools and equipment are not in full working order 2.8 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity 2.9 describe the action that should be taken if materials do not meet the requirements of the activity 2.10 explain whom to inform when the work activity has been completed 2.11 describe the information and/or documentation required to confirm that the activity has been completed 2.12 explain what materials, equipment and tools can be reused 2.13 explain how any waste materials and/or products are transferred, stored and disposed of 2.14 explain where tools and equipment should be stored and located

2.15	describe the importance of making recommendations for improving working practices
2.16	describe the procedure and format for making suggestions for improvements
2.17	describe the benefits to organisations if improvements can be identified
2.18	describe the importance of maintaining effective working relationships within the workplace
2.19	describe the procedures to deal with and report any problems that can affect working relationships
2.20	describe the difficulties that can occur in working relationships
2.21	describe the regulations that affect how they should be treated at work
2.22	describe the benefits of continuous personal development
2.23	describe the training opportunities that are available in the workplace
2.24	describe the importance of reviewing their training and development
2.25	explain with whom to discuss training and development issues
2.26	describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.

Unit 403 Working efficiently and effectively in engineering

Supporting information

Guidance

2.21 (such as Equal Opportunities Act, Race and Sex Discrimination, working Time Directive)

Unit 404 Reinstating the work area on completion of activities

UAN:	**K/601/4228**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard aeronautical engineering Unit 004: Reinstating the work Area on completion of activities (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to reinstate the work area, in accordance with approved procedures. The learner 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. The learner 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. The learner's 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. The learner 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. The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the required procedures. The learner 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.

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

Learning outcome
The learner will: 1. Be able to reinstate the work area on completion of activities
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following activities during reinstatement of the work area: • work to current schedules • 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 • report any loss or damage to equipment • report any identified hazards within the work area • return all consumables and materials to their correct location • complete any documentation as required 1.3 separate equipment, components, and materials for re-use from waste items and materials 1.4 store reusable materials and equipment in an appropriate location 1.5 correctly label and store four the following resources: • finished products/components • components requiring overhaul/repair • surplus materials/components • tooling, jigs, fixtures or other equipment used • drawings requiring actioning/adjusting • scrap components • measuring and test instruments • finished drawings • finished documentation • documentation requiring actioning/adjusting 1.6 dispose of waste materials in line with organisational and environmental safe procedures

1.7 deal with waste materials, in line with company and environmental regulations, to include two of the following:
- correctly segregating waste materials
- correctly dispose of waste materials
- disposing of joining compounds, sealants and adhesives
- disposing of other chemical products
- removing non-hazardous materials
- disposing of fluid waste (such as oil, hydraulic fluids, fuel)

1.8 restore the work areas to a safe condition in accordance with agreed requirements and schedules

1.9 carry out reinstatement activities on two work areas from:
- workshops/hangers
- airside
- areas at height (such as platforms, staging, lifts)
- internal areas of aircraft (such as wings, tanks, fuselage sections)
- office environment
- computer aided design (CAD) environment
- technical/clean room environment
- other appropriate environment

1.10 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will: 2. know how to reinstate the work area on completion of activities
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures they need to observe when reinstating the work area 2.2 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.3 describe the hazards associated with reinstating the work area, and explain how to minimise them and reduce any risks 2.4 explain the safe working practices and procedures to be followed when carrying out the various activities 2.5 explain what personal protective clothing and equipment needs to be worn, and where this can be obtained 2.6 explain why work areas need to be restored to a set standard, and what these requirements are 2.7 describe the types of work area that will need to be restored 2.8 Exp[lain the importance of tool and equipment control, and why this is critical within the aerospace industry 2.9 explain the meaning of 'foreign object debris', and why it is vital to ensure that this does not occur or is removed 2.10 describe the stores procedures for tools and equipment, documentation and surplus or waste materials 2.11 explain what materials will need to be stored and disposed of, and why they need to be segregated, correctly identified and labelled

2.12	explain how the various disposal bins can be identified
2.13	explain the procedures for disposing of hazardous materials
2.14	explain what documentation needs to be used on completion of the reinstatement activities
2.15	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve.

Unit 404 Reinstating the work area on completion of activities

Supporting information

Guidance

2.1 (such as any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.4 (such as lifting and handling techniques)

2.7 (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)

2.12 (such as colour coded, labelled)

2.13 (such as chemicals, adhesives, oil, hydraulic fluids, fuel

Unit 413 Repairing airframes and structures

UAN:	**A/601/4380**
Level:	3
Credit value:	62
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 013: Repairing Airframes and Structures (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to repair airframes and structures, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft. The learner will be required to select the appropriate tools and equipment to use, based on the repair operations required, and to check that they are in a safe and serviceable condition. In carrying out the repair operations, the learner will be required to follow laid-down procedures and specific repair techniques, such as insertion repair, primary structure repair, secondary structure repair, tertiary structure repair and patch repair, in order to satisfy the repair scheme in the aircraft structural repair manual. The repair activities will also include making all necessary checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the repair activities undertaken, and to report any problems with the repair activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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 work that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate repair techniques and procedures. The learner will understand the airframe

	structure being repaired, and will know about the components, repair techniques and fastening devices used during the repair operation, in adequate depth to provide a sound basis for carrying out the activities to the required specification. The learner will understand the safety precautions required when carrying out the repair operations. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to repair airframes and structures
Assessment criteria
The learner can: 1.1 Work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 Carry out all of the following activities during the repair: • obtain and use the appropriate documentation (such as job instructions, aircraft assembly/repair drawings, planning and quality control documentation, aircraft procedures and specifications) • 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 • provide and maintain a safe working environment for the repair activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • follow safe practice/approved repair techniques and procedures at all times • ensure that correct part numbers are used, including (where appropriate) left or right handed parts • return all tools and equipment to the correct location on completion of the repair activities • dispose of waste materials in accordance with approved procedures • leave the work area and assembly in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow the relevant specifications for the component to be repaired 1.4 Prepare the component for repair 1.5 Carry out the repairs within agreed timescale using approved materials and components and methods and procedures 1.6 Repair one type of airframe or structure from: • commercial aircraft

- military aircraft
- light aircraft
- helicopters

1.7 Undertake three of the following types of repair:
- insertion repair
- primary structure repair
- secondary structure repair
- tertiary structure repair
- patch repair

1.8 Repair airframes or structures, to include five the following methods and techniques:
- making holes in airframe materials
- marking out
- cutting
- profiling
- deburring
- securing and locking components
- blending

1.9 Use three of the following types of joining method during repairs:
- adhesives/sealants
- locking devices
- rivets
- nuts and bolts
- special fasteners

1.10 Check that the repaired component meets the specified operating conditions

1.11 Produce repairs which comply with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft design/manufacturer's requirements

1.12 Produce accurate and complete records of all repair work carried out

1.13 Complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- build records
- log cards
- aircraft log book
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to repair airframes and structures
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions and procedures that they need to observe whilst carrying out the repairs 2.2 Explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 Explain the health and safety requirements of the work area in which they are carrying out the repair activities, and the responsibility these requirements place on them 2.4 Describe the hazards associated with repairing airframes and systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 Explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.6 Explain how to interpret the drawings, standards, quality control procedures and specifications used for the repair 2.7 Explain how to carry out currency/issue checks on the specifications they are working with 2.8 Explain how to identify the components to be used; component identification systems (such as codes and component orientation indicators) 2.9 Explain what preparations need to be undertaken on the airframe or structure, prior to repair 2.10 Describe the repair methods and procedures to be used, and explain the importance of adhering to these procedures 2.11 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.12 Explain the importance of using the specified fasteners for the repair, and why they must not use substitutes 2.13 Explain the application of sealants and adhesives within the repair activities, and the precautions that must be taken when working with them 2.14 Describe the quality control procedures to be followed during the repair operations 2.15 Explain how to conduct any necessary checks to ensure the accuracy and quality of the repair 2.16 Explain how to recognise defects 2.17 Describe the methods and equipment used to transport, handle and lift the structures into position, and how to check that the equipment is within its current certification dates 2.18 Describe the tools and equipment used in the repair activities, and explain their calibration/care and control procedures 2.19 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 2.20 Describe the problems that can occur with the repair operations, and explain how these can be overcome 2.21 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
2.22	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 413 Repairing airframes and structures

Supporting information

Guidance

2.1 (such as any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.6 (such as BS, ISO or BSEN schematics, symbols and terminology)

2.11 (such as open and blind rivets, threaded fasteners, special securing devices)

2.16 (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)

Unit 414 Modifying airframes

UAN:	**F/601/4381**
Level:	3
Credit value:	60
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 014: Modifying Airframes (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to modify airframes, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment to use, based on the modification operations required, and to check that they are in a safe and serviceable condition. In carrying out the modification operations, the learner will be required to follow laid-down procedures, and to use specific modification leaflets or service bulletins. This unit covers both fixed wing and rotary winged aircraft, and the modification requirements will include such things as fuselage sections, under-floor structures, floors, flaps/ailerons, wings, fins, nose areas, tail sections, doors, cockpit/cabin areas, hatches, windows, bulkheads, mission consoles, galleys, stairs, trunking/ducting, engine nacelles, box sections and avionics cabinets. The modification activities will also include making all necessary checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the modification activities undertaken, and to report any problems with the modification activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate modification techniques and procedures. The

learner will understand the airframe structure being modified, and will know about the components, modification methods and techniques, and fastening devices used during the modification activities, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

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

Note: This unit is intended to cover airframe modifications of a significant or complex nature, involving the use of a range of techniques and a number of different components. The nature of the complexity will take into account the class of structure, primary, secondary etc, the size and timescale of the modification, the tolerances required and the difficulty of access. This unit should not be used solely for simple modifications, such as changes to, or the addition of, simple platework or brackets.

Learning outcome
The learner will: 1. Be able to modify airframes
Assessment criteria
The learner can: 1.1 Work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 Carry out all of the following during the modification activities: • obtain and use the appropriate documentation (such as job instructions, aircraft modification drawings, planning and quality control documentation, aircraft procedures and specifications) • 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 • provide and maintain a safe working environment for the modification activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe the power isolation and safety procedures • ensure that correct part numbers are used, including (where appropriate) left or right handed parts • follow safe practice/approved modification techniques and procedures at all times

- return all tools and equipment to the correct location on completion of the modification activities
- dispose of waste materials in accordance with approved procedures
- leave the work area and aircraft in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Obtain and follow the relevant modification specifications and job instructions

1.4 Confirm and agree what modifications are to be carried out to meet the specification

1.5 Prepare the airframe for the required modification

1.6 Carry out the airframe modification, using approved materials, methods and procedures

1.7 Modify airframes from one of the following types of aircraft:

- commercial aircraft
- light aircraft
- military aircraft
- helicopters

1.8 Modify an airframe/structure, to include at least three from:

- fuselage sections
- under-floor structures
- floor
- flaps/ailerons
- wing
- fin
- nose
- tail
- doors
- cockpit/cabin
- hatches
- windows
- bulkheads
- mission consoles
- galleys
- stairs
- trunking/ducting
- engine nacelle
- box sections
- avionics cabinets

1.9 Use five of the following methods and techniques during the modification activities:

- making holes in airframe materials
- securing and locking components
- marking out
- cutting
- assembling
- profiling

- deburring

1.10 Use three of the following types of joining method during the modifications:
- adhesives/sealants
- locking devices
- rivets
- nuts and bolts
- special fasteners

1.11 Complete the modification within the agreed timescale

1.12 Check that the modified airframe meets the specified operating conditions

1.13 Produce modifications which comply with one of the following:
- Civil Aviation Authority (CAA) / European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.14 Produce accurate and complete records of all modification work carried out

1.15 Complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- modification records
- log cards
- aircraft log book
- job cards
- aircraft flight log

1.16 Deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome
The learner will: 2. Know how to modify airframes
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions and procedures to be observed whilst carrying out the modifications 2.2 Explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 Explain the health and safety requirements of the work area in which they are carrying out the modification activities, and the responsibility these requirements place on them 2.4 Describe the hazards associated with modifying airframes and systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.5	Explain what personal protective equipment and clothing needs to be worn during the modification activities
2.6	Describe the various types of drawing and specification that are used during the modification
2.7	Explain how to identify the components to be used; component identification systems
2.8	Explain what preparations need to be undertaken on the airframe or structure, prior to modification
2.9	Describe the methods and procedures to be used for removing and replacing components, and explain the importance of adhering to these procedures
2.10	Describe the various mechanical fasteners that will be used, and explain their method of installation
2.11	Explain the importance of using the specified fasteners for the modification, and why they must not use substitutes
2.12	Explain the application of sealants and adhesives within the modification activities, and the precautions that must be taken when working with them
2.13	Describe the quality control procedures to be followed during the modification operations
2.14	Explain how to conduct any necessary checks to ensure the accuracy and quality of the modification
2.15	Explain how to recognise defects
2.16	Describe the methods and equipment used to transport, handle and lift the structures into position, and how to check that the equipment is within its current certification dates
2.17	Describe the tools and equipment used in the modification activities, and explain their calibration/care and control procedures
2.18	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
2.19	Describe the problems that can occur with the modification operations, and explain how these can be overcome
2.20	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
2.21	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 414 Modifying airframes

Supporting information

Guidance

2.1 (such as any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.7 (such as codes and component orientation indicators)

2.10 (such as open and blind rivets, threaded fasteners, special securing devices)

2.15 (such as skin blemishes, poor skin lines, ineffective fasteners, foreign object damage)

Unit 541 Carrying out fault diagnosis on aircraft airframe, mechanical components and systems

UAN:	**Y/601/4807**
Level:	3
Credit value:	53
GLH:	119
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 141: Carrying out fault diagnosis on aircraft airframe, mechanical components and systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out fault diagnosis on aircraft airframe and mechanical components and systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and covers a range of mechanical equipment and systems such as power plant and auxiliary engines, flying controls, engine starting and monitoring, fuel and lubrication, hydraulic, pneumatic, environmental, power transmission, ice and rain protection, propeller control, cabin equipment and furnishings and airframe, at sub-assembly or component level, as applicable. The learner will be expected to use a variety of fault diagnostic methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, the learner will be expected to identify the fault and its probable cause, and to determine appropriate action to remedy the problem. The learner's responsibilities will require them to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner

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 work that they carry out. The learner must ensure that all tools, equipment and materials used in the maintenance activities are removed from the aircraft on completion of the activities, and that all necessary job/task documentation is completed, accurately and legibly.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying appropriate fault diagnostic procedures to aircraft airframe and mechanical equipment and systems. The learner will understand the various fault diagnostic methods and techniques used, and their application. The learner will know how to apply and interpret information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities and for identifying faults or conditions that are outside the required specification.

The learner will understand the safety precautions required when carrying out the fault diagnostic activities, especially those for isolating the equipment. The learner 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.

Learning outcome
The learner will: 1. Be able to carry out fault diagnosis on aircraft airframe, mechanical components and systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the fault diagnostic activities: • plan the fault diagnosis activities prior to beginning the work • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)

- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- provide and maintain a safe working environment for the diagnostic activities
- carry out the fault diagnostic activities, using approved techniques and procedures
- collect equipment fault diagnostic evidence from live and isolated systems
- disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
- identify the fault and determine the appropriate corrective action
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 carry out fault diagnosis on three of the following aircraft airframe/mechanical systems, to sub-assembly or component level, as appropriate:

- power plant (including APU)
- auxiliary engines
- engine starting and monitoring
- fuel
- lubrication
- power transmission
- flying controls
- undercarriage
- propeller control
- hydraulic
- pneumatic
- environmental (cabin conditioning, pressurisation, oxygen)
- ice and rain protection
- cabin equipment and furnishings
- airframe (including freight)
- cabin systems (such as water, galley, sanitary)

1.4 review and use all relevant information on the symptoms and problems associated with the products or assets

1.5 collect information about the fault from four of the following sources:

- the person who reported the fault
- monitoring equipment or gauges
- recording devices
- aircraft self-diagnostics
- approved sensory checks (such as sight, sound, smell, touch)
- aircraft log/documentation

- operation of the equipment
- fault records

1.6 diagnose faults from two of the following breakdown categories:
- intermittent problem
- partial failure or reduced performance
- complete breakdown

1.7 select, use and apply diagnostic techniques, tools and aids to locate faults

1.8 use a range of fault diagnostic techniques, to include three of the following:
- pressure/leak test
- functional testing
- input-to-output
- injection and sampling
- half-split technique
- unit substitution
- six point technique
- non-destructive testing techniques

1.9 use a variety of diagnostic aids and equipment, to include two of the following:
- aircraft maintenance manual (AMM)
- equipment self-diagnostics
- circuit diagrams/specifications
- fault analysis charts (such as fault trees)
- troubleshooting guides
- algorithms/flow charts

1.10 use two of the following types of test equipment to help in the fault diagnosis:
- mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
- electrical/electronic measuring instruments (such as a multimeter)
- fluid power test equipment (such as test rigs, flow meters, pressure gauges)
- built in test equipment (BITE)
- 'special-to-type' test equipment
- ferrous or non-ferrous crack detection equipment

1.11 investigate and establish the most likely causes of the faults

1.12 complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved

1.13 determine the implications of the fault for other work and for safety considerations

1.14 use the evidence gained to draw valid conclusions about the nature and probable cause of the fault

1.15 record details on the extent and location of the faults in an appropriate format

1.16 provide a record of the outcome of the fault diagnosis, using one of the following:
- step-by-step analytical report

- aircraft service/flight log
- aircraft log book
- corrective action report
- company-specific reporting procedure
- computer records.

Learning outcome
The learner will: 2. Know how to carry out fault diagnosis on aircraft airframe, mechanical components and systems
Assessment criteria
The learner can: 2.1 explain the health and safety requirements of the area in which they are carrying out the fault diagnostic activities, and the responsibility these requirements place on them 2.2 explain the specific safety precautions to be taken when carrying out the fault diagnosis of the particular aircraft airframe/mechanical system 2.3 describe the isolation and lock-off procedure or permit-to-work procedure that applies 2.4 explain the importance of wearing protective clothing and other appropriate safety equipment during the fault diagnostic activities, the type of safety equipment to be used and where to obtain it 2.5 describe the hazards associated with carrying out fault diagnosis on aircraft mechanical systems and explain how to minimise them and reduce any risks 2.6 explain where to obtain, and how to interpret drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed for the fault diagnostic activities 2.7 describe the basic principles of how the mechanical system functions, and the working purpose of the various units and components 2.8 describe the various fault finding techniques that can be used, and how they are applied 2.9 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.10 explain how to evaluate the various types of information available for fault diagnosis 2.11 explain how to evaluate sensory information from sight, sound, smell, touch 2.12 explain how to conduct test for cracks or fatigue in airframe structure components 2.13 explain the procedures to be followed to investigate faults, and how to deal with intermittent conditions 2.14 explain how to use the various aids and reports available for fault diagnosis 2.15 describe the types of equipment that can be used to aid fault diagnosis and explain how to check that the equipment is calibrated or configured correctly for the intended use, and that it is free from damage and defects 2.16 describe the application of specific fault finding methods and techniques that are best suited to the problem

2.17	explain how to analyse and evaluate possible characteristics and causes of specific faults/problems
2.18	explain how to make use of previous reports/records of similar fault conditions
2.19	explain how to evaluate the likely risk of running the aircraft with the displayed fault, and the effects the fault could have on the aircraft performance and safety
2.20	explain how to prepare a report which complies with the company policy on fault diagnosis
2.21	describe the extent of their own authority and explain to whom they should report if they have problems that they cannot resolve

Unit 541 Carrying out fault diagnosis on aircraft airframe, mechanical components and systems

Supporting information

Guidance

2.5 (such as working on pressurised systems, hot or moving parts, using faulty or damaged tools and equipment, using practices and procedures that do not follow laid-down procedures),

2.8 (such as half-split, input-to-output, six point technique, functional testing, unit substitution, injection and sampling techniques, and equipment self-diagnostics)

2.10 (such as pilot reports, monitoring equipment, aircraft history records, function of the equipment/system)

2.15 (such as mechanical measuring instruments, electrical measuring instruments, test rigs, pressure and flow devices)

Unit 542 Undertaking scheduled maintenance of aircraft airframe and mechanical equipment

UAN:	**H/601/4809**
Level:	3
Credit value:	40
GLH:	91
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 142: Undertaking scheduled maintenance of aircraft airframe and mechanical equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled maintenance activities on aircraft airframes and mechanical equipment, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and covers a range of mechanical equipment such as power plant and auxiliary engines, flying controls, engine starting and monitoring, fuel and lubrication, hydraulic, pneumatic, environmental equipment (such as cabin conditioning, oxygen, pressurisation), power transmission, ice and rain protection, propeller control, cabin equipment and furnishings and airframe components. The learner will need to organise and carry out the maintenance activities to minimise down time, and ensure that the maintained equipment/system meets airworthiness standards, and performs at operational levels and to the required specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with the maintenance activities, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment, and materials used in

	the maintenance activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed, accurately and legibly. The learner 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 work that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying scheduled maintenance procedures on aircraft airframe/mechanical equipment. The learner will know how the system and equipment functions, and potential problems or defects that may occur. The learner will understand the process of developing scheduled maintenance, and its application, and will know about the maintenance criteria, in adequate depth to provide a sound basis for carrying out the activities safely and effectively, and for ensuring that the equipment is maintained to the required specification. In addition, the learner will be expected to report where the outcome of the maintenance activity identifies the need for further investigation or maintenance work. The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner 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..

Learning outcome
The learner will: 1. Be able to undertake scheduled maintenance of aircraft airframe and mechanical equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the scheduled maintenance activities: • plan the scheduled maintenance activities to cause minimal disruption to normal working • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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

- obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures (such as mechanical, electricity, gas, air or fluids)
- provide and maintain a safe working environment for the maintenance activities
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- carry out the maintenance activities, using approved techniques and procedures
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- re-connect and return the system to service on completion of the maintenance activities
- dispose of waste items in a safe and environmentally acceptable manner
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and system in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the relevant maintenance schedules to carry out the required work

1.4 carry out planned maintenance based on one of the following types of maintenance schedule:

- condition based maintenance
- depth maintenance
- scheduled maintenance
- total preventative maintenance (TPM)

1.5 carry out the scheduled maintenance on three of the following aircraft airframe, mechanical equipment/systems:

- power plant (including APU)
- auxiliary engines
- engine starting and monitoring
- power transmission
- fuel
- lubrication
- flying controls
- propeller control
- hydraulic
- pneumatic
- ice and rain protection
- cabin equipment and furnishings
- airframe (including freight)
- undercarriage
- cabin systems (such as water, galley, sanitary)
- environmental (such as cabin conditioning, oxygen,

pressurisation)

1.6 carry out the maintenance activities within the limits of their personal authority

1.7 carry out twelve of the following scheduled maintenance procedures:

- carrying out specified visual inspections
- carrying out testing of equipment against the maintenance schedule
- replacing 'lifed' consumables (such as oils, grease, belts, gaskets, seals and filters)
- replacing 'lifed' components
- checking the condition of operating mechanisms (such as levers and links, bearings, turnbuckles)
- checking the operation of all gauges and sensors
- checking alignment of running/sliding components
- making routine adjustments to components
- carrying out leak checks on all connections
- making visual checks of equipment and cables
- checking the integrity of all connections
- torque testing critical fastenings
- replacing damaged or defective fasteners
- inspecting and cleaning sensors
- making approved sensory checks (such as sight, sound, smell, touch)
- checking airframe components for damage/fatigue
- carrying out system self-analysis checks
- checking and adjusting shock mountings
- carrying out specified lubrication
- testing and reviewing the system operation
- replacing missing or damaged locking and retaining devices (such as proprietary fasteners, locking wires)
- recording the results of the maintenance activity and reporting any defects found

1.8 carry out three of the following checks during the maintenance activities:

- mechanical measuring checks (such as measuring operating clearance, travel, timings, symmetry checks)
- fluid power checks (such as pressure, flow, leak)
- 'special-to-type' tests
- ferrous or non-ferrous crack detection tests
- functional tests
- zonal inspections

1.9 check that the maintained equipment/system meets all of the following:

- all components and units are fit for purpose
- all connections are safe and sound
- systems are leak free
- equipment operates within acceptable limits for successful

continuous operation
- any potential defects are identified and reported for future action
- all relevant documentation is completed, accurately and legibly

1.10 carry out the maintenance activities in the specified sequence and in an agreed timescale

1.11 ensure that the maintained equipment complies with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

1.13 complete the relevant maintenance records accurately and pass them on to the appropriate person, to include one of the following:
- computer records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.14 dispose of waste materials in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to undertake scheduled maintenance of aircraft airframe and mechanical equipment
Assessment criteria
The learner can: 2.1 explain the specific safety precautions and procedures to be observed whilst carrying out the maintenance 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the area in which the scheduled maintenance activity is to take place, and the responsibility these requirements place on them 2.4 describe the isolation and lock-off procedure or permit-to-work procedure that applies to the aircraft system being maintained 2.5 explain the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where it may be obtained

2.6	describe the hazards associated with carrying out maintenance activities on aircraft airframe/mechanical equipment, and explain how to minimise them and reduce any risks
2.7	explain how to obtain and interpret drawings, charts, specifications, aircraft manuals, history/maintenance reports and other documents needed for the maintenance activities
2.8	describe the various planned maintenance schedules that are generally used, and the methods to be followed to comply with company procedures for the maintenance of the aircraft airframe/mechanical equipment
2.9	explain the equipment operating and control procedures, and how to apply them in order to carry out the scheduled maintenance activities
2.10	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.11	describe the basic principle of operation of the equipment or system being maintained, and explain the purpose of individual units/components and how they interact
2.12	describe the application and use of a range of mechanical operating mechanisms, and explain the likely functions that will require checking
2.13	describe the different types of pipe and hose that are used, and explain what to check during the maintenance activities
2.14	describe the methods of checking that components are fit for purpose, and explain the need to replace 'lifed' items
2.15	explain how to recognise defects in aircraft airframe/mechanical equipment
2.16	explain the adjustments/corrections/tuning required to maintain the equipment/system at operational standard through full range parameters
2.17	describe the methods of checking airframe structure components for damage, wear and fatigue
2.18	explain what testing methods and procedures are to be used to check that the system conforms to acceptable limits
2.19	explain how to make sensory checks by sight, sound, smell, touch
2.20	explain the company policy on repair/replacement of components during the maintenance activities
2.21	explain the importance of ensuring that the equipment is maintained to the prescribed category of cleanliness
2.22	explain what maintenance documentation and/or reports need to be completed on completion of the maintenance activity
2.23	describe the problems that can occur whilst carrying out the maintenance activities, and explain how they can be avoided
2.24	describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
2.25	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 542 Undertaking scheduled maintenance of aircraft airframe and mechanical equipment

Supporting information

Guidance

2.1 (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.6 (such as working with pressurised systems, handling fluids, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures)

2.8 (such as condition based maintenance, scheduled maintenance, and total preventative maintenance (TPM))

2.12 (such as levers and links, pulleys and pivots, bearings, turnbuckles)

2.15 (such as under or over performance)

Unit 543 Removing and replacing aircraft power plant and components

UAN:	**H/601/4812**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 143: Removing and replacing aircraft power plant and components (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of a complete engine exchange unit and the removal and replacement of components of aircraft power plant, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes a range of power plant such as turbo prop, turbo jet, by-pass, ducted fan, turbo shaft, piston engines, and auxiliary power units (APU) or ground turbine start (GTS units). The removal and replacement activities will include taking all necessary safeguards to isolate the system, support and lift removed and replaced parts, replacing faulty equipment at component or unit level, replenishing fluids, setting and adjusting replaced components, and leaving the power plant in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft power plant. The learner will understand the removal and replacement methods and procedures, and their application, along with the power plant maintenance requirements. The learner will know how the power plant 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on aircraft power plant, especially those for isolating the equipment. The learner 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: To display competence in this unit it is necessary to both remove and replace components from aircraft power plant. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace aircraft power plant and components
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other

relevant maintenance documentation)

- 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
- ensure the safe isolation of the power plant before carrying out work on the equipment
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- use approved removal and replacement techniques and procedures at all times
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- ensure that components and surrounding structures are maintained free from damage
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and the power plant in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

1.3 follow the relevant aircraft manuals and publications to carry out the required work

1.4 establish and, where appropriate, mark component orientation for re-assembly

1.5 ensure that any stored energy or substances are released safely and correctly

1.6 carry out the removal and replacement activities, within the limits of their personal authority

1.7 carry out all of the following removal and replacement activities:

- disconnecting electrical connections
- disconnect/removing hoses and pipes
- supporting equipment to be removed
- dismantling equipment to an appropriate level
- proof marking components to aid reassembly
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing all damaged/defective components
- applying gaskets and sealant/adhesives
- positioning and aligning replaced components
- setting and adjusting replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- making 'off-load' checks before starting up
- replenishing fluids, oils and greases
- use of ground support equipment

- using lifting operations (manual or automated)
- securing components using mechanical fasteners and threaded devices
- applying bolt locking methods (such as split pins, wire locking, lock nuts)
- labelling (and storing in the correct location) components that require repair or overhaul
- protecting and preparing removed components for transportation for overhaul

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove and replace one of the following types of aircraft power plant assembly:

- turbo prop
- ducted fan
- turbo jet
- turbo-shaft
- turbo-fan
- piston
- auxiliary power unit (APU)
- ground turbine start (GTS)

1.10 remove and replace components from each of the following groups:major engine components: remove and replace one of the following:

- air intake
- exhaust unit
- propellers
- gear box
- reverse thrusters
- fuel control unit
- starter motor
- gearbox ancillaries
- coolers (air, oil, fuel)
- heat exchangers (oil, fuel)
- torque converters
- superchargers
- turbochargers
- pumps (fuel, oil)
- cylinder heads
- valve mechanisms
- magneto
- constant pitch and speed units

other engine components: remove and replace two of the following:

- filters (fuel, oil, air)
- pipes and hoses
- igniters
- sensors

- levers and linkages
- damper/connector arm
- spark plugs
- fire bottle
- fire detection units
- fire wire
- magnetic chip detectors
- other specific components

1.11 remove and replace aircraft power plant and components in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log books
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to remove and replace aircraft power plant and components
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft power plant 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft power plant components, and with the tools and equipment used and explain how to minimise them and reduce any risks

2.4	explain what protective equipment they need to use for both personal protection and protection of the aircraft
2.5	explain how to extract and use information from aircraft maintenance manuals, history/maintenance reports, flight logs, and other documents needed in the removal and replacement process
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	explain the terminology used in aircraft power plant systems
2.8	describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
2.9	describe the techniques used to remove components from aircraft power plant without damage to the components or surrounding structure and explain the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected
2.10	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.11	describe the various mechanical fasteners that will need to be removed and replaced, and explain their method of removal and replacement
2.12	describe the various types of electrical connectors that are used, methods of unlocking, orientation indicators and locating and locking in of the connections
2.13	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.14	describe the identification and application, fitting and removal of different types of bearings
2.15	explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
2.16	describe the uses of measuring equipment
2.17	explain the need to replace 'lifed' items
2.18	explain the need to correctly label and store components that require repair or overhaul, and the importance of checking that replacement components have the correct part/identification markings
2.19	explain how to replace and re-connect components into the system
2.20	explain how to make adjustments to components/assemblies to ensure that they function correctly
2.21	explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
2.22	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.23	explain the importance of making 'off-load' checks before running the equipment under power
2.24	explain how to check that tools and equipment are free from damage or defect, are in a safe and usable condition and are configured correctly for the intended purpose
2.25	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.26	explain how to use lifting and handling equipment in the maintenance activity
2.27	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
2.28	describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids
2.29	describe the problems associated with removing and replacing power plant components, and explain how they can be overcome
2.30	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 543 Removing and replacing aircraft power plant and components

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as handling oils, greases, aviation fuel, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures),

2.9 (such as release of pressures/force, draining of fluids, proof marking, extraction of components),

2.11 (such as threaded fasteners, special securing devices)

2.14 (such as roller, ball, thrust)

2.16 (such as micrometers, Verniers, expansion indicators and other measuring devices)

2.17 (such as seals and gaskets)

2.19 (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)

2.20 (such as balancing of rotating components, setting working clearance, setting travel, setting backlash in gears, preloading bearings)

Unit 544 Removing and replacing components of aircraft control systems

UAN:	**M/601/4814**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 144: Removing and replacing components of aircraft control systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes equipment and components associated with flying controls and powerplant. The removal and replacement activities will include taking all necessary safeguards to isolate the system, supporting and lifting removed and replaced parts, replacing faulty equipment at component or unit level, setting and adjusting replaced components, and leaving the control system in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft control system components. The learner will understand the removal and replacement methods and procedures, and their application, along with the aircraft control system maintenance requirements. The learner will know how the aircraft controls function, 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, The learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on aircraft controls, especially those for isolating the equipment, lifting and handling control components. The learner 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: To display competence in this unit it is necessary to both remove and replace components from aircraft controls. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft control systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures

- obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
- 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
- ensure the safe isolation of the control system before carrying out work on the equipment
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- use approved removal and replacement techniques and procedures at all times
- ensure that components and surrounding structures are maintained free from spillages, damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and the control system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

1.3 follow the relevant aircraft manuals and publications to carry out the required work

1.4 establish and, where appropriate, mark component orientation for re-assembly

1.5 ensure that any stored energy or substances are released safely and correctly

1.6 carry out the removal and replacement activities, within the limits of their personal authority

1.7 carry out all of the following removal and replacement activities:

- releasing stored pressure (where appropriate)
- disconnecting electrical connections
- removing mechanical fasteners and securing devices
- supporting equipment to be removed
- dismantling equipment to an appropriate level
- proof marking components to aid reassembly
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing all damaged/defective components
- replacing all 'lifed' items (such as seals, bearings, gaskets)
- positioning and aligning replaced components
- setting and adjusting replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- using lifting operations (manual or automated)
- securing components using mechanical fasteners and

threaded devices
- applying bolt locking methods (such as split pins, wire locking, lock nuts)
- labelling (and storing in the correct location) components that require repair or overhaul
- protecting and preparing removed components for transportation for overhaul

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft control systems, and replace components from three of the following aircraft control systems:
- air brakes
- spoilers/speed brakes
- flaps/slats
- tailplane
- propeller
- rudders/yaw
- ailerons/tailerons
- flaperons
- cyclic
- reaction control
- wing sweep
- auxiliary transmission
- canards
- main gear steering
- elevators
- trim tabs
- powerplant
- collective
- auxiliary power
- thrust reverse
- main rotor blades
- horizontal stabilisers
- tail rotor blades/yaw
- power augmentation
- vectored thrust
- nose wheel steering

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following:major control components: remove and replace three of the following:
- pedals
- flap selectors
- control columns/sticks
- air/speed brake selectors
- trim wheels
- reaction control nozzles

- powered flying control units
- fuel control units
- auto pilot system components
- auxiliary controls
- throttle boxes
- torque tubes
- control surfaces
- gradient boxes
- AFCS series and parallel actuators
- mixer units
- artificial feel units
- primary flight computers (including actuator control electronic (ACE))
- full authority digital engine control and full authority fuel control units (FADEC and FAFC)

other control components: remove and replace four of the following:

- turnbuckles
- cables and pulleys
- connecting rods
- position transmitters/desyns
- levers and linkages
- sensors
- actuators/motors
- reaction control ducting
- pedal shakers
- locks and stops
- bell cranks
- other specific components

1.11 remove and replace aircraft control components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, including one from the following, and pass it to the appropriate people:

- job cards

- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components in accordance with safe working practices and approved procedures

Learning outcome

The learner will:

2. Know how to remove and replace components of aircraft control systems

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft control systems

2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures

2.3 describe the hazards associated with removing and replacing aircraft control components, and with the tools and equipment used and explain how to minimise them and reduce any risks

2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft

2.5 explain how to extract and use information from aircraft maintenance manuals, history/maintenance reports, flight logs, and other documents needed in the removal and replacement process

2.6 explain how to carry out currency/issue checks on the specifications they are working with

2.7 explain the terminology used in aircraft control systems

2.8 describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact

2.9 describe the techniques used to remove components from aircraft controls without damage to the components or surrounding structure and explain the need to protect the system integrity by fitting blanking plugs and ensuring that exposed components are correctly covered/protected

2.10 describe the various mechanical fasteners to be removed and replaced, and explain their method of removal and replacement

2.11 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

2.12 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.13 explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

2.14 explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics

2.15 describe the uses of measuring equipment

2.16 explain the need to replace 'lifed' items

2.17	explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings
2.18	explain how to replace and re-connect components into the system
2.19	explain how to make adjustments to components/assemblies to ensure that they function correctly
2.20	explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	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
2.23	explain how to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for the intended purpose
2.24	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.25	explain how to use lifting and handling equipment in the maintenance activity
2.26	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
2.27	describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids
2.28	describe the problems associated with removing and replacing power plant components, and explain how they can be overcome
2.29	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 544 Removing and replacing components of aircraft control systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as handling oils, greases, stored pressure/force, lifting and moving components, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures),

2.9 (such as release of pressures/force, proof marking, extraction of components),

2.10 (such as threaded fasteners, special securing devices)

2.15 (such as micrometers, Verniers, expansion indicators and other measuring devices)

2.16 (such as seals and gaskets)

2.18 (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)

2.19 (such as setting working clearance, setting travel, pre-loading bearings)

Unit 545 Removing and replacing components of aircraft fuel and lubrication systems

UAN:	**A/601/4816**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 145: Removing and replacing components of aircraft fuel and lubrication systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft fuel and lubrication systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of fuel and lubrication equipment associated with propulsion units/power plant, auxiliary engines and transmission systems, main and auxiliary fuel tanks and in flight refuelling equipment, as applicable to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed. The removal and replacement activities will include taking all necessary safeguards to isolate the system, drain fluids, support and lift removed and replaced parts, and will also include replacing faulty equipment at component or unit level, replenishing fluids, setting and adjusting replaced components, and leaving the system in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft fuel and lubrication equipment and systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner will know how the fuel and lubrication systems and 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on the aircraft fuel and lubrication system, especially those relating to the risk of spillage, fire and explosion. The learner 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: To display competence in this unit, it is necessary to both remove and replace components from aircraft fuel and lubrication systems. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft fuel and lubrication systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • ensure the safe isolation and depressurisation of the fuel and lubrication system before breaking into the system • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures • use approved removal and replacement techniques and procedures at all times • ensure that components and surrounding structures are maintained free from spillages, damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • leave the aircraft and the fuel and lubrication system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 ensure that any stored energy or substances are released safely and correctly 1.6 carry out the removal and replacement activities, within the limits of their personal authority 1.7 carry out all of the following removal and replacement activities: • releasing stored pressure (where appropriate) • draining and removing fluids (where appropriate) • disconnecting electrical connections • disconnecting/removing hoses and pipes

- ensuring that any part dismantled components are secure/supported
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- replacing fluids and bleeding the system
- making 'off-load' checks before re-pressurising
- re-pressurising the system (where applicable)
- use of ground support equipment
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting replaced components (such as travel, working clearance)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)
- fitting blanks to open systems to prevent entry of contaminating debris
- securing components by using mechanical fasteners and threaded devices

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft fuel and lubrication systems, and replace components from three of the following aircraft fuel and lubrication systems:

- propulsion/power plant fuel system
- auxiliary engine fuel system
- propulsion/power plant lubrication system
- auxiliary engine lubrication system
- oil storage system
- transmission system
- in-flight refuelling equipment
- auxiliary fuel tank
- external/drop down fuel tanks
- main fuel tanks
- fuel drain and jettison system

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following: major fuel or lubrication components: remove and replace three of the following:

- pumps
- reservoirs/supply tanks
- fuel/oil cooling units
- compresser

- fuel and de-fuel connections
- safety devices
- fuel manifold
- pressure intensifiers
- cylinders
- actuating mechanisms
- carburettors
- fuel flow regulators
- control valves (drain, bleed, change-over valves, dump)
- electrical controls (solenoids, motors, pressure switches)
- injectors
- other specific components

other fuel and lubrication components: remove and replace four of the following:

- fuel filters
- oil filters
- strainers
- fuel injectors
- rigid pipework
- hoses
- gaskets and seals
- sensors
- dip sticks, drip sticks, drop sticks
- gauges
- magnetic chips

1.11 remove and replace aircraft fuel and lubrication components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book

- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft fuel and lubrication systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft fuel and lubrication systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the safety procedures that must be carried out before work is started on removing the fuel system components 2.4 describe the hazards associated with removing aircraft fuel and lubrication system components, and with the tools and equipment used and explain how to minimise them and reduce any risks 2.5 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.6 explain how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft fuel and lubrication systems, and other documents needed in the removal and replacement process 2.7 explain how to carry out currency/issue checks on the specifications they are working with 2.8 explain the terminology used in aircraft fuel and lubrication systems, and the use of diagrams and associated symbols 2.9 describe the various types of pipes and components that make up the aircraft fuel and lubrication system 2.10 describe the basic principles of operation of the aircraft fuel or lubrication system being worked on, and the performance characteristics and function of the components within the circuit 2.11 describe the techniques used to remove components from aircraft fuel and lubrication systems, without damage to the components or surrounding structure 2.12 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.13 describe the various mechanical fasteners that will need to be removed and replaced, and explain their method of removal and replacement 2.14 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections 2.15 explain the methods of lifting and supporting the components/equipment during the removal and replacement activities 2.16 explain the importance of ensuring that the work area is free from dirt, swarf and foreign object damage, and of ensuring that any

exposed components or pipe ends are correctly covered/protected

2.17 explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the fuel or lubrication system

2.18 explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings

2.19 explain how to re-connect components into the system

2.20 explain how to make adjustments to components/assemblies to ensure that they function correctly

2.21 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.22 explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used

2.23 describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures

2.24 explain the need to control and account for all tools and equipment used during the removal and replacement activity

2.25 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

2.26 describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids

2.27 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 545 Removing and replacing components of aircraft fuel and lubrication systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as displaying warning notices, ensuring adequate fire fighting equipment)

2.4 (such as handling fluids, flammable fluids, fire and explosion, misuse of tools)

2.9 (such as rigid pipes, flexible hoses, pipe connectors, pipe sealing and supporting devices, valves used for flow and change over, fuel and lubrication pumps, pressure intensifiers, mechanical and electrical control devices)

2.11 (such as release of pressures/force, draining of fluids, proof marking, extraction of components and explain the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)

2.13 (such as threaded fasteners, special securing devices)

2.19 (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and valve connections; eliminating stress on pipework/connections; ensuring that pipework is supported at suitable intervals; carrying out visual checks of all components; checking the security of joints and that the system is safe to re-fill/pressurise)

2.20 (such as flow and pressure settings and their effect on the system, travel and working clearance)

Unit 546 Removing and replacing components of aircraft hydraulic systems

UAN:	**J/601/4818**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 146: Removing and replacing components of aircraft hydraulic systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft hydraulic systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of hydraulic equipment such as landing gear, flying controls, main and tail rotor control, blade fold, rotor brakes, nose wheel steering, cargo and weapon bay doors, emergency and utility systems and other aircraft specific equipment. The removal and replacement activities will include making all necessary checks to support and chock pistons/moving parts, isolating and de-pressurising the system, breaking into the system circuit, removing and replacing faulty equipment at component or unit level, replenishing fluids, pressurising the system, setting and adjusting the completed system, and leaving components in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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,

accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures on aircraft hydraulic equipment and systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, they will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on aircraft hydraulic systems, especially those for isolating the equipment. The learner 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: 1. To display competence in this unit, it is necessary to both remove and replace components from aircraft hydraulic systems. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft hydraulic systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures

- obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
- 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
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- ensure the safe isolation and depressurisation of the hydraulic equipment before breaking into the system
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- use approved removal and replacement techniques and procedures at all times
- ensure that components and surrounding structures are maintained free from spillages, damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft and the hydraulic system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing

1.3 follow the relevant aircraft manuals and publications to carry out the required work

1.4 establish and, where appropriate, mark component orientation for re-assembly

1.5 ensure that any stored energy or substances are released safely and correctly

1.6 carry out the removal and replacement activities, within the limits of their personal authority

1.7 carry out all of the following removal and replacement activities:

- chocking and supporting components
- releasing stored pressure
- draining and removing fluids
- disconnecting electrical connections
- disconnecting/removing hoses and pipes
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- replacing fluids and bleeding the system
- making 'off-load' checks before re-pressurising

- re-pressurising the system
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting replaced components (such as travel, working clearance)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft hydraulic systems, and replace components from three of the following aircraft hydraulic systems:

- main undercarriage
- nose undercarriage
- tail undercarriage
- nose wheel steering
- main gear steering
- wheel braking system
- damping mechanisms
- flying controls
- rotor brakes
- blade fold
- main rotor control
- tail rotor control
- spoilers
- outriggers
- doors (such as cabin, cargo, hold)
- weapon bay doors
- emergency systems
- utility systems
- ram air turbine (RAT)
- other specific systems (such as hoists)

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following major hydraulic components: remove and replace two of the following:

- pumps
- hydraulic motors
- oil coolers
- pressure intensifiers
- brake units
- accumulators
- reservoirs/tanks
- actuators/rams
- control valves

other system components: remove and replace two of the following:

- filters
- non-return valves

- regulators
- pipes and hoses
- pressure reducing valves
- sensors
- gauges
- hydraulic fuses
- computers/control cards

1.11 remove and replace aircraft hydraulic components in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft hydraulic systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft hydraulic systems and when using synthetic oils 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft hydraulic system components, and with the tools and equipment used and explain how to minimise them and reduce any risks

2.4	explain what protective equipment they need to use for both personal protection and protection of the aircraft
2.5	explain how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft hydraulic systems, and other documents needed in the removal and replacement process
2.6	explain how to carry out currency/issue checks on the specifications they are working with
2.7	explain the terminology used in aircraft hydraulic systems, and the use of fluid power diagrams and associated symbols
2.8	describe the various types of pipe and component that make up the aircraft hydraulic system
2.9	describe the basic principles of operation of the hydraulic system being worked on, and the performance characteristics and function of the valves, cylinders/actuators within the circuit
2.10	describe the techniques used to remove components from aircraft hydraulic systems, without damage to the components or surrounding structure and explain the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits
2.11	describe the various mechanical fasteners that will need to be removed and replaced, and explain their method of removal and replacement
2.12	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections
2.13	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
2.14	explain the methods of lifting, handling and supporting the components/equipment during the removal/replacement activities
2.15	explain the importance of ensuring that the work area is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.16	explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the hydraulic system
2.17	explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings
2.18	explain how to re-connect components into the circuit
2.19	explain how to make adjustments to components/assemblies to ensure that they function correctly
2.20	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.21	explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
2.22	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures
2.23	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.24	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
2.25	describe the procedure for the safe disposal of waste materials, scrap components and hydraulic fluids
2.26	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 546 Removing and replacing components of aircraft hydraulic systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as the need to support the aircraft and/or its components, the use of cylinder chocks and wedges, safe release of pressurised systems, handling hydraulic fluids, misuse of tools)

2.8 (such as rigid pipes; flexible hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure, flow and directional control; double and single action cylinders/actuators; pump; pressure intensifier, mechanical and electrical control device)

2.10 (such as release of pressures/force, draining of fluids, proof marking, extraction of components)

2.11 (such as threaded fasteners, special securing devices)

2.18 (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct tightness of pipe fittings and valve connections; eliminating stress on pipework/connections; ensuring that pipework is supported at suitable intervals; carrying out visual checks of all components; checking the security of joints and that the system is safe to re-pressurise)

2.19 (such as pressure settings and their effect on the system, travel and working clearance)

Unit 547 Removing and replacing components of aircraft pneumatic and vacuum systems

UAN:	**J/601/4821**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 147: Removing and replacing components of aircraft pneumatic and vacuum systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft pneumatic and vacuum systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of air equipment such as emergency blow-down systems, de-icing systems, air stairs, sanitary and waste disposal systems, arrester mechanisms, deck locks, air start systems, weapons systems, flying controls and other aircraft specific equipment, as applicable to the aircraft type. The removal and replacement activities will include making all necessary checks to support and chock pistons/moving parts, isolating and de-pressurising the system, breaking into the system circuit, removing and replacing faulty equipment at component or unit level, pressurising the system, setting and adjusting the completed system, and leaving components in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft pneumatic and vacuum equipment and systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on aircraft pneumatic and vacuum systems, especially those for isolating the equipment. The learner 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: To display competence in this unit, it is necessary to both remove and replace components from aircraft pneumatic and vacuum systems. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft pneumatic and vacuum systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • ensure the safe isolation and depressurisation of the equipment before breaking into the system • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures • use approved removal and replacement techniques and procedures at all times • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • leave the aircraft and the pneumatic and vacuum systems in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 ensure that any stored energy or substances are released safely and correctly 1.6 carry out the removal and replacement activities, within the limits of their personal authority 1.7 carry out all of the following removal and replacement activities: • chocking and supporting components • releasing stored pressure • disconnecting electrical connections • disconnecting/removing hoses and pipes

- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- making 'off-load' checks before re-pressurising
- re-pressurising the system
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting replaced components (such as travel, working clearance)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft pneumatic and vacuum systems, and replace components from three of the following aircraft pneumatic and vacuum systems:

- emergency blow down systems
- air driven gyros
- spoilers
- slats
- flaps
- flying controls
- nose wheel steering
- wheel braking
- de-icing systems
- air stairs
- engine air start
- waste disposal systems
- air intake shutters
- sanitary systems
- waste disposal/utility systems
- damping mechanisms
- deck locks
- arrester mechanisms
- gun cocking
- weapon bay doors
- other specific systems

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following major components: remove and replace two of the following:

- pumps

- vacuum pumps
- motors
- air coolers
- pressure intensifiers
- compressors
- accumulators
- air reservoirs/tanks
- cylinders/actuating mechanisms
- control valves

other system components: remove and replace two of the following:

- air filters
- non-return valves
- regulators
- pipes, ducting and hoses
- pressure reducing valves
- sensors
- gauges
- sealing devices

1.11 remove and replace aircraft pneumatic and vacuum system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Authority (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. know how to remove and replace components of aircraft pneumatic and vacuum systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft pneumatic and vacuum systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft pneumatic and vacuum system components, and with the tools and equipment used and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft pneumatic and vacuum systems, and other documents needed in the removal and replacement process 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft pneumatic and vacuum systems, and the use of fluid power diagrams and symbols 2.8 describe the various types of pipe and component that make up the aircraft pneumatic or vacuum system 2.9 describe the basic principles of operation of the pneumatic or vacuum system being worked on, and the performance characteristics and function of the valves, cylinders/actuators within the circuit 2.10 describe the techniques used to remove components from aircraft pneumatic and vacuum systems, without damage to the components or surrounding structure (such as release of pressures/force, proof marking, extraction of components), and explain the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits 2.11 describe the various mechanical fasteners that will need to be removed and replaced, and explain their method of removal and replacement 2.12 describe the various types of electrical connectors that are used, methods of unlocking, orientation indicators and locating and locking in of the connections 2.13 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment/device 2.14 explain the methods of lifting and supporting the components/equipment during the removal and replacement activities 2.15 explain the importance of ensuring that the work area is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected 2.16 explain how to recognise contaminants and the problems they can

create; the effects and likely symptoms of contamination in the pneumatic or vacuum system

2.17 explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings

2.18 explain how to reconnect components into the circuit

2.19 explain how to make adjustments to components/assemblies to ensure that they function correctly

2.20 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.21 explain why securing devices need to be tightened to the correct torque, locked and labelled and the different methods that are used

2.22 describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures

2.23 explain the need to control and account for all tools and equipment used during the removal and replacement activity

2.24 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

2.25 describe the procedure for the safe disposal of waste materials, scrap components and fluids

2.26 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 547 Removing and replacing components of aircraft pneumatic and vacuum systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as the need to support the aircraft and/or its components, the use of cylinder chocks and wedges, safe release of pressurised systems, handling hydraulic fluids, misuse of tools)

2.8 (such as rigid pipes; flexible hoses; pipe connectors; pipe sealing and supporting devices; valves used for pressure, flow and directional control; double and single action cylinders/actuators; pump; pressure intensifier, mechanical and electrical control device)

2.10 (such as release of pressures/force, draining of fluids, proof marking, extraction of components)

2.11 (such as threaded fasteners, special securing devices)

2.18 (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct tightness of pipe fittings and valve connections; eliminating stress on pipework/connections; ensuring that pipework is supported at suitable intervals; carrying out visual checks of all components; checking the security of joints and that the system is safe to re-pressurise)

2.19 (such as pressure settings and their effect on the system, travel and working clearance)

Unit 548 Removing and replacing components of aircraft environmental systems

UAN:	**R/601/4823**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 148: Removing and replacing components of aircraft environmental systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft environmental systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of equipment associated with oxygen equipment, cabin pressurisation equipment, therapeutic masks, air conditioning and heating systems, anti-g, pressurisation of bulkheads, pressure domes, door, canopy and window seals and demisting equipment, avionic cooling, water and waste, ice and rain protection, as applicable to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed. The removal and replacement activities will include taking all necessary safeguards to isolate the system, drain fluids, support and lift removed and replaced parts, and will also include replacing faulty equipment at component or unit level, replenishing fluids, setting and adjusting replaced components, and leaving the system in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft environmental equipment and systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner will know how the environmental system and 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on the aircraft environmental system, especially those for isolating the system. The learner 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: To display competence in this unit, it is necessary to both remove and replace components from aircraft environmental systems. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft environmental systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • ensure the safe isolation and draining/depressurisation of the environmental equipment before breaking into the system • ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures • use approved removal and replacement techniques and procedures at all times • ensure that components and surrounding structures are maintained free from damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • leave the aircraft and the environmental system in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 ensure that any stored energy or substances are released safely and correctly 1.6 carry out the removal and replacement activities, within the limits of their personal authority 1.7 carry out all of the following removal and replacement activities: • releasing stored pressure (where applicable) • disconnecting electrical connections • disconnecting/removing hoses and pipes • ensuring that any part-dismantled components are

secure/supported

- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- re-pressurising the system (where applicable)
- use of ground support equipment
- labelling (and storing in the correct location) components that require repair or overhaul
- applying bolt locking methods (such as split pins, wire locking, lock nuts)
- fitting blanks to open systems to prevent entry of contaminating debris
- securing components using mechanical fasteners and threaded devices
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft environmental systems, and replace components from three of the following aircraft environmental systems:

- oxygen systems
- air conditioning systems
- cabin heating and cooling
- avionic cooling systems
- cabin pressurisation systems
- pressurised bulkheads
- pressure domes
- demisting equipment
- ice protection
- rain protection
- anti-g

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following major environmental system components: remove and replace four of the following:

- reservoirs/supply tanks
- accumulators
- pressure intensifiers
- cold air units/air cycle machines
- air-conditioning packs
- air receivers
- diffusers

- charging bottles
- heat exchangers
- actuating mechanisms
- compressor
- pumps
- water extractors
- pressure controllers
- sensors
- regulators
- cylinders
- humidifier
- safety devices
- oxygen generation components
- face mask and allied equipment
- environmental seals and sealants
- door, window and canopy seals
- valves (such as by-pass, shut-off, check, pressure relief, temperature control, outflow, anti-g)
- ozone converters
- other specific components

other environmental system components: remove and replace four of the following:

- filters
- strainers including water separator
- earthing straps/jumper braids
- rigid pipework/ducting
- hoses
- gaskets and seals
- unions and couplings
- gauges
- electrical controls (solenoids, motors, switches)

1.11 remove and replace environmental system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components in accordance with safe working practices and approved procedures

Learning outcome

The learner will:

2. Know how to remove and replace components of aircraft environmental systems

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft environmental systems

2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures

2.3 explain the safety procedures that must be carried out before work is started on removing environmental system components

2.4 describe the hazards associated with removing aircraft environmental system components, and with the tools and equipment used and explain how to minimise them and reduce any risks

2.5 explain what protective equipment they need to use for both personal protection and protection of the aircraft

2.6 explain how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, charts, circuit and physical layouts, specifications, symbols used in aircraft environmental systems, and other documents needed in the removal and replacement process

2.7 explain how to carry out currency/issue checks on the specifications they are working with

2.8 explain the terminology used in aircraft environmental systems, and the use of diagrams and associated symbols

2.9 describe the various types of pipes and components that make up the aircraft environmental system

2.10 describe the basic principles of operation of the aircraft environmental system being worked on, and the performance characteristics and function of the components within the circuit

2.11 describe the techniques used to remove components from aircraft environmental systems without damage to components or surrounding structure

2.12 describe the various mechanical fasteners to be removed and replaced, and explain their method of removal and replacement (such as threaded fasteners, special securing devices)

2.13 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and

	locking in of the connections
2.14	explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment/device
2.15	explain the methods of lifting, handling and supporting the components/equipment during removal and replacement activities
2.16	explain the importance of ensuring that the work area is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.17	explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the system
2.18	explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings
2.19	explain how to re-connect components into the system
2.20	explain how to make adjustments to components/assemblies to ensure that they function correctly and their effect on the system, travel and working clearance
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	explain why securing devices need to be tightened to the correct torque, locked and labelled and the different methods that are used
2.23	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures
2.24	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.25	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
2.26	describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids
2.27	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 548 Removing and replacing components of aircraft environmental systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as displaying warning notices, draining and depressurising systems)

2.4 (such as handling fluids, pressurised systems, misuse of tools),

2.9 (such as rigid pipes, flexible hoses, pipe connectors, pipe sealing and supporting devices, compressors, pumps, pressure intensifiers, mechanical and electrical control devices)

2.11 (such as release of pressures/force, draining of fluids, proof marking, extraction of components, and explain the need to protect the circuit integrity by fitting blanking plugs and labelling exposed circuits)

2.17 (especially hydrocarbons in oxygen systems)

2.19 (such as the use of gaskets/seals and jointing/sealing compounds; ensuring the correct tightness of pipe fittings and valve connections; eliminating stress on pipework/connections; ensuring that pipework is supported at suitable intervals; carrying out visual checks of all components; checking security of joints and that the system is safe to re-fill/pressurise)

2.20 (such as flow and pressure settings),

Unit 549 Removing and replacing components of aircraft power transmission systems

UAN:	**D/601/4825**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 149: Removing and replacing components of aircraft power transmission systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft power transmission systems, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed. The aircraft power transmission system components to be removed will include items such as drive shafts, drive shaft supports, gearbox assemblies, couplings, mechanical fasteners, accelerometers, vibration monitoring equipment, and main and tail rotor assemblies. The removal and replacement activities will include taking all necessary safeguards to isolate the system, support and lift removed and replaced parts, replacing faulty equipment at component or unit level, setting and adjusting replaced components, and leaving the power transmission system in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft power transmission systems. The learner will understand the removal and replacement methods and procedures, and their application, along with the power transmission maintenance requirements. The learner will know how the power transmission system 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on aircraft power transmission systems, especially those for isolating the equipment, and for lifting and handling heavy and bulky components. The learner 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: To display competence in this unit, it is necessary to both remove and replace components from aircraft transmission systems. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft power transmission systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures • obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation) • 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 • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • ensure the safe isolation of the power transmission system before commencing work on the equipment ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate) • where appropriate, apply electrostatic discharge (ESD) protection procedures • use approved removal and replacement techniques and procedures at all times • ensure that components and surrounding structures are maintained free from spillages, damage and foreign objects • return all tools and equipment to the correct location on completion of the activities • leave the aircraft and the power transmission systems in a safe and appropriate condition, free from foreign object debris and in a condition ready for testing 1.3 follow the relevant aircraft manuals and publications to carry out the required work 1.4 establish and, where appropriate, mark component orientation for re-assembly 1.5 ensure that any stored energy or substances are released safely and correctly 1.6 carry out the removal and replacement activities, within the limits of their personal authority 1.7 carry out all of the following removal and replacement activities: • draining and removing fluids • disconnecting electrical connections • disconnecting/removing hoses and pipes • removing mechanical fasteners and securing devices

- supporting equipment to be removed
- dismantling equipment to an appropriate level
- proof marking components to aid reassembly
- checking components for serviceability
- replacing all damaged/defective components
- applying gaskets and sealant/adhesives
- replacing all 'lifed' items (such as seals, bearings, gaskets)
- positioning and aligning replaced components
- setting and adjusting replaced components
- making mechanical connections
- making electrical connections
- tightening fastenings to the required torque
- making 'off-load' checks before starting up
- use of ground support equipment
- using lifting operations (manual or automated)
- applying and removing covering/protection to exposed components, wires, pipework or vents
- securing components using mechanical fasteners and threaded devices
- applying bolt locking methods (such as split pins, wire locking, lock nuts)
- labelling (and storing in the correct location) components that require repair or overhaul
- protecting and preparing removed components for transportation for overhaul

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft power transmission systems, and replace components from three of the following aircraft power transmission systems:

- intermediate gear box
- tail gear box
- main rotor head assembly
- main gear box
- nose gear box
- tail rotor assembly

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following major power transmission components: remove and replace three of the following:

- drive shaft
- drive shaft support
- bearings
- couplings
- main rotor head
- tail rotor head
- dynamic seals
- control valves

- flexi couplings
- rotor brakes
- swash plate
- gearboxes

other power transmission components: remove and replace four of the following:

- static seals/gaskets
- mechanical controls (plungers, springs, rollers)
- electrical controls (solenoids, motors, switches)
- accelerometers
- levers and linkages
- sensors
- locks and stops
- control units
- other specific components

1.11 remove and replace aircraft power transmission system components in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures.

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft power transmission systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft power transmission systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing aircraft power transmission system components, and with the tools and equipment used and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain how to extract and use information from aircraft maintenance manuals, history/maintenance reports, flight logs, and other documents needed in the removal and replacement process 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used in aircraft power transmission systems 2.8 describe the basic principles of how the transmission system and equipment functions, its operating sequence, the working purpose of individual units/components and how they interact 2.9 describe the techniques used to remove components from aircraft power transmission systems, without damage to the components or surrounding structure and explain the need to protect the system integrity by fitting blanking plugs and ensuring exposed components are correctly covered/protected 2.10 describe the various mechanical fasteners to be removed and replaced, and explain their method of removal and replacement 2.11 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections 2.12 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment 2.13 explain the methods of lifting, handling and supporting the components/equipment during removal and replacement activities 2.14 describe the identification and application, fitting and removal of different types of bearings (such as roller, ball, thrust) 2.15 explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics 2.16 describe the use of measuring equipment 2.17 explain the need to replace 'lifed' items 2.18 explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings 2.19 explain how to replace and reconnect components into the system 2.20 explain how to make adjustments to components/assemblies to ensure that they function correctly

2.21	explain why securing devices need to be tightened to the correct torque, locked and labelled, and different methods used
2.22	explain how to recognise contaminants and the problems they can create; the effects and likely symptoms of contamination in the power transmission system
2.23	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.24	explain the importance of making 'off-load' checks before running the equipment under power
2.25	explain how to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for the intended purpose
2.26	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.27	explain how to use lifting and handling equipment in the maintenance activity
2.28	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
2.29	describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids
2.30	describe the problems associated with removing and replacing power plant components, and explain how they can be overcome
2.31	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 549 Removing and replacing components of aircraft power transmission systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as handling oils, greases, stored pressure/force, lifting and moving heavy and bulky components, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures),

2.9 (such as release of pressures/force, proof marking, extraction of components)

2.10 (such as threaded fasteners, special securing devices)

2.16 (such as micrometers, Verniers, expansion indicators and other devices)

2.17 (such as seals and gaskets)

2.19 (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)

2.20 (such as setting working clearance, setting travel, preloading bearings)

Unit 550 Removing and replacing components of aircraft cabin systems, equipment and furnishings

UAN:	**M/601/4828**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 150: Removing and replacing components of aircraft cabin systems, equipment and furnishings (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of components of aircraft cabin equipment and furnishings, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of equipment associated with seating, standard and VIP furniture, luggage racks, galley cubicles and equipment, toilet cubicles, panels, soft furnishings, safety equipment, power supplies and in-flight entertainment equipment, as applicable to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be removed. The removal and replacement activities will include taking all necessary safeguards to isolate the equipment, support and lift removed and replaced parts, replacing faulty equipment at component or unit level, setting and adjusting replaced components, and leaving the equipment in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to aircraft cabin equipment and furnishings. The learner will understand the removal and replacement methods and procedures, and their application, along with the systems maintenance requirements. The learner will know how the cabin 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when working on the aircraft cabin equipment and furnishings. The learner 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: To display competence in this unit, it is necessary to both remove and replace components of aircraft cabin equipment and furnishings. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace components of aircraft cabin systems, equipment and furnishings
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines

1.2 carry out all of the following during the removal and replacement activity:

- obtain clearance to work on the aircraft, and observe all relevant safety procedures
- obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
- 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
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- ensure the safe isolation and, where appropriate, draining of the equipment before removing it
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- use approved removal and replacement techniques and procedures at all times
- ensure that components and surrounding structures are maintained free from spillages, damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft in a safe and appropriate condition, free from foreign object debris

1.3 follow the relevant aircraft manuals and publications to carry out the required work

1.4 establish and, where appropriate, mark component orientation for re-assembly

1.5 ensure that any stored energy or substances are released safely and correctly

1.6 carry out the removal and replacement activities, within the limits of their personal authority

1.7 carry out all of the following removal and replacement activities:

- disconnecting electrical connections (where appropriate)
- ensuring that any part dismantled components are secure/supported
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing all 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections (where appropriate)
- tightening fastenings to the required torque
- labelling (and storing in the correct location) components that require repair or overhaul

- setting, and adjusting replaced components (such as travel, working clearance)
- securing components using mechanical fasteners and threaded devices
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove components from three of the following aircraft cabin equipment and furnishing systems, and replace components from three of the following aircraft cabin equipment and furnishing systems:

- cabin furniture
- toilet equipment
- galley equipment
- fresh water
- cockpit furniture
- panel systems
- decorative trim and covering
- waste/foul water
- luggage and storage systems
- auxiliary equipment
- safety equipment

1.10 during the activities identified in 1.9 above, they must cover the removal and replacement of the following major cabin equipment and furnishings: remove and replace three of the following:

- seating (such as crew and passenger)
- cabin furniture (such as standard and VIP)
- flooring (such as carpets, vinyl)
- panels (such as ceiling, side, floor, soft panels)
- cabin dividers/removable bulkheads
- equipment consoles
- water compressors
- galley equipment
- food preparation equipment
- beverage machines
- power support units
- freight rollers/power drives
- static line cables
- window panels
- entertainment equipment
- water heaters
- fresh water storage
- waste water storage
- sanitary units and fittings
- other specific components
- storage units (such as luggage racks, overhead storage, dog boxes)

other cabin equipment and furnishings: remove and replace four of the following:

- fire extinguishers/blankets
- passenger restraint kits
- emergency escape/survival equipment
- galley storage boxes
- oxygen bottles
- pipes and hoses
- seat covers
- hard trim
- curtains/blinds
- aero medical equipment (such as first aid boxes, stretchers)
- specialist life saving equipment (such as defibrillator, airway kits)

1.11 remove and replace aircraft cabin equipment and furnishings in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.12 take suitable precautions to prevent damage to components and the surrounding structure

1.13 complete the relevant documentation, in accordance with organisational requirements

1.14 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.15 label and store (in an appropriate location) components that require repair or overhaul

1.16 dispose of waste materials and scrap components, in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to remove and replace components of aircraft cabin systems, equipment and furnishings
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on aircraft cabin equipment and furnishings 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the safety procedures that must be carried out before work is started on removing cabin equipment and furnishing components 2.4 describe the hazards associated with removing aircraft cabin equipment and furnishings, and with the tools and equipment used and explain how to minimise them and reduce any risks 2.5 explain what protective equipment that they need to use for both personal protection and protection of the aircraft 2.6 explain how to extract and use information from aircraft manuals, history/maintenance reports, flight logs, physical layouts, specifications, and other documents needed in the removal and replacement process 2.7 explain how to carry out currency/issue checks on the specifications they are working with 2.8 explain the terminology used in aircraft cabin equipment and furnishings, and the use of diagrams and associated symbols 2.9 describe the techniques used to remove cabin equipment and furnishing components from the aircraft, without damage to the components or surrounding structure 2.10 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices 2.11 describe the various mechanical fasteners that will need to be removed and replaced, and explain their method of removal and replacement 2.12 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections 2.13 explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities 2.14 explain the importance of ensuring that the work area is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected 2.15 explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings 2.16 explain how to reconnect components into the system 2.17 explain how to make adjustments to components/assemblies to ensure that they function correctly 2.18 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.19	explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used
2.20	describe the tools and equipment used in the removal and replacement activities, and explain their calibration/care and control procedures
2.21	explain the need to control and account for all tools and equipment used during the removal and replacement activity
2.22	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
2.23	describe the procedure for the safe disposal of waste materials, scrap components oils and fluids
2.24	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 550 Removing and replacing components of aircraft cabin systems, equipment and furnishings

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as displaying warning notices, isolating systems, draining and depressurising systems)

2.4 (such as lifting and handling, misuse of tools),

2.11 (such as threaded fasteners, special securing devices)

2.16 (such as the use of gaskets/seals and jointing/sealing compounds; ensuring correct tightness of pipe fittings, eliminating stress on pipework and cable connections; carrying out visual checks of all components)

2.17 (such as seat recline mechanisms, settings travel and working clearance)

Unit 551 Removing and replacing major assemblies of aircraft airframes

UAN:	**M/601/4831**
Level:	3
Credit value:	89
GLH:	175
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 151: Removing and replacing major assemblies of aircraft airframes (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out the removal and replacement of major assemblies of aircraft airframes, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes a range of assemblies such as landing gear, flying control surfaces, main and tail rotor assemblies, tail pylon, transmission systems, cabin, cargo and weapon bay doors, and other aircraft specific equipment. The removal and replacement activities will include making all necessary checks to support and chock pistons/moving parts, lifting and handling components, removing and replacing faulty equipment at component or unit level, setting and adjusting the completed system, and leaving the components in a safe condition and ready for testing. The learner's responsibilities will require them to comply with organisational policy and procedures for the removal and replacement 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. The learner 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, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate removal and replacement techniques and procedures to major components of the aircraft airframe. The learner will understand the removal and replacement methods and procedures, and their application, along with the system maintenance requirements. The learner 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 removal and replacement activities, and for ensuring that the equipment is replaced to the required standard. In addition, the learner will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the replacement.

The learner will understand the safety precautions required when removing and replacing major airframe components, especially those for isolating the equipment, and lifting and moving the components. The learner 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: To display competence in this unit, it is necessary to both remove and replace major components from aircraft airframes. The learner must remove components; however, they may fit a replacement component where the original was previously removed by another person.

Learning outcome
The learner will: 1. Be able to remove and replace major assemblies of aircraft airframes
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the removal and replacement activity: • obtain clearance to work on the aircraft, and observe all relevant safety procedures

- obtain and use the appropriate documentation (such as job instructions, aircraft manuals, technical instructions, and other relevant maintenance documentation)
- 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
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- ensure the safe isolation and depressurisation of equipment before breaking into the system
- ensure that all relevant safety devices and mechanical/physical locks are in place (where appropriate)
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- use approved removal and replacement techniques and procedures at all times
- ensure that components and surrounding structures are free from spillages, damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the aircraft in a safe and appropriate condition, free from foreign object debris and ready for testing

1.3 follow the relevant aircraft manuals and publications to carry out the required work

1.4 establish and, where appropriate, mark component orientation for re-assembly

1.5 ensure that any stored energy or substances are released safely and correctly

1.6 carry out the removal and replacement activities, within the limits of their personal authority

1.7 carry out all of the following removal and replacement activities:

- isolation of the components to be removed (such as electrical, fluid power)
- chocking and supporting components
- releasing stored pressure (where applicable)
- draining and removing fluids (where applicable)
- disconnecting electrical connections
- disconnecting/removing hoses/pipes (where applicable)
- disconnecting mechanical fastening devices
- lifting and moving components
- applying and removing covering/protection to exposed components, wires, pipework or vents
- checking components for serviceability
- replacing damaged/defective components
- replacing 'lifed' items (seals, filters, gaskets)
- positioning and aligning replaced components
- making mechanical connections
- making electrical connections

- tightening fastenings to the required torque
- replacing fluids and bleeding the system (where applicable)
- making 'off-load' checks before re-pressurising (where applicable)
- re-pressurising the system (where applicable)
- labelling (and storing in the correct location) components that require repair or overhaul
- setting, and adjusting replaced components (such as travel, working clearance)
- applying bolt locking methods (such as split pins, wire locking, lock nuts)

1.8 remove and replace the required components, using approved tools and techniques

1.9 remove three of the following major airframe components, and replace three of the following major airframe components:

- main undercarriage
- nose undercarriage
- tail undercarriage
- wing
- spoilers/speed brakes
- air brakes
- horizontal stabiliser/tailplane
- propeller
- rudders
- ailerons/tailerons
- main rotor assembly
- tail rotor assembly
- canopy
- tail pylon
- flapperons
- flaps/slats
- outriggers
- canards
- elevators
- stabilisers
- cargo doors
- weapon bay doors
- cabin doors
- main gear box
- intermediate gear box
- tail gear box
- nose gear box
- tailplane

1.10 remove and replace major airframe components in compliance with one of the following:

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

- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- aircraft manufacturer's requirements

1.11 take suitable precautions to prevent damage to components and the surrounding structure

1.12 complete the relevant documentation, in accordance with organisational requirements

1.13 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:

- job cards
- computer records
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.14 label and store (in an appropriate location) components that require repair or overhaul

1.15 dispose of waste materials and scrap components in accordance with safe working practices and approved procedures

Learning outcome
The learner will: 2. Know how to remove and replace major assemblies of aircraft airframes
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when working on major airframe components 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 describe the hazards associated with removing and replacing major airframe components, and with the tools and equipment used and explain how to minimise them and reduce any risks 2.4 explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.5 explain how to extract and use information from aircraft maintenance manuals, history/maintenance reports, flight logs, and other documents needed in the removal and replacement process 2.6 explain how to carry out currency/issue checks on the specifications they are working with 2.7 explain the terminology used for major airframe components 2.8 describe the basic principles of how the major airframe components and equipment functions, its operating sequence, the working purpose of individual units/components and how they interact 2.9 describe the techniques used to remove the major airframe

components from the aircraft, without damage to the components or surrounding structure

2.10 describe the various mechanical fasteners to be removed and replaced, and explain their method of removal and replacement

2.11 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

2.12 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.13 explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities

2.14 explain the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics

2.15 explain the need to correctly label and store components that require repair or overhaul, and to check that replacement components have the correct part/identification markings

2.16 explain how to replace and reconnect the major airframe components onto the aircraft

2.17 explain how to make adjustments to components/assemblies to ensure that they function correctly

2.18 explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.19 explain why securing devices need to be tightened to the correct torque, locked and labelled, and the different methods that are used

2.20 explain how to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for the intended purpose

2.21 explain the need to control and account for all tools and equipment used during the removal and replacement activity

2.22 explain how to use lifting and handling equipment in the maintenance activity

2.23 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

2.24 describe the procedure for the safe disposal of waste materials, scrap components, oils and fluids

2.25 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 551 Removing and replacing major assemblies of aircraft airframes

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.3 (such as the need to support the aircraft and/or its components, lifting and moving heavy and bulky components, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures),

2.9 (such as release of pressures/force, draining of fluids, proof marking, extraction of components and explain the need to protect the circuit integrity by fitting blanking plugs, and ensuring that exposed components are correctly covered/protected)

2.10 (such as threaded fasteners, special securing devices)

2.16 (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)

2.17 (such as setting working clearance, setting travel)

Unit 552 Modifying aircraft propulsion equipment and systems

UAN:	**T/601/4832**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 152: Modifying aircraft propulsion equipment and systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to modify aircraft propulsion equipment and systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, where the systems and components may have to be modified for a number of reasons, which could include performance being out of specification, inherent design problems, changes to customer specification, or assembly problems. The learner will be required to prepare the work area, ensuring that it is safe and free from hazards, to check that the correct component parts requiring modification are available, to obtain all relevant and current documentation, and to obtain the tools and equipment required for the modification, checking that they are in a safe and usable condition. In carrying out the modification operations, the learner will be required to follow laid-down procedures, and to use specific modification leaflets or service bulletins. The modification requirements will include such things as blade set changes and component upgrades. The modification activities will also include making all necessary checks, including functional checks of systems that have been disturbed during the modification. The learner's responsibilities will require them to comply with organisational policy and procedures for the modification 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. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate modification techniques and procedures. The learner will understand the propulsion equipment being modified, and its application, and will know about the components, systems and fastening devices of systems disturbed during the modification operation, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

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

Note: This unit is intended to cover propulsion system modifications of a significant or complex nature, involving the use of a range of techniques and a number of different components. The extent of the complexity will include the size and timescale of the modification, the tolerances required and the difficulty of access. This unit should not be used solely for simple modifications such as changes to, or the addition of, simple pipework, platework or brackets.

Learning outcome
The learner will: 1. Be able to modify aircraft propulsion equipment and systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the modification activities: • obtain and use the appropriate documentation (such as job instructions, aircraft modification drawings, technical instructions, planning and quality control documentation, aircraft standards and specifications) • 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

- provide and maintain a safe working environment for the modification activities
- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date
- obtain clearance to work on the aircraft, and observe the power isolation and safety procedures
- use safe and approved modification techniques and procedures at all times
- ensure that correct part numbers are used, including (where appropriate) left or right handed parts
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- return all tools and equipment to the correct location on completion of the activities
- dispose of waste items in a safe and environmentally acceptable manner
- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 obtain and follow the relevant modification specifications and job instructions

1.4 confirm and agree what modifications are to be carried out to meet the specification

1.5 prepare the propulsion equipment/system for the required modification

1.6 carry out the modification using approved materials, methods and procedures

1.7 modify propulsion equipment/systems from one of the following type of aircraft:

- commercial aircraft
- light aircraft
- military aircraft
- helicopters

1.8 modify aircraft propulsion equipment/systems, to include three from:

- pumps
- filters
- pipework
- bearings
- engine nacelle
- control mechanisms
- compressor blades
- turbine blades
- exhaust system
- combustion chamber
- heat exchangers (oil, fuel)
- sensors (vibration, fire)
- thermocouples
- electrical modules

- electrical harnesses
- ancillary equipment
- engine suspension mounts
- engine starting equipment
- engine monitoring equipment

1.9 carry out the modification, using two of the following methods:

- adjustment
- remove and replace with new components
- modify existing components
- manufacture of new components

1.10 use five of the following methods and techniques during the modification activities:

- dismantling and re-assembling
- changing components
- securing and locking components
- electrical fitting and assembly
- making holes in materials
- hand fitting
- pipe fitting and assembly
- repositioning units
- adjusting or tuning components
- fabricating (such as brackets, clips or covers)
- brazing or welding
- bonding

1.11 use three of the following types of joining method during modifications:

- adhesives/sealants
- locking devices
- rivets
- nuts and bolts
- special fasteners

1.12 modify aircraft power plant in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- aircraft manufacturer's requirements
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.13 complete the modification within the agreed timescale

1.14 ensure that the modified propulsion equipment/system meets the specified operating conditions

1.15 produce accurate and complete records of all modification work carried out

1.16 complete the relevant paperwork, to include one from the following, and pass it to the appropriate people:
- modification records
- log cards
- job cards
- aircraft flight log
- aircraft log book

1.17 deal promptly and effectively with problems within their control and report those that cannot be solved

Learning outcome

The learner will:

2. Know how to modify aircraft propulsion equipment and systems

Assessment criteria

The learner can:

2.1 explain the specific safety precautions to be taken while carrying out modifications on aircraft propulsion equipment/systems and components

2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures

2.3 explain the health and safety requirements of the work area in which they are carrying out the modification activities, and the responsibility these requirements place on them

2.4 explain the COSHH regulations with regard to substances used in the modification process

2.5 describe the hazards associated with modifying aircraft propulsion equipment/systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.6 explain what personal protective equipment and clothing needs to be worn during the modification activities

2.7 describe the various types of drawing and specification that are used during the modification

2.8 explain how to carry out currency/issue checks on the specifications they are working with

2.9 explain why systems and components may require modification

2.10 explain what preparations need to be undertaken on the propulsion equipment and system, prior to modification

2.11 describe the various methods that could be used to modify assemblies

2.12 describe the techniques that can be used, where appropriate, to modify the propulsion equipment/system

2.13 explain how to identify the components to be used; component identification systems

2.14 explain the methods and procedures to be used for removing and replacing components, and the importance of adhering to these procedures

2.15 describe the various mechanical fasteners that will be used and explain their method of installation

2.16 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators and locating and locking in of the connections

2.17 explain the importance of applying electrostatic discharge (ESD)

	procedures when working on sensitive equipment or devices
2.18	explain the importance of using the specified fasteners for the modification, and why they must not use substitutes
2.19	explain the application of sealants and adhesives within the modification activities, and the precautions that must be taken when working with them
2.20	describe the quality control procedures to be followed during the modification operations
2.21	explain how to conduct any necessary checks to ensure the accuracy, position, security, function and completeness of the modification
2.22	explain the methods and equipment used to transport, handle and lift the components into position, and how to check that the equipment is within its current certification dates
2.23	explain how to check that the tools and equipment to be used are correctly calibrated, and are in a safe and serviceable condition
2.24	explain the importance of ensuring that all tools are used correctly and within their permitted operating range
2.25	explain the importance of ensuring that all tools, equipment and components are accounted for and returned to their correct location on completion of the modification activities
2.26	describe the problems associated with carrying out modifications on aircraft propulsion systems and components, and explain the importance of informing the appropriate people of non-conformances
2.27	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
2.28	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 552 Modifying aircraft propulsion equipment and systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)

2.11 (such as adjust, remove and replace, repair and manufacture)

2.12 (such as fabrication of brackets or covers, mechanical fitting, electrical and electronic or fluid/air/pipe fitting)

2.13 (such as codes and component orientation indicators)

2.15 (including open and blind rivets, threaded fasteners, special securing devices)

Unit 553 Carrying out tests on aircraft engines and systems

UAN:	**L/601/4836**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 153: Carrying out tests on aircraft engines and systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test operational aircraft engines, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes testing main and auxiliary engines, as appropriate to the aircraft type. The learner will be required to carry out all necessary preparations to the aircraft, in readiness for the tests to be carried out, and these will include ensuring that the aircraft is positioned in an appropriate test area, is secured, braked and chocked, and has an appropriate amount of fuel, and that all cockpit/cabin controls are in the appropriate positions. In carrying out the tests, the learner will be required to follow laid-down procedures, to ensure that the working area is clear, that appropriate guards and notices are displayed, that ground tests and engine runs are carried out in accordance with the appropriate schedule, that monitoring procedures are complied with and analysis of results is undertaken, and that test documentation is completed accurately and legibly. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to undertaking the appropriate engine test procedures. The learner will understand the engine being tested, and the specific test schedule to be followed, and they will know what the cabin/cockpit controls do and what the various gauges and indicators mean, in adequate depth to provide a sound basis for carrying out the tests to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, in particular those involved with running the engines. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft engines and systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the aircraft for testing by carrying out all of the following, as applicable to the aircraft type: • obtain and use the appropriate documentation (such as technical/job instructions, ground test schedule, test procedures and quality documentations) • 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 • position the aircraft in an appropriate engine test bay • secure the aircraft by applying brakes, chocking and/or ground anchoring • ensure that all appropriate ground locks are in position and, where applicable, check that ejector seat safety pins are engaged • ensure that the aircraft is electrically bonded and suitably fuelled for the tests being carried out • check that all cabin/cockpit controls are set as per the test schedule • check that electrical power is applied, either internally or by the use of external units • obtain clearance to undertake the engine test on the aircraft

- ensure that safe working distance procedures are set up (with appropriate warning notices)
- ensure the presence of fire fighting equipment, manual or tender, as appropriate to the situation
- ensure that tests are conducted as per the test procedure for the aircraft/engine type

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft engines using appropriate tools or test equipment, to include two of the following:

- built in test equipment (BITE)
- 'special-to-type' test equipment
- sampling devices
- aircraft instruments

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out tests on one of the following types of powerplant:

- turbo prop
- turbo jet
- turbo-fan
- ducted fan
- turbo-shaft
- piston engines
- auxiliary power unit (APU)
- ground turbine start (GTS)

1.7 carry out four of the following types of test:

- post installation
- fault proving/diagnosis
- fluid sampling
- performance testing
- leak test
- functional test of engine driven component (such as generator, hydraulic pump, lubrication pump and air services)
- other specific tests

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- manufacturer's specific power plant requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review and analyse the results and carry out further tests if necessary

Learning outcome

The learner will:

2. Know how to carry out tests on aircraft engines and systems

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft engines

2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures

2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.4 explain the safety procedures that must be carried out before work is started on the aircraft

2.5 explain what protective clothing and equipment needs to be worn for the testing activities

2.6 describe the hazards associated with testing aircraft engines, and explain how to minimise them and reduce any risks

2.7 explain what preparations need to be carried out on the aircraft prior to starting the engine tests

2.8 explain how to ensure that the aircraft is electrically bonded prior to fuelling and de-fuelling, and why this is so important

2.9 explain how to obtain the required test schedules and specifications for the aircraft and engine type being tested, and how to check their currency and validity

2.10 explain how to read and interpret the specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

2.11 explain the correct operating procedures of the engines being tested

2.12 explain the methods and procedures to be used to carry out the various engine tests

2.13 explain the basic principle of operation of the engines under test, and explain the function of the individual components within the system

2.14 explain the need to apply engine power in incremental stages, and to check all readings, temperatures and pressures at each stage

2.15 explain why equipment control is critical, and what to do if a piece

	of equipment is unaccounted for on completion of the activities
2.16	explain how to record the results of each individual test, and the documentation that must be used
2.17	explain from whom to seek authorisation if they need to alter or change the test procedures
2.18	explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft
2.19	explain the procedures to be followed if the engine or system fails to meet the test specification
2.20	describe the potential problems that can occur with the testing activities, and explain how they can be overcome
2.21	describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.22	explain any required environmental controls relating to the testing
2.23	explain what documentation needs to be completed at the end of the testing activities
2.24	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 553 Carrying out tests on aircraft engines and systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice required for the activities, equipment or materials used)

2.4 (such as electrical bonding of the aircraft, checking that ground locks are in position, checking that safety pins are in critical controls (such as ejector seats, undercarriage), erecting warning signs and ensuring all personnel are clear of the test area)

2.7 (such as applying brakes, chocking the aircraft, anchoring the aircraft to the ground, positioning cockpit and cabin controls in the correct positions, applying electrical power to the aircraft)

Unit 554 Carrying out tests on aircraft control systems

UAN:	**Y/601/4841**
Level:	3
Credit value:	53
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 154: Carrying out tests on aircraft control systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft control systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes control systems associated with flying controls and powerplant. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, and making rigging and function tests, range of movement and ground running activities. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft control system testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and legibly. The learner 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 work that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide

an informed approach to applying the appropriate aircraft control system test procedures. The learner will understand the aircraft control system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft control systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft control systems: • obtain and use the appropriate documentation (such as job instructions, aircraft control system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • carry out the tests using the specified techniques and procedures • make any permitted adjustments to components and equipment to bring the system to the specification requirements • return all tools and equipment to the correct location on completion of the testing activities • leave the aircraft and work area in a safe and appropriate

condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft control systems, using appropriate tools or test equipment, to include two of the following:

- built in test equipment (BITE)
- aircraft displays and gauges
- ground support equipment
- use of safety locks
- 'special-to-type' test equipment
- measuring equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft control systems:

- air brakes
- spoilers/speed brakes
- flaps/slats
- tail plane
- propeller
- rudders/yaw
- flapperons
- ailerons/tailerons
- cyclic
- reaction control
- wing sweep
- auxiliary transmission
- canards
- main gear steering
- elevators
- trim tabs
- powerplant
- collective
- auxiliary power
- thrust reverse
- main rotor blades
- horizontal stabilisers
- tail rotor blades/yaw
- power augmentation
- vectored thrust
- nose wheel steering

1.7 carry out four of the following types of test:

- functional
- rigging check
- static friction check
- 'special-to-type' tests
- built in test equipment (BITE)

- timings
- cable tension check
- safety interlock test
- ground run tests
- freedom and range of movement
- leak test

Including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft control systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft control systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn,

and where it can be obtained

2.6 describe the hazards associated with testing aircraft control systems, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the control system being tested

2.8 explain the electrical bonding specifications and their importance

2.9 explain how to obtain the required test schedules and specifications for the aircraft and controls being tested, and how to check their currency and validity

2.10 explain how to read and interpret test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

2.11 explain what types of test are to be carried out on the aircraft control systems

2.12 describe the testing methods and procedures to be used to carry out the various tests on the control systems

2.13 explain what test equipment is to be used and its selection for the particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made

2.14 explain the techniques, methods and procedures to be used during the tests

2.15 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities

2.16 describe the basic principle of operation of the control system under test, and explain the function of the individual components within the system

2.17 explain the importance of carrying out the tests in the specified sequence, and of checking all readings, movements and pressures at each stage

2.18 explain the importance of ensuring that pressure is maintained, and the methods used to detect leaks and faults within the system

2.19 explain how to record the results of each individual test, and the documentation that must be used

2.20 explain from whom to seek authorisation if they need to alter or change the test procedures

2.21 explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft

2.22 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.23 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.24 describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these

2.25 explain any required environmental controls relating to the testing

2.26 explain what documentation needs to be completed at the end of the testing activities

2.27 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 554 Carrying out tests on aircraft control systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as working on pressurised systems, traps from moving parts)

2.11 (such as functional checks, rigging checks, safety interlock tests, freedom and range of movement checks, ground run tests, leak checks)

Unit 555 Carrying out tests on aircraft fuel and storage systems

UAN:	**H/601/4857**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 155: Carrying out tests on aircraft fuel and storage systems (Suite 3) .
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft fuel and storage systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes fuel and storage systems such as main fuel tanks, auxiliary fuel tanks, fuel transmission systems, in-flight refuelling, and fuel drain and fuel jettison systems. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components and systems are leak free and are operating correctly, that fuel levels are displayed correctly and that fuel transfer systems are operating correctly. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft fuel system testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate aircraft fuel system test procedures. The learner will understand the aircraft fuel system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft fuel and storage systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft fuel and storage systems: • obtain and use the appropriate documentation (such as job instructions, aircraft fuel and storage system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • carry out the tests using the specified techniques and procedures • make any permitted adjustments to components and equipment to bring the system to the specification

requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft fuel and fuel storage systems/components, using appropriate tools or test equipment, to include two of the following:
- fuel pumps
- flushing pipes
- bleeding equipment
- built-in test equipment (BITE)
- blanking equipment
- sampling devices
- pressure devices
- testing rigs
- fuel testing rigs
- flushing blocks
- connecting equipment
- 'special-to-type' test equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft fuel and fuel storage systems/components:
- full system fuel flow
- reduced system fuel flow
- cross-over/change-over tanks
- in-flight refuelling system
- fuel transmission systems
- bleed valve
- fuel filters
- fuel drain systems
- fuel jettison system
- main fuel tanks
- fuel and de-fuel connections
- auxiliary fuel tank
- external/drop down fuel tanks
- feed valves and systems

1.7 carry out four of the following types of test:
- return line pressure test
- pressure line pressure test
- leak test
- fuel level/contents check
- reduced system flush

- system flush
- 'special-to-type' tests
- fuel transfer tests
- system fuel flow functional test
- fuel sampling/taking results
- BITE test

including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft fuel and storage systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft fuel systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn,

and where it can be obtained

2.6 describe the hazards associated with testing aircraft fuel systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the aircraft fuel system being tested

2.8 explain the electrical bonding specifications and their importance

2.9 explain how to obtain the required test schedules and specifications for the aircraft fuel and fuel storage system being tested, and how to check their currency and validity

2.10 explain how to read and interpret the specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

2.11 describe the testing methods and procedures to be used to carry out the various tests on the fuel systems

2.12 explain what test equipment is to be used and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks that need to be made

2.13 explain the techniques, methods and procedures to be used during the tests

2.14 explain the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices

2.15 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities

2.16 describe the basic principle of operation of the aircraft fuel and fuel storage system under test, and explain the function of the individual components within the system

2.17 explain the need to apply tests in the specified stages, and to check all readings, pressures and contents at each stage

2.18 explain how to record the results of each individual test, and the documentation that must be used

2.19 explain from whom to seek authorisation if they need to alter or change the test procedures

2.20 explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft

2.21 explain the procedures to be followed if the equipment or system fails to meet the test specification

2.22 describe the problems that can occur with the testing activities, and explain how they can be overcome

2.23 describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these

2.24 explain any required environmental controls relating to the testing of the fuel systems

2.25 explain what documentation needs to be completed at the end of the testing activities

2.26 describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 555 Carrying out tests on aircraft fuel and storage systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

Unit 556 Carrying out tests on aircraft hydraulic systems

UAN:	**L/601/4870**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 156: Carrying out tests on aircraft hydraulic systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft hydraulic systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes hydraulic systems associated with landing gear, flying controls, main and tail rotor control, blade fold, rotor brakes, nose wheel steering, cargo and weapon bay doors, emergency and utility systems. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components and systems are leak free, are operating at the correct pressure, and have the required range of movement, sequencing and timings. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft hydraulic testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate aircraft hydraulic test procedures. The learner will understand the aircraft hydraulic system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft hydraulic systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft hydraulic systems: • obtain and use the appropriate documentation (such as job instructions, aircraft hydraulic system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • carry out the tests using the specified techniques and procedures • make any permitted adjustments to components and equipment to bring the system to the specification requirements

- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft hydraulic systems, using appropriate tools or test equipment, to include two of the following:

- aircraft hydraulic pumps
- hydraulic testing rigs
- built-in test equipment (BITE)
- sampling devices
- 'special-to-type' test equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft hydraulic systems:

- main undercarriage
- nose undercarriage
- tail undercarriage
- nose wheel steering
- wheel braking system
- damping mechanisms
- flying controls
- rotor brakes
- blade fold
- main rotor control
- tail rotor control
- spoilers/speed brakes
- outriggers
- main gear steering
- ram air turbine
- cargo doors
- weapon bay doors
- emergency systems
- utility systems
- other specific systems (such as hoists)

1.7 carry out four of the following types of test:

- leak test
- functional test
- 'special-to-type' tests
- fluid sampling
- pressure test
- range of movement
- timings
- sequencing

- BITE test

including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft hydraulic systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing hydraulic systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials) 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 describe the hazards associated with testing aircraft hydraulic systems, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks

2.7	explain the correct operating procedures of the system being tested
2.8	explain the electrical bonding specifications and their importance
2.9	explain how to obtain the required test schedules and specifications for the aircraft and hydraulic system being tested, and how to check their currency and validity
2.10	explain how to read and interpret the specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications
2.11	describe the testing methods and procedures to be used to carry out the various tests on the hydraulic systems
2.12	explain what test equipment is to be used, and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made
2.13	explain the techniques, methods and procedures to be used during the tests
2.14	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities
2.15	describe the basic principle of operation of the hydraulic system under test, and explain the function of the individual components within the system
2.16	explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage
2.17	explain how to record the results of each individual test, and the documentation that must be used
2.18	explain from whom to seek authorisation if they need to alter or change the test procedures
2.19	explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft
2.20	explain the procedures to be followed if the equipment or system fails to meet the test specification
2.21	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.22	describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.23	explain any required environmental controls relating to the testing
2.24	explain what documentation needs to be completed at the end of the testing activities
2.25	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 556 Carrying out tests on aircraft hydraulic systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as handling hydraulic fluids, working on pressurised systems, traps from moving parts)

Unit 557 Carrying out tests on aircraft pneumatic and vacuum systems

UAN:	**Y/601/4872**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 157: Carrying out tests on aircraft pneumatic and vacuum systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft pneumatic and vacuum systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes pneumatic and vacuum systems associated with emergency blow-down systems, de-icing systems, air stairs, sanitary and waste disposal systems, arrestor mechanisms, deck locks, air start systems, weapons systems, flying controls and other aircraft specific equipment, as applicable to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. The testing activities will include making all necessary checks and adjustments to ensure that components and systems are leak free, are operating at the correct pressure and have the required range of movement, sequencing and timings. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft pneumatic or vacuum testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary

documentation is completed, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate test procedures for aircraft pneumatic or vacuum systems. The learner will understand the aircraft hydraulic or vacuum system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft pneumatic and vacuum systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft pneumatic or vacuum systems: • obtain and use the appropriate documentation (such as job instructions, aircraft pneumatic and vacuum system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate)

- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft pneumatic and vacuum systems, using appropriate tools or test equipment, to include two of the following:

- air pumps
- pressure gauges/devices
- pneumatic test rigs
- built-in test equipment (BITE)
- priming equipment
- blanking equipment
- bleeding equipment
- vacuum pumps
- connecting equipment
- leak detection medium
- other test devices

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft pneumatic or vacuum systems:

- emergency blow-down systems
- air driven gyros
- spoilers
- slats
- flaps
- flying controls
- nose wheel steering
- de-icing systems
- air stairs
- engine air start
- waste disposal systems
- air intake shutters
- sanitary systems
- waste disposal/utility systems
- wheel braking
- damping mechanisms
- deck locks
- arrester mechanisms
- gun cocking

- weapon bay doors
- other specific systems

1.7 carry out four of the following types of test:

- leak test
- functional test
- 'special-to-type' tests
- system priming and bleeding
- system charging
- pressure test
- range of movement
- air line vapour tests
- system components tests
- reduced system test
- timings
- sequencing
- BITE test

including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft pneumatic and vacuum systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft pneumatic and vacuum systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.4 explain the safety procedures that must be carried out before work is started on the aircraft 2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 describe the hazards associated with testing aircraft pneumatic and vacuum systems, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks 2.7 explain the correct operating procedures of the system being tested 2.8 explain the electrical bonding specifications and their importance 2.9 explain how to obtain the required test schedules and specifications for the aircraft pneumatic or vacuum system being tested, and how to check their currency and validity 2.10 explain how to read and interpret the specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications 2.11 describe the testing methods and procedures to be used to carry out the various tests on the pneumatic or vacuum systems 2.12 explain what test equipment is to be used and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made 2.13 explain the techniques, methods and procedures to be used during the tests 2.14 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities 2.15 describe the basic principle of operation of the pneumatic or vacuum system under test, and explain the function of the individual components within the system 2.16 explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage 2.17 explain how to record the results of each individual test, and the documentation that must be used 2.18 explain from whom to seek authorisation if they need to alter or change the test procedures 2.19 explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft 2.20 explain the procedures to be followed if the equipment or system fails to meet the test specification 2.21 describe the problems that can occur with the testing activities,

	and explain how they can be overcome
2.22	describe the things that may cause errors or discrepancies in/with the test results, and how to avoid these
2.23	explain any required environmental controls relating to the testing
2.24	explain what documentation needs to be completed at the end of the testing activities
2.25	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve.

Unit 557 Carrying out tests on aircraft pneumatic and vacuum systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as handling working on pressurised systems, traps from moving parts)

Unit 558 Carrying out tests on aircraft environmental systems

UAN:	**A/601/4878**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 158: Carrying out tests on aircraft environmental systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft environmental equipment and systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes oxygen equipment, cabin pressurisation equipment, therapeutic masks, air conditioning and heating systems, anti-g, pressurisation of bulkheads, pressure domes, door, canopy and window seals and demisting equipment, avionic cooling, water and waste, ice and rain protection, as applicable to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned. Functional testing, to prove system integrity and correct operation of system components, will be carried out using pumps, pressure gauges/devices, test rigs, blanking equipment, connecting equipment, air compressors, and other test devices. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft system testing 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. The learner will ensure that all tools, equipment and

materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate aircraft environmental system test procedures. The learner will understand the aircraft environmental system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft environmental systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft environmental systems: • obtain and use the appropriate documentation (such as job instructions, aircraft environmental system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up

(where appropriate)

- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft environmental systems, using appropriate tools or test equipment, to include four of the following:

- built-in test equipment (BITE)
- pumps
- pressure gauges/devices
- test rigs
- use of safety locks
- air compressors
- blanking equipment
- connecting equipment
- 'special-to-type' test equipment
- other test devices
- aircraft engines/GTS/APU

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft environmental systems:

- oxygen systems
- air conditioning systems
- cabin heating and cooling
- avionic cooling systems
- cabin pressurisation systems
- pressurised bulkheads
- pressure domes
- demisting equipment
- anti-g
- ice protection
- rain protection

1.7 carry out four of the following types of test:

- built-in test equipment (BITE)
- line pressure test
- flow tests
- cabin pressure test
- pressure balancing
- leak test

- oxygen mask deployment
- air temperature tests
- equipment functional test
- 'special-to-type' tests
- air line vapour tests
- bulkhead and dome pressure tests
- visual inspection
- oxygen concentration test
- timings

including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. Know how to carry out tests on aircraft environmental systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft environmental systems 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.4	explain the safety procedures that must be carried out before work is started on the aircraft
2.5	explain what protective clothing and equipment to be worn, and where it can be obtained
2.6	describe the hazards associated with testing aircraft environmental systems, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks
2.7	explain the correct operating procedures of the environmental system being tested
2.8	explain the electrical bonding specifications and their importance
2.9	explain how to obtain the required test schedules and specifications for the aircraft and environmental system being tested, and how to check their currency and validity
2.10	explain how to read and interpret test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications
2.11	explain what tests are to be carried out on the aircraft environmental systems
2.12	describe the testing methods and procedures to be used to carry out the various tests on the environmental systems
2.13	explain what test equipment is to be used and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made
2.14	explain the techniques, methods and procedures to be used during the tests
2.15	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities
2.16	describe the basic principle of operation of the environmental system under test, and explain the function of the individual components within the system
2.17	explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and pressures at each stage
2.18	explain the importance of ensuring that pressure is maintained; and the methods used to detect leaks and faults within the system
2.19	explain how to record the results of each individual test, and the documentation that must be used for this
2.20	explain from whom to seek authorisation if they need to alter or change the test procedures
2.21	explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft
2.22	explain the procedures to be followed if the equipment or system fails to meet the test specification
2.23	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.24	describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.25	explain any required environmental controls relating to the testing
2.26	explain what documentation needs to be completed at the end of the testing activities
2.27	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 558 Carrying out tests on aircraft environmental systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as working on pressurised systems, moving parts)

2.11 (such as functional checks, pressure tests, pressure balancing, air temperature tests, oxygen mask deployment, oxygen concentration, safety interlock tests, leak checks)

Unit 559 Carrying out tests on aircraft power transmission systems

UAN:	**J/6014883**
Level:	3
Credit value:	55
GLH:	133
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 159: Carrying out tests on aircraft power transmission systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to test aircraft power transmission systems, in accordance with approved procedures. It covers rotary winged aircraft, and includes units and components associated with the aircraft power transmission systems to be tested, such as drive shafts, drive shaft supports, gearbox assemblies, couplings, mechanical fasteners, accelerometers, vibration monitoring equipment, and main and tail rotor assemblies. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the systems to be tested. testing activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, functional testing of power transmission systems, including rotor heads, drive trains and gear boxes. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft power transmission testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and

legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate test procedures to aircraft power transmission systems. The learner will understand the aircraft power transmission system under test, and its application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out tests on aircraft power transmission systems
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the aircraft power transmission systems: • obtain and use the appropriate documentation (such as job instructions, aircraft power transmission system test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate) • carry out the tests using the specified techniques and

procedures
- make any permitted adjustments to components and equipment to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 test aircraft power transmission system components, using appropriate tools or test equipment, to include three of the following:
- built-in test equipment (BITE)
- dial test indicator
- laser alignment
- clinometers
- lay straight wires
- use of safety locks
- plumb and bob
- feeler/slip gauges
- 'go/no-go' gauge
- vibration analysis equipment
- 'special-to-type' test equipment
- optical site instruments
- jigs/fixture

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following aircraft power transmission system assemblies/components:
- drive shaft/high speed shaft
- intermediate gear box
- main gear box
- flexi couplings
- swash plate
- tail rotor assembly
- tail gear box
- drive shaft support
- couplings
- nose gear box
- accelerometer
- main rotor assembly

1.7 carry out five of the following types of test:
- visual inspection
- functional check
- gear box alignment (main, tail, intermediate)
- drive shaft/high speed shaft alignment

- 'special-to-type' tests
- built-in test equipment (BITE)
- timings
- tension adjuster check
- safety interlock test
- main rotor rigging
- tail rotor rigging
- static or dynamic balancing
- ground run tests
- freedom and range of movement
- leak test
- vibration analysis
- phasing check

including the following :

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome
The learner will: 2. know how to carry out tests on aircraft power transmission systems
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft power transmission systems

2.2	explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures
2.3	explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them
2.4	explain the safety procedures that must be carried out before work is started on the aircraft
2.5	explain what protective clothing and equipment needs to be worn, and where it can be obtained
2.6	describe the hazards associated with testing aircraft power transmission systems, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks
2.7	explain the correct operating procedures of the power transmission system being tested
2.8	explain the electrical bonding specifications and their importance
2.9	explain how to obtain the required test schedules and specifications for the aircraft and power transmission system being tested, and how to check their currency and validity
2.10	explain how to read and interpret test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications
2.11	explain what types of test are to be carried out on the aircraft power transmission systems
2.12	describe the testing methods and procedures to be used to carry out the various tests on the power transmission systems
2.13	explain what test equipment is to be used, and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made
2.14	explain the techniques, methods and procedures to be used during the tests
2.15	explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the testing activities
2.16	describe the basic principle of operation of the power transmission system under test, and explain the function of the individual components within the system
2.17	explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and pressures at each stage
2.18	explain the importance of ensuring that pressure is maintained, and the methods used to detect leaks and faults within the system
2.19	explain how to record the results of each individual test, and the documentation that must be used for this
2.20	explain from whom to seek authorisation if they need to alter or change the test procedures
2.21	explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft
2.22	explain the procedures to be followed if the equipment or system fails to meet the test specification
2.23	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.24	describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.25	explain any required environmental controls relating to the testing

2.26	explain what documentation needs to be completed at the end of the testing activities
2.27	describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 559 Carrying out tests on aircraft power transmission systems

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as working with oil and grease, moving/rotating parts),

2.11 (such as alignment checks, balance checks, freedom and range of movement checks, ground run tests, leak checks, safety interlock tests)

Unit 560 Carrying out checks and tests on replaced airframe major assemblies

UAN:	**H/601/4888**
Level:	3
Credit value:	53
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical engineering Unit 160: Carrying out checks and tests on replaced airframe major assemblies (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out checks and tests on major airframe assemblies, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with landing gear, flying control surfaces, main and tail rotor assemblies, tail pylon, transmission systems, cabin, cargo and weapon bay doors, and other aircraft specific equipment. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment to be checked or tested. The activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, and functional testing to ensure that correct operation is achieved. The learner's responsibilities will require them to comply with organisational policy and procedures for the checking and testing 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. The learner will ensure that all tools, equipment and materials used are correctly accounted for on completion of the testing activities, and that all necessary documentation is completed, accurately and

legibly. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the appropriate checking and testing procedures for the particular major airframe components. The learner will understand the components under test, and their application, and will know about the tools and equipment used, and the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, and for ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when carrying out the checking and testing activities, and when using the associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out checks and tests on replaced airframe major assemblies
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the testing of the major components of the aircraft airframe: • obtain and use the appropriate documentation (such as job instructions, aircraft airframe component test procedures, quality control documentation, history sheets, flight logbook, aircraft standards and specifications) • 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 • provide and maintain a safe working environment for the testing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current calibration date • obtain clearance to work on the aircraft, and observe all relevant isolation and safety procedures • ensure that safe working distance procedures are set up (where appropriate)

- carry out the tests using the specified techniques and procedures
- make any permitted adjustments to components and equipment to bring the system to the specification requirements
- return all tools and equipment to the correct location on completion of the testing activities
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 follow the appropriate procedures for use of tools and equipment to carry out the required tests

1.4 check/test major components of the aircraft airframe, using appropriate tools or test equipment, to include three of the following:

- built-in test equipment (BITE)
- aircraft displays and gauges
- laser alignment
- inclinometers
- lay straight wires
- use of safety locks
- ground support equipment
- plumb and bob
- vibration analysis equipment
- 'special-to-type' test equipment
- optical site instruments
- measuring equipment

1.5 set up and carry out the tests using the correct procedures and within agreed timescales

1.6 carry out testing on three of the following major airframe assemblies/components:

- main undercarriage
- nose undercarriage
- tail undercarriage
- spoilers/speed brakes
- propeller
- wing
- air brakes
- tailplane
- rudders
- ailerons/tailerons
- flapperons
- main rotor assembly
- tail rotor assembly
- fin/vertical stabiliser
- horizontal stabiliser/tail plane
- flaps/slats
- outriggers

- canards
- elevators
- stabilisers
- cargo doors
- cabin doors
- canopy
- weapon bay doors
- main gear box
- intermediate gear box
- tail pylon
- tail gear box
- nose gear box

1.7 carry out four of the following types of check/test:

- visual inspection
- functional check
- gear box alignment (main, tail, intermediate)
- rigging/symmetry check
- static friction check
- 'special-to-type' tests
- built-in test equipment (BITE)
- timings
- tension adjuster check
- safety interlock test
- main rotor rigging
- tail rotor rigging
- static or dynamic balancing
- ground run tests
- freedom and range of movement
- leak test
- vibration analysis
- phasing check

including the following:

- a full system test that incorporates at least three of the above tests

1.8 carry out tests in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- extended twin operations procedures (ETOpS) (where appropriate)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- aircraft manufacturer's requirements
- customer standards and requirements
- company standards and procedures
- specific system requirements

1.9 record the results of the tests in the appropriate format

1.10 complete the relevant paperwork, to include one from the following, indicating the results of the tests, and pass it to the appropriate people:

- computer records
- test records
- job cards
- aircraft service/flight log
- aircraft log book
- permit to work/formal risk assessment

1.11 review the results and carry out further tests if necessary

Learning outcome

The learner will:

2. Know how to carry out checks and tests on replaced airframe major assemblies

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures that they need to observe when checking/testing major components of aircraft airframes

2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures

2.3 explain the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them

2.4 explain the safety procedures that must be carried out before work is started on the aircraft

2.5 explain what protective clothing and equipment needs to be worn, and where it can be obtained

2.6 describe the hazards associated with checking/testing major components of aircraft airframes, and with the tools, materials and equipment used and explain how to minimise them and reduce any risks

2.7 explain the correct operating procedures of the major airframe components being checked/tested

2.8 explain the electrical bonding specifications and their importance

2.9 explain how to obtain the required checking/test schedules and specifications for the airframe components being checked/tested, and how to check their currency and validity

2.10 explain how to read and interpret test schedules and specifications, and from whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

2.11 describe the types of check/test to be carried out on the major airframe components

2.12 explain what testing methods and procedures are to be used to carry out the various checks/tests on the airframe components

2.13 explain what checking and test equipment to be used, and its selection for particular tests; calibration of test equipment (where applicable); and the currency and issue checks to be made

2.14 explain why equipment control is critical, and what to do if a piece of

	equipment is unaccounted for on completion of the testing activities
2.15	describe the basic principle of operation of the major airframe components under test, and explain the function of the individual components within the assembly
2.16	explain the importance of carrying out the tests in the specified sequence, checking all readings, movements and pressures at each stage
2.17	explain the importance of ensuring that pressure is maintained, and the methods used to detect leaks and faults within the system
2.18	explain how to record the results of each individual test, and the documentation that must be used
2.19	explain from whom to seek authorisation if they need to alter or change the test procedures
2.20	explain how to analyse the test results, and how to make valid decisions about the acceptability of the aircraft
2.21	explain the procedures to be followed if the equipment or system fails to meet the test specification
2.22	describe the problems that can occur with the testing activities, and explain how they can be overcome
2.23	describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.24	explain any required environmental controls relating to the testing
2.25	explain what documentation needs to be completed at the end of the testing activities
2.26	describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 560 Carrying out checks and tests on replaced airframe major assemblies

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.6 (such as working with oil and grease, moving/rotating parts)

2.11 (such as alignment checks, balance checks, freedom and range of movement checks, ground run tests, leak checks, safety interlock tests, symmetry and rigging checks)

Unit 561 Carrying out test bed runs on aircraft engines (uninstalled)

UAN:	**K/601/4889**
Level:	3
Credit value:	150
GLH:	357
Relationship to NOS:	This unit has been derived from national occupational standard aeronautical engineering Unit 161: carrying out test bed runs on aircraft engines (uninstalled) (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out test bed runs on aircraft engines, as appropriate to the engine type, in accordance with approved procedures. The engines to be tested will include turbo prop, turbo jet, turbo fan, ducted fan, turbo shaft, piston engines, auxiliary power units (APU), and ground turbine start units (GTS). The learner will be required to carry out all necessary preparations to the engine, in readiness for the tests to be carried out, and these will include ensuring that the engine is correctly mounted to the test bed/pylon, that all ancillary equipment is fitted to the engine, appropriate blanking plates are fitted, test instrumentation is correctly connected and that all necessary electrical checks are carried out. In carrying out the tests, the learner will be required to follow laid-down procedures to ensure that the working area is clear, appropriate guards and notices are displayed, engine runs/tests are carried out in accordance with the appropriate schedule, monitoring procedures are complied with, analysis of results is made, and that test documentation is completed, accurately and legibly. The learner's responsibilities will require them to comply with organisational policy and procedures for the tests undertaken, and to report any problems with the testing activities that they cannot personally resolve, or that are outside their permitted authority, to the

relevant people. The learner 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 work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to undertaking the engine test procedures. The learner will understand the engine being tested, the specific test schedule to be followed, and will know what the various instruments and readings mean, in adequate depth to provide a sound basis for carrying out the tests to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, in particular those involved with fuelling and running the engines. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to carry out test bed runs on aircraft engines (uninstalled)
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the engine for testing by carrying out all of the following, as applicable to the engine type: • obtain and use the correct issue of engine test schedule, test procedures and quality documentation • 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 • fit all the required test instrumentation to the engine • attach and secure the engine to the test pylon • fit all required ancillary equipment (to include starter motors, control valves, slave oil filters, magnetic chip detectors and strainers) • fit appropriate blanks (to include bleed off-take, anti-icing, generator and hydraulic) • make all required connections to the engine (to include fuel connections, electrical and instrumentation) • carry out all necessary electrical checks, and confirm that the engine is ready for testing • ensure that all personal are clear of the test facility and that safe working distance procedures are maintained 1.3 follow the appropriate procedures for use of tools and equipment

to carry out the required tests

1.4 set up and carry out the tests using the correct procedures and within agreed timescales

1.5 carry out tests to appropriate schedules, on one of the following types of engine:

- turbo prop
- turbo jet
- turbo-fan
- ducted fan
- turbo-shaft
- piston engines
- auxiliary power unit (APU)
- ground turbine start (GTS)

1.6 carry out tests to appropriate schedules on one of the following categories of engines:

- production engines
- repaired/overhauled engines
- development engines

1.7 undertake engine tests, as listed in the appropriate engine test schedule, to include all of the following:

- visually checking that the engine is free from any damage or obvious defects
- filling the engine with oil
- checking that engine igniter mechanisms operate correctly
- carrying out ground idle checks
- checking that fuel flow is operating correctly
- carrying out running and handling checks
- carrying out performance curves
- carrying out vibration surveys
- checking that engine pressure ratios are within specification
- checking that engine temperature is within specification
- checking that throttle/high pressure fuel flow operates smoothly
- checking that the bleed air system functions correctly
- ensuring that maximum thrust/power is achieved
- checking that fire detection and protection equipment is functioning

1.8 deal with two of the following complexities during the engine tests:

- engine runs with no faults
- engine runs with faults
- engine with intermittent faults

1.9 de-rig the engine on completion of the testing procedures, to include carrying out all of the following:

- removing and checking magnetic chip detectors for contamination
- removing and checking slave filters for contamination
- installing the engine's own magnetic chip detectors and filters
- draining all oil and fuel from the engine

- removing all blanks and test instrumentation
- removing the engine from the pylon, safely and correctly
- passing the engine to dispatch (where applicable)

1.10 carry out tests in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- Joint Airworthiness Authority (JAA)
- extended twin operations procedures (ETOpS)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- power plant manufacturer's specific requirements

1.11 record the results of the tests in the appropriate format

1.12 review and analyse the results of the tests, using two of the following, and carry out further tests if necessary:
- engine test schedule
- data sheets
- calibration records
- log cards/history sheet
- fault records
- maintenance manuals and records
- company-specific documentation

Learning outcome
The learner will: 2. Know how to carry out test bed runs on aircraft engines (uninstalled)
Assessment criteria
The learner can: 2.1 explain the specific safety practices and procedures that they need to observe when testing aircraft engines 2.2 explain the importance of maintenance on, and impact upon ETOpS systems, legislation and local procedures 2.3 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 2.4 explain the safety procedures that must be carried out before tests are started on the engine 2.5 explain what protective clothing and equipment needs to be worn during the testing activities 2.6 describe the hazards associated with testing aircraft engines, and explain how to minimise them and reduce any risks 2.7 explain what preparations need to be carried out on the engine prior to starting the engine tests 2.8 explain how to obtain the required test schedules and specifications for the aircraft and engine type being tested, and how to check their currency and validity 2.9 explain how to read and interpret the specifications, and from

whom they can seek assistance if they have problems or issues regarding the test schedules or specifications

2.10 explain the correct operating procedures for the engines being tested

2.11 describe the basic principle of operation of the engines under test, and explain the function of the individual units within the system

2.12 describe the testing methods and procedures to be used to carry out the various engine tests

2.13 explain the need to apply engine power in incremental stages, and to check all readings, temperatures and pressures at each stage

2.14 explain how to record the results of each individual test, and the documentation that must be used for this

2.15 explain from whom to seek authorisation if they need to alter or change the test procedures

2.16 explain how to analyse the test results, and how to make valid decisions about the acceptability of the engine

2.17 explain the procedures to be followed if the engine or system fails to meet the test specification

2.18 describe the potential problems that can occur with the testing activities, and explain how they can be overcome

2.19 describe things that may cause errors or discrepancies in/with the test results, and explain how to avoid them

2.20 explain any required environmental controls relating to the testing

2.21 explain what documentation needs to be completed at the end of the testing activities

2.22 explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities

2.23 describe the extent of their own authority and explain to whom they should report if they have a problem that they cannot resolve

Unit 561 Carrying out test bed runs on aircraft engines (uninstalled)

Supporting information

Guidance

2.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.4 (such as the lock guard system is functioning, test cell is empty of people, bed doors are closed, all personnel are clear of the test area)

2.7 (such as attaching to the test pylon, fitting test instrumentation, fitting ancillary equipment, fitting blanking plates, filling the engine with oil, making fuel connections, attaching electrical power and making final electrical checks of all systems)

Appendix 1 Relationships to other qualifications

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see **www.cityandguilds.com/functionalskills**
- Essential Skills (Northern Ireland) – see **www.cityandguilds.com/essentialskillsni**
- Essential Skills Wales – see **www.cityandguilds.com/esw**

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 **Centres and Training Providers homepage** on **www.cityandguilds.com**.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications 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 homepage** section of the City & Guilds website also contains useful information such on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

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Useful contacts

UK learners **General qualification information**	**T: +44 (0)844 543 0033** **E: learnersupport@cityandguilds.com**
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: **intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: **singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: **walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: **business@cityandguilds.com**
Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: feedbackandcomplaints@cityandguilds.com

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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