QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Aeronautical Engineering (Aircraft Manufacture Mechanical) (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 Manufacture Mechanical)	1789-31	600/1575/5

Version and date	Change detail	Section
1.1 November 2012	• Formatting (not allowing sentences to split between two pages) • Amended the numbering of the assessment criteria for learning outcome 1	• Units 001, 403, 404 • Unit 411
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 qualification:

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 Manufacture Mechanical)**, learners must achieve **20** credits from the mandatory units and a minimum of **128** credits from the optional units available.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Mandatory			
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
Optional			
A/601/4363	405	Marking out composite and/or metallic aircraft components	28
J/601/4365	406	Cutting and shaping aircraft components	48
R/601/4367	407	Bending and forming aircraft components	48
Y/601/4368	408	Installing aircraft mechanical fasteners into composite and/or metallic components	42

Unit accreditation number	City & Guilds unit	Unit title	Credit value
D/601/4369	409	Producing aircraft detail assemblies	71
Y/601/4371	410	Producing composite and/or metallic aircraft sub-assemblies	71
D/601/4372	411	Producing composite and/or metallic aircraft major assemblies	70
H/601/4373	412	Installing aircraft mechanical controls	86
A/601/4380	413	Repairing airframes and structures	62
F/601/4381	414	Modifying airframes	60
D/601/4386	415	Modifying aircraft mechanical systems	77
M/601/4389	416	Carrying out routine servicing of aircraft	42
D/601/4422	423	Moulding acrylic aircraft components	50
J/601/4432	426	Producing aircraft composite assemblies	86
J/601/4446	427	Vacuum forming aircraft components	50
D/601/4453	428	Producing aircraft components by plastic injection moulding	62
T/601/4474	430	Assembling aircraft transparencies	40
M/601/4506	439	Drilling and finishing holes in composite and/or metallic aircraft structures or components	40
A/601/4508	441	Installing aircraft hydraulic systems	86
T/601/4510	442	Installing aircraft pneumatic systems	86
F/601/4512	443	Installing aircraft de-icing systems	86
L/601/4514	444	Installing aircraft fuel systems	86
D/601/4517	445	Installing aircraft environmental systems	86
K/601/4519	446	Installing flying control surfaces and systems	86
H/601/4521	447	Installing aircraft armament systems	86
T/601/4524	448	Installing aircraft assisted escape mechanisms	70
F/601/4526	449	Installing aircraft main engines	95
R/601/4529	450	Installing aircraft auxiliary engines	89
R/601/4532	451	Installing aircraft power transmission systems	89
M/601/4537	452	Testing installed aircraft engines	55
A/601/4542	453	Testing aircraft power transmission systems	55
L/601/4545	454	Testing aircraft hydraulic systems	55

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Y/601/4547	455	Testing aircraft pneumatic systems	55
Y/601/4550	456	Testing aircraft environmental systems	55
M/601/4554	457	Testing aircraft de-icing systems	55
F/601/4560	458	Testing aircraft fuel systems	55
T/601/4572	459	Testing aircraft flying control surfaces and systems	55
R/601/4577	460	Testing aircraft armament systems	50
D/601/4579	461	Testing aircraft assisted escape systems	50
L/601/4707	493	Applying finishes to aircraft composite mouldings	46
F/601/5188	602	Producing aircraft composite mouldings using pre-preg laminating techniques	86
J/601/5192	603	Producing aircraft composite mouldings using wet lay-up techniques	86
Y/601/5195	604	Producing aircraft composite mouldings using resin infusion laminating techniques	86
H/601/5197	605	Trimming aircraft composite mouldings using hand tools	46
Y/601/5200	606	Identifying defects in aircraft composite mouldings	30
D/601/5201	607	Repairing aircraft composite mouldings	77
K/601/5203	608	Bonding aircraft composite mouldings	30
K/601/6111	611	Setting plastic injection moulding machines for the production of aircraft components	70

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 405 Marking out composite and/or metallic aircraft components

UAN:	**A/601/4363**
Level:	3
Credit value:	28
GLH:	52
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 005: Marking Out Composite and/or Metallic Aircraft 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 mark out composite and/or metallic aircraft components, in accordance with approved procedures. The learner will be required to select the appropriate equipment to use, based on the features to be marked out and the accuracy required, and this will include the use of precision instruments. Marking out will be in preparation for activities such as aircraft detail fitting, machining, development of simple patterns for fabrication purposes or the production of templates. Materials to be marked out will include ferrous, non-ferrous, non-metallic and composites, and may be in flat form, square or rectangular section, circular or irregularly shaped. In some circumstances, the learner will need to take material grain flow into account when carrying out the marking out activities. The learner's responsibilities will require them to comply with organisational policy and procedures for the marking out activities undertaken, and to report any problems with the marking out activities, materials used or marking out equipment, that they cannot personally resolve, 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 produce. The learner's knowledge will provide a good understanding of their work, and will provide

an informed approach to applying marking out procedures. The learner will understand the marking out process and its application, and will know about the equipment, relevant materials and marking mediums 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 marking out 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 mark out composite and/or metallic aircraft 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 activities during marking out: • obtain and use the appropriate documentation (such as job instructions, installation 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 marking out activities • obtain the correct tools and equipment for the marking out activity, and check that they are in a safe and usable condition and within current calibration date • follow safe practice/approved marking out techniques and procedures at all times • return all tools and equipment to the correct location on completion of the marking out activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Obtain and use the correct information for marking out 1.4 Obtain the appropriate marking out equipment and check that it is in a usable condition 1.5 Use five of the following types of marking out equipment: • rules/tapes • laser tracking • jigs for marking out • squares

- protractors
- scribers
- Vernier instruments
- dividers/compass
- approved aerospace markers

1.6 Prepare suitable datum and marking out surfaces

1.7 Mark out using appropriate methods

1.8 Mark out a range of material forms, to include three from:

- flat materials
- curved surfaces
- cylindrical sections
- rolled sections
- irregular shaped items
- assemblies
- machined items
- castings/forgings
- composite mouldings

1.9 Use marking out methods and techniques which include two from:

- direct marking using instruments
- through skin sensor
- tracing/transfer methods
- use of templates

1.10 Mark out workpieces, to include five of the following features:

- datum/centre lines
- square/rectangular profiles
- angles/angular profiles
- circles and radial profiles
- laser tracking
- linear hole positions
- radial hole positions
- simple allowances for bending
- pattern development
- other specific shapes/profiles

1.11 Check that the marking out complies with the specification

1.12 Mark out workpieces in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- company standards and procedures
- BS, ISO or BSEN standards and procedures
- customer standards and requirements

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

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

- build records

- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to Mark Out Composite and/or Metallic Aircraft Components
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures they need to observe when marking out 2.2 Explain the health and safety requirements of the work area in which they are carrying out the marking out activities, and the responsibility these requirements place on them 2.3 Describe the hazards associated with marking out aerospace materials and structures, and explain how to minimise them and reduce any risks 2.4 Explain what protective equipment that they need to use for both personal protection and protection of the aircraft components 2.5 Explain how to extract and use information from engineering drawings and related specifications 2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 Explain how to carry out currency/issue checks on the specifications they are working with 2.8 Explain the principles of marking out and the equipment used in the aerospace industry 2.9 Explain how to select and establish suitable workpiece datum's 2.10 Describe the methods of holding and supporting workpiece during the marking out activities, and equipment that can be used 2.11 Explain how to mark out the workpiece 2.12 Describe the various methods of pattern development that can be used and typical applications of each method 2.13 Explain how to clean and prepare the surfaces to be marked out ensuring, where appropriate, that grain flow is taken into account 2.14 Explain how to calculate bending allowances for marking out 2.15 Explain the standards to be attained and the company quality control procedures 2.16 Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 405 Marking out composite and/or metallic aircraft components

Supporting information

Guidance

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

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken

2.11 (including datum's, guidelines, square and rectangular profiles, circular and radial profiles, angles, holes which are linearly positioned, boxed and on pitch circles)

2.12 (such as parallel line, radial line, triangulation)

Unit 406 Cutting and shaping aircraft components

UAN:	**J/601/4365**
Level:	3
Credit value:	48
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 006: Cutting and Shaping Aircraft 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 cut and shape materials to produce aircraft components, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment and to check that they are in a safe and serviceable condition to use. The learner will be expected to use a range of different materials, ensuring efficient use of them and, when applicable, ensuring that grain flow is taken into account. In carrying out the cutting and shaping activities, the learner will need to use a range of hand tools, portable power tools and simple machines to produce a variety of shapes and profiles, which will include internal and external square and rectangular profiles, circular and curved profiles, angular profiles, and holes linearly pitched and radially/circularly pitched. The learner's responsibilities will require them to comply with organisational policy and procedures for the cutting and shaping activities undertaken, and to report any problems with the activities, material tools or equipment 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 cutting and

shaping procedures and instructions. The learner will understand the cutting and shaping methods and techniques used, and their application, and will know about the tools, equipment, materials and consumables, 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 working with the cutting and shaping 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 cut and shape aircraft 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 activities during cutting and shaping: • obtain and use the appropriate documentation (such as job instructions, aircraft drawings, planning and quality control documentation, 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 cutting and shaping 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 cutting and shaping techniques and procedures at all times • return all tools and equipment to the correct location on completion of the activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow relevant specifications for the component to be produced 1.4 Obtain the appropriate tools and equipment for the shaping operations and check that they are in a safe and usable condition 1.5 Shape the materials using appropriate methods and techniques 1.6 Cut and shape the materials using four of the following: • saws (hand or mechanical) • guillotines • bench knives

- tin snips
- drills and hole saws
- nibblers
- cropping machines
- files
- abrasive discs

1.7 Produce a range of components with features that include five of the following:
- edges/faces that are square to each other
- edges/faces that are parallel
- edges/faces that are angled
- curved or circular forms
- internal profiles
- external profiles
- holes linearly pitched
- holes radially pitched

1.8 Cut and shape material that include three of the following forms:
- flat sheet
- bar stock
- angle section
- channel sections

1.9 Use two types of material from:
- aluminium
- titanium
- stainless steel
- composite material
- glass reinforced plastic (GRP)
- carbon fibre

1.10 Check that all the required shaping operations have been completed to the required specification

1.11 Produce components which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

Learning outcome
The learner will: 2. Know how to Cut and Shape Aircraft Components
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the cutting and shaping operations 2.2 Explain the health and safety requirements of the work area in which they are carrying out the cutting and shaping activities, and the responsibility these requirements place on them 2.3 Explain what personal protective equipment and protective clothing needs to be worn during the cutting and shaping activities 2.4 Describe the hazards associated with cutting and shaping aircraft components, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 Describe the range of hand and power operated tools that are to be used for the shaping operations 2.6 Explain how to check that the tools and equipment to be used are in a safe and serviceable condition 2.7 Explain the importance of ensuring that all tools and equipment are used in the correct manner and within their permitted operating range 2.8 Describe the shaping methods and techniques that can be used to produce a range of shapes/profiles on the various section materials 2.9 Explain how to select saw blades for different applications and materials, and methods of setting saw blades for cutting externally and internally 2.10 Describe the various shearing methods that can be used 2.11 Describe the methods of drilling and finishing holes in sheet and stock materials 2.12 Describe the various types of file that are available; the cut of files for different applications; the importance of ensuring that file handles are safe and free from embedded foreign bodies 2.13 Describe the methods of shaping and finishing materials using abrasives 2.14 Explain how to identify the materials to be used; material identification systems; codes used and grain flow indicators 2.15 Explain the importance of labelling all components produced and of ensuring that materials returned to stores are suitably identified 2.16 Explain what preparations and/or treatments that may need to be carried out on the materials before and after the cutting and shaping operations 2.17 Describe the quality control procedures to be followed, and how to conduct any necessary checks to ensure the accuracy and quality of the components produced 2.18 Describe the problems that can occur with the shaping operations, and explain how these can be overcome 2.19 Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 406 Cutting and shaping aircraft components

Supporting information

Guidance

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

2.8 (such as sawing, shearing, drilling, filing, abrading)

2.9 (such as hand saws, mechanical saws, band saws)

2.10 (such as tin snips, bench shears, guillotines, cropping machines and nibbling machines)

2.11 (such as drills, reamers, countersinks, hole saws)

2.13 (such as emery cloth, linishing and polishing)

Unit 407 Bending and forming aircraft components

UAN:	**R/601/4367**
Level:	3
Credit value:	48
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 007: Bending and Forming Aircraft 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 bend and form materials to produce aircraft components, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment for the bending activities to be carried out, and to check that they are in a safe and serviceable condition to use. The learner will be expected to use a range of different materials, ensuring efficient use of them and, when applicable, ensuring that grain flow is taken into account. In carrying out the bending and forming activities, the learner will need to use a range of hand tools and simple hand operated machines to produce a variety of shapes and profiles, which will include bends and tray sections, cylindrical and curved sections, conical sections and dished items. 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 bending and forming activities, materials or equipment 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 bending and

forming procedures and instructions. The learner will understand the bending and forming methods and techniques used, and how the operations may affect the various materials, and they will know about the tools, equipment, materials and consumables 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 working with the bending and forming 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 bend and form aircraft 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 bending and forming activities: • obtain and use the appropriate documentation (such as job instructions, aircraft drawings, planning and quality control documentation, 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 bending and forming 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 bending and forming techniques and procedures at all times • return all tools and equipment to the correct location on completion of the activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow the correct component drawing and any other related specifications for the component to be produced 1.4 Determine what has to be done and how this will be achieved 1.5 Use the appropriate tools and equipment for the pressure shaping operations and check that they are in a safe and usable condition 1.6 Shape the materials to the required specification using appropriate

methods and techniques

1.7 Bend and form materials using four of the following:
- bench folding machines
- box pan folding machines
- pinch or pyramid rolling machines
- presses
- hand tools
- heating techniques
- shrinking techniques
- stretching techniques

1.8 Produce a range of components with features that include five of the following:
- right angled bends
- angled bends
- square flanges
- tray sections and channels
- curved/circular flanges
- curved profile
- cylindrical shape
- conical shape
- dished profile

1.9 Use two different types of material from:
- aluminium sheet
- alloy sheet
- titanium sheet
- stainless steel sheet
- other materials

1.10 Check that all the required shaping operations have been completed to the required standard

1.11 Produce components which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

Learning outcome
The learner will: 2. Know how to bend and form aircraft components
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the bending and forming operations 2.2 Explain the health and safety requirements of the work area in which they are carrying out the bending and forming activities, and the responsibility these requirements place on them 2.3 Describe the hazards associated with bending and forming aircraft components, and explain how to minimise them and reduce any risks 2.4 Explain what personal protective equipment and protective clothing needs to be worn during the bending and forming activities 2.5 Describe the range of hand tools and associated equipment used to produce a variety of shapes, bends, curved surfaces, dished profiles 2.6 Describe the range of bending and forming machines that is to be used 2.7 Explain how to check that the tools and equipment to be used are in a safe and usable condition 2.8 Explain the importance of ensuring that all tools and equipment are used in the correct manner and within their permitted operating range 2.9 Explain how to set up a bending machine to produce a range of forms 2.10 Explain how to set up simple presses to produce a variety of forms 2.11 Explain how to set up pinch/pyramid forming rolls to produce a variety of forms 2.12 Explain how to produce flanges on curved/cylindrical components using machines and hand tools 2.13 Explain how to identify the materials to be used; material identification systems; codes used and grain flow indicators 2.14 Explain the importance of labelling all components produced, and of ensuring that materials returned to stores are suitably identified 2.15 Explain what preparations and/or treatments may need to be carried out on the materials before and after the bending and forming operations 2.16 Describe the quality control procedures to be followed, and explain how to conduct any necessary checks to ensure the accuracy and quality of the components produced 2.17 Describe the problems that can occur with the bending and forming operations, and explain how these can be overcome 2.18 Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 407 Bending and forming aircraft components

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 fly presses, bending machines, rolling machines, flanging machines)

2.9 (such as right-angled bends, angled bends, tray sections, channel sections)

2.10 (such as bends, profiles)

2.11 (such as curved profiles, cylinders, cones)

Unit 408 Installing aircraft mechanical fasteners into composite and/or metallic components

UAN:	**Y/601/4368**
Level:	3
Credit value:	42
GLH:	98
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 008: Installing Aircraft Mechanical Fasteners into Composite and/or Metallic 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 install aircraft mechanical fasteners into composite and/or metallic components, 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 types of mechanical fastener to be installed. The mechanical fasteners to be installed will include hollow and solid rivets, threaded fasteners, anchor nuts, pins and other locking devices. The learner will need to use a range of different techniques to prepare, install and check that the mechanical fasteners are installed to the required specification. 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 installation activities, materials or equipment used that they cannot personally resolve, or that are outside their personal authority, to the relevant people and, where appropriate, to seek approval to rectify any faults in the installation of the fasteners. The learner must also ensure that all tools, equipment and materials are correctly accounted for on completion of the activities, and must complete all necessary job/task documentation 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 installation techniques and procedures. The learner will understand the mechanical fasteners being installed, and their application, and will know about the equipment, tooling and relevant materials, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the fasteners are installed to the required specification.

The learner will understand the safety precautions required when installing the fasteners, and when using the installation 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 install aircraft mechanical fasteners into composite and/or metallic 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, planning and quality control documentation, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Use four types of equipment from the following:

- gauges for intrusions
- drills and tools with attachments
- redline templates
- fastener installation tool
- jigs
- gripping pins and location dowels
- clamps

1.6 Install, position and secure the equipment and components in accordance with the specification

1.7 Install mechanical fasteners, to include four of the following:

- hollow rivets
- solid rivets
- collared fasteners
- threaded fasteners
- split pins
- NAPP pins
- pin clips
- PIT pins
- wire locks
- anchor nuts
- bonded fasteners
- other locking devices

1.8 Use five of the following installation methods and techniques:

- countersinking
- milling fasteners
- wire locking
- installing fasteners with a clearance fit
- installing fasteners with an interference fit
- bonded fasteners
- solid riveting (single and double handed) squeeze, percussion, reaction
- blind riveting
- through-hole
- taperlok

1.9 Make three types of connection from:

- wet assembly
- dry assembly
- panels
- skins
- structures
- repairs

1.10 Check that all necessary connections to the equipment are

complete

1.11 Install fasteners in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

Learning outcome

The learner will:

2. Know how to install aircraft mechanical fasteners into composite and/or metallic components

Assessment criteria

The learner can:

2.1 Explain the specific safety precautions to be taken whilst installing the mechanical fasteners

2.2 Explain the health and safety requirements of the work area in which they are carrying out the installation activities, and the responsibility these requirements place on them

2.3 Describe the hazards associated with installing mechanical fasteners in aerospace structures, 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 wear for both personal protection and protection of the aircraft

2.5 Explain the need to work to the installation instructions and appropriate specifications

2.6 Explain why they must obtain design approval before removing and replacing faulty fasteners

2.7 Explain the purpose and use of joint sealing agents and anti-electrolysis barriers, and the precautions to be taken when using them

2.8 Explain the regulations concerning electrical bonding and anti-electrolysis barriers

2.9 Describe the various types and range of screwed fasteners used on aircraft, and methods of installing them

2.10 Describe the types and applications of aircraft rivets, and explain the advantages of hollow rivets over solid rivets

2.11	Describe the methods of installing rivets
2.12	Explain the reasons for using screw fastenings rather than rivets
2.13	Explain the purpose and use of a countersink cage
2.14	Explain the various locking devices used with fastenings
2.15	Explain the purpose and use of locating dowels, gripping pins and gauges when carrying out fastening operations
2.16	Explain the procedures to be adopted when removing rivets and other fasteners
2.17	Explain the term 'quilting', its occurrence and avoidance
2.18	Explain 'Bolt break-offs', and where they occur
2.19	Explain how to check that riveting guns, power tools and attachments are in a safe and usable condition, and the action to be taken in the event of identifying defective equipment
2.20	Describe the types of gauge used to measure angles, depths, countersinks and torque
2.21	Explain how and why tools are calibrated, and how to check that the tools they are using are within calibration dates
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 408 Installing aircraft mechanical fasteners into composite and/or metallic components

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 blind rivets, squeeze, percussion and reaction riveting)

Unit 409 Producing aircraft detail assemblies

UAN:	**D/601/4369**
Level:	3
Credit value:	71
GLH:	140
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 009: Producing Aircraft Detail 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 assemble components to produce aircraft detail assemblies, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment to use, based on the assembly operations required, and to check that they are in a safe and usable condition. In carrying out the assembly operations, the learner will be required to follow laid-down procedures and specific assembly techniques, in order to assemble the various components into detail assemblies. Typical assemblies to be produced will include stringers, frames, panels, trays, skins, ribs, tanks and other small assemblies, as appropriate. 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 assembly activities, materials or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will need to ensure that all tools, equipment and materials used in the assembly are correctly accounted for on completion of the activities, and they must complete all necessary job/task documentation 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 assembly techniques and procedures. The learner will understand the structure being assembled, and its application, and will know about the relevant materials and fastening devices, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work is to the required specification.

The learner will understand the safety precautions required when carrying out the assembly 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 produce aircraft detail 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 activities during assembly: • obtain and use the appropriate documentation (such as job instructions, aircraft assembly drawings, planning and quality control documentation, 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 assembly 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 assembly techniques and procedures at all times • return all tools and equipment to the correct location on completion of the activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow the relevant instructions, assembly drawings and any other specifications 1.4 Check that the specified components are available and that they are in a usable condition 1.5 Assemble components which include four of the following: • cleats

- brackets
- angles
- skins
- stringers
- ribs
- pipes, unions and joints
- jumper braids, bonding clips, earthing straps
- aircraft general supplies

1.6 Use the appropriate methods and techniques to assemble the components in their correct positions

1.7 Apply all of the following assembly methods and techniques:

- welding (if appropriate)
- drilling and riveting
- applying sealants/adhesives
- electrical bonding of components
- ensuring that correct part numbers are used
- ensuring that correct hand of components used (left or right handed)
- positioning and aligning components for cosmetic appearance and skin lines
- securing components, using mechanical fasteners and threaded devices
- applying bolt locking methods (split pins, wire locking, lock nuts, stiff nuts)

1.8 Produce aircraft detail assemblies which include three of the following:

- skins
- stringers
- frames
- panels
- ribs
- trays
- tanks
- other small assemblies as applicable

1.9 Secure the components using the specified connectors and securing devices

1.10 Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.11 Carry out quality and accuracy checks which include three from:

- cosmetic appearance
- accuracy of skin lines
- freedom from damage
- torque loading checks
- electrical bonding and continuity

1.12 Produce assemblies which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety

Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

Learning outcome
The learner will: 2. Know how to produce aircraft detail assemblies
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the detail assembly operations 2.2 Explain the health and safety requirements of the work area in which they are carrying out the detail assembly activities, and the responsibility these requirements place on them 2.3 Explain what personal protective equipment and protective clothing needs to be worn during the detail assembly activities 2.4 Describe the hazards associated with producing aircraft assemblies, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 Explain how to identify the components to be used; component identification systems; codes used and component orientation indicators 2.6 Explain what preparations need to be undertaken on the components prior to fitting them into the assembly 2.7 Describe the assembly methods and procedures to be used, and explain the importance of adhering to these procedures 2.8 Explain how the components are to be aligned and positioned, and the tools and equipment that are used 2.9 Describe the methods used to hold the components in their correct position prior to securing them with the appropriate fasteners 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 particular assembly, and why they must not substitute others. 2.12 Explain what to do if the components or fastening devices are not assembled correctly, are damaged, or have other faults 2.13 Explain the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with the various adhesives and sealants 2.14 Describe the quality control procedures to be followed during the

assembly operations

2.15 Explain how to conduct any necessary checks to ensure the accuracy and quality of the assemblies produced

2.16 Explain how to check that the tools and equipment to be used are correctly calibrated and are in a safe and useable condition

2.17 Explain the importance of using all tools in the correct manner and within their permitted operating range

2.18 Explain the importance of ensuring that the completed assembly is free from dirt, swarf and foreign objects

2.19 Describe the problems that can occur with the assembly operations and explain how these can be overcome

2.20 Describe the extent of their own authority within the assembly activities and explain to whom to report if they have problems that they cannot resolve

Unit 409 Producing aircraft detail assemblies

Supporting information

Guidance

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

2.8 (including jigs and fixtures)

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

Unit 410 Producing composite and/or metallic aircraft sub-assemblies

UAN:	**Y/601/4371**
Level:	3
Credit value:	71
GLH:	140
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 010: Producing Composite and/or Metallic Aircraft Sub-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 produce composite and/or metallic aircraft sub-assemblies, 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 type of components to be installed, and to check that they are in a safe and serviceable condition. In carrying out the sub-assembly operations, the learner will be required to follow laid-down procedures and specific assembly techniques in order to assemble the various components into sub-assemblies, such as flaps, ailerons, under-floor structures, side structures, cabin roof, avionics cabinets, mission consoles, engine nacelle, windows, galleys, hatches, doors, stairs, trunking/ducting, and bulkheads. The sub-assembly activities will also include making all necessary checks and adjustments to ensure that components are correctly positioned and, where appropriate, have accurate skin lines, that fasteners are tightened to the correct torque and function as per specification, and that the sub-assembly is free from damage and has an appropriate cosmetic appearance. The learner's responsibilities will require them to comply with organisational policy and procedures for the sub-assembly activities undertaken, and to report any problems with the sub-assembly 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 in the sub-assembly are correctly accounted for on completion of the activities, and they must complete all necessary job/task documentation 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 sub-assembly techniques and procedures. The learner will understand the structure being assembled, and its application, and will know about the production techniques, components, equipment, relevant materials and fastening devices, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the finished work is to the required specification.

The learner will understand the safety precautions required when carrying out the assembly 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 produce composite and/or metallic aircraft sub-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 assembly activities: • obtain and use the appropriate documentation (such as job instructions, aircraft assembly 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 assembly 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 assembly techniques and procedures at all times • return all tools and equipment to the correct location on completion of the assembly 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 instructions, assembly drawings and any other specifications

1.4 Check that the specified components are available and that they are in a usable condition

1.5 Use four of the following types of component in the sub-assemblies:

- details
- brackets
- skins/covers
- angles
- ribs
- levers, linkages
- packers
- frames
- spars
- stringers
- doublers
- pipes, unions and joints
- jumper braids, bonding clips, earthing straps

1.6 Use the appropriate methods and techniques to assemble the components in their correct positions

1.7 Apply all of the following sub-assembly methods and techniques:

- applying sealants/adhesives
- ensuring correct part numbers are used
- drilling holes
- finishing holes (such as countersinking, deburring, spot facing
- electrical bonding of components
- ensuring that the correct hand of components is used (left or right handed)
- positioning and aligning components for cosmetic appearance and skin lines to drawing requirements, as appropriate
- securing components using mechanical fasteners, threaded devices, liquid shimming, riveting, taperlok, interference/clearance fit and bonding to drawing requirements, as appropriate
- applying bolt locking methods (such as split pins, wire locking, lock nuts, stiff nuts)

1.8 Produce aircraft sub-assemblies which include one of the following:

- flaps
- ailerons
- under-floor structures
- side structures
- stringer to skin/cover
- windows
- galleys
- bulk heads
- avionics cabinets

- rib to spar
- mission consoles
- hatches
- doors
- cabin roof
- rib and spar to skin/cover
- stairs
- trunking/ducting
- engine nacelle/pylons
- wing box sections

1.9 Secure the components using the specified connectors and securing devices

1.10 Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.11 Carry out quality and accuracy checks to drawing requirements and/or manufacturers' instructions, which include three of the following:

- cosmetic appearance
- accuracy of skin lines
- freedom from damage
- torque loading checks
- electrical bonding and continuity

1.12 Produce sub-assemblies which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

- build records
- job cards
- log cards
- aircraft log

Learning outcome
The learner will: 2. Know how to produce composite and/or metallic aircraft sub-assemblies
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the assembly

2.2	Explain the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them
2.3	Explain what personal protective equipment and clothing needs to be worn during the assembly activities
2.4	Describe the hazards associated with producing composite and metallic aircraft sub-assemblies, and explain how to minimise them and reduce any risks
2.5	Describe the various types of drawing and specification that are used during the assembly
2.6	Explain how to identify the components to be used; component identification systems
2.7	Explain what preparations need to be undertaken on the components prior to fitting them into the assembly
2.8	Describe the assembly methods and procedures to be used, and explain the importance of adhering to the procedures
2.9	Explain how the components are to be aligned and positioned prior to securing, and the tools and equipment that are used
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 assembly, and why they must not use substitutes
2.12	Explain how to deal with components or fastening devices incorrectly assembled, damaged or having other faults
2.13	Explain the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with them
2.14	Describe the quality control procedures to be followed during the assembly operations
2.15	Explain how to conduct any necessary checks to ensure the accuracy and quality of the assemblies produced
2.16	Explain how to recognise defects
2.17	Describe the methods and equipment used to transport, handle and lift the components into position, and explain how to check that the equipment is within its current certification dates
2.18	Explain how to check that the tools and equipment to be used are correctly calibrated and are in a safe and serviceable condition
2.19	Explain the importance of ensuring that all tools are used correctly and within their permitted operating range
2.20	Explain the importance of ensuring that the completed assembly is free from dirt, swarf and foreign objects
2.21	Describe the problems that can occur with the assembly operations, and explain the importance of informing appropriate people of non-conformances
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 410 Producing composite and/or metallic aircraft sub-assemblies

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 codes and component orientation indicators)

2.9 (including jigs and fixtures)

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

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

Unit 411 Producing composite and/or metallic aircraft major assemblies

UAN:	**D/601/4372**
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 011: Producing Composite and/or Metallic Aircraft 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 assemble major aircraft composite and metallic assemblies, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment to use, based on the assembly operations required, and to check that they are in a safe and serviceable condition. In carrying out the assembly operations, the learner will be required to follow laid-down procedures and specific assembly techniques, in order to assemble the various components into major assemblies that make up front, rear and centre fuselage sections, floors, wings, fin and tail sections, nose sections, cabins or cockpits. The assembly activities will also include making all necessary checks and adjustments to ensure that components are correctly positioned and have accurate skin lines, that fasteners are tightened to the correct torque and function as per the specification, and that the assembly is free from damage and has an appropriate cosmetic appearance. The learner's responsibilities will require them to comply with organisational policy and procedures for the assembly activities undertaken, and to report any problems with the assembly activities, materials or equipment 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 assembly techniques and procedures. The learner will understand the structure being assembled, and its application, and will know about the equipment, relevant materials and fastening devices, 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 assembly 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 produce composite and/or metallic aircraft 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 activities during the installation: • obtain and use the appropriate documentation (such as job instructions, aircraft assembly 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 assembly 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 assembly 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 assembly 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 instructions, assembly drawings and any other specifications

1.4 Check that the specified components are available and that they are in a usable condition

1.5 Assemble components which include four of the following:

- ribs
- spars
- skins/covers
- brackets
- packers
- frames
- jumper braids
- stringers
- bonding clips
- doublers
- earthing straps
- pipes, unions/joints

1.6 Use the appropriate methods and techniques to assemble the components in their correct positions

1.7 Apply all of the following assembly methods and techniques:

- positioning and aligning components for cosmetic appearance and skin lines to drawing requirements, as appropriate
- applying sealant/adhesives
- drilling and finishing holes (such as countersinking, deburring, spot facing)
- securing components, using mechanical fasteners (such as threaded devices, liquid shimming, riveting, taperlok, interference/clearance fit and bonding) to drawing requirements, as appropriate
- applying bolt locking methods (split pins, wire locking, lock nuts, stiff nuts)
- electrical bonding of components

1.8 Produce one of the following aircraft major assemblies:

- front fuselage section
- centre fuselage section
- rear fuselage section
- floor
- cockpit/cabin
- wing
- fin
- nose
- side structures
- tail plane
- cabin roof
- flying control surfaces

1.9 Secure the components using the specified connectors and securing devices

1.10 Check the completed assembly to ensure that all operations have

been completed and the finished assembly meets the required specification

1.11 Carry out quality and accuracy checks which include three from:

- cosmetic appearance
- accuracy of skin lines
- freedom from damage
- torque loading checks
- electrical bonding and continuity

1.12 Produce assemblies which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to produce composite and/or metallic aircraft major assemblies
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the assembly 2.2 Explain the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them 2.3 Describe the hazards associated with producing major aircraft assemblies, and with the tools and equipment that are used, and explain how to minimise them and reduce any risks 2.4 Explain what personal protective equipment and clothing needs to be worn during the assembly activities 2.5 Describe the various types of drawing and specifications that are used during the assembly. 2.6 Explain how to identify the components to be used; component identification systems 2.7 Explain what preparations need to be undertaken on the components prior to fitting them into the assembly 2.8 Describe the assembly methods and procedures to be used, and explain the importance of adhering to the procedures

2.9	Explain how the components are to be aligned and positioned prior to securing, and the tools and equipment that are used, including jigs and fixtures
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 assembly, and why they must not use substitutes
2.12	Explain how to deal with components or fastening devices that are incorrectly assembled, damaged or having other faults
2.13	Explain the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with them
2.14	Describe the quality control procedures to be followed during the assembly operations
2.15	Explain how to conduct any necessary checks to ensure the accuracy and quality of the assemblies produced
2.16	Explain how to recognise defects
2.17	Describe the methods and equipment used to transport, handle and lift the components into position, and explain how to check that the equipment is within its current certification dates
2.18	Explain how to check that the tools and equipment to be used are correctly calibrated and are in a safe and serviceable condition
2.19	Explain the importance of ensuring that all tools are used correctly and within their permitted operating range
2.20	Explain the importance of ensuring that the completed assembly is free from dirt, swarf and foreign objects
2.21	Describe the problems that can occur with the assembly operations, and explain the importance of informing appropriate people of non-conformances
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 411 Producing composite and/or metallic aircraft major assemblies

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 codes and component orientation indicators)

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

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

Unit 412 Installing aircraft mechanical controls

UAN:	**H/601/4373**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 012: Installing Aircraft Mechanical Controls (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 install aircraft mechanical controls for the following systems: hydraulic; pneumatic; flying control; fuel; power transmission; and engine/propulsion, 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 components to be installed. The mechanical controls to be installed will include items such as chains and sprockets, cables, pulleys and turnbuckles, levers and linkages, control rods, pivots and bell cranks, struts and stays, micro switches and stops, locks and jacks, servo actuators, tie rods, torque tubes, trim wheels, and fail-safe devices. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that they function as per the specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the installation activities, components or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to ensure that all tools, equipment and materials used in the installation are

correctly accounted for on completion of the activities, and to complete all necessary job/task documentation accurately and legibly. 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 installation techniques and procedures. The learner will understand the aircraft system being worked on and the function of the mechanical controls being installed, and will know about the relevant components, fastening and securing devices, 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 installation 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 install aircraft mechanical controls
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 installation: • obtain and use the appropriate documentation (such as job instructions, aircraft installation 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures

- leave the work area and installation in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install mechanical control components for three of the following aircraft systems:

- hydraulic systems
- pneumatic systems
- flying control systems
- fuel systems
- power transmission systems
- engine/propulsion systems

1.7 Install eight of the following types of component:

- cables and pulleys
- levers and linkages
- chains and sprockets
- turnbuckles
- control rods
- struts and stays
- locks
- fail-safe devices
- tie rods
- torque tubes
- trim wheels
- jacks
- pivots and bell cranks
- servo actuators
- microswitches and stops
- seals/sealants

1.8 Apply installation methods and techniques, to include four from:

- positioning and aligning
- functional checks
- sealants
- tensioning cables
- setting working clearance
- earth bonding
- manual handling

1.9 Use three of the following types of mechanical securing device:

- nuts and bolts
- locking devices
- screws
- torque load bolts

- quick-release fasteners

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to install aircraft mechanical controls
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with aircraft mechanical controls 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 installing aircraft mechanical controls, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 Explain how to carry out currency/issue checks on the specifications they are working with 2.7 Describe the components to be installed, and explain their function within the particular mechanical control system 2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.11	Explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
2.12	Describe the quality control procedures to be followed during the installation operations
2.13	Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.14	Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage
2.15	Describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.16	Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.17	Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.18	Describe the procedure for the safe disposal of waste materials
2.19	Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	Explain how to recognise installation defects
2.21	Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	Describe the problems that can occur with the installation operations, and explain how these can be overcome
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 extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 412 Installing aircraft mechanical controls

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

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

2.20 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)

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 415 Modifying aircraft mechanical systems

UAN:	**D/601/4386**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 015: Modifying Aircraft Mechanical 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 mechanical systems, 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. The modification requirements will include such things as undercarriage systems, flying controls systems, hydraulics systems, pneumatics systems, oxygen systems, air conditioning systems, cabin pressurisation systems, de-icing systems, engine/propulsion systems, aircraft fuel systems, oil storage systems and power transmission systems. 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 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 modification techniques and procedures. The learner will understand the systems being modified, and their 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.

Learning outcome
The learner will: 1. Be able to modify aircraft mechanical 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, 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 system for the required modification

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

1.7 Carry out modifications to mechanical systems, to include three from the following:

- undercarriage systems
- flying control systems
- hydraulic systems
- pneumatic systems
- oxygen systems
- air conditioning systems
- cabin pressurisation systems
- de-icing systems
- engine/propulsion systems
- aircraft fuel systems
- oil storage systems
- power transmission systems

1.8 Undertake all of the following procedures:

- dismantle systems
- reassemble systems
- undertake the modification
- check for wear
- set clearances and angular alignment
- replace 'out-of-specification' components
- check the modified system, in accordance with the modification leaflet or service bulletin

1.9 Complete the modification within the agreed timescale

1.10 Check that the modified system meets the specified operating conditions

1.11 Carry out modifications in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

- build records

- job cards
- log cards
- aircraft flight log

1.14 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 mechanical systems
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 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 2.3 Describe the hazards associated with modifying aircraft mechanical systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.4 Explain what personal protective equipment and clothing needs to be worn during the modification activities 2.5 Describe the various types of drawing and specification that are used during the modification 2.6 Explain how to identify the components to be used; component identification systems 2.7 Explain what preparations need to be undertaken on the system, prior to modification 2.8 Describe the methods and procedures to be used, and explain the importance of adhering to the procedures 2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.10 Explain the importance of using the specified fasteners for the modification, and why they must not use substitutes 2.11 Explain the application of sealants and adhesives within the modification activities, and the precautions that must be taken when working with them 2.12 Describe the quality control procedures to be followed during the modification operations 2.13 Explain how to conduct any necessary checks to ensure the accuracy and quality of the modification 2.14 Explain how to recognise defects 2.15 Explain the importance of ensuring that the completed modification 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 Describe the methods and equipment used to transport, handle and lift components into position, and how to check that the equipment is within its current certification dates 2.17 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 2.18 Describe the problems that can occur with the modification

	operations, and explain how these can be overcome
2.19	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
2.20	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 415 Modifying aircraft mechanical systems

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 codes and component orientation indicators)

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

2.14 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)

Unit 416 Carrying out routine servicing of aircraft

UAN:	**M/601/4389**
Level:	3
Credit value:	42
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 016: carrying Out Routine Servicing of Aircraft (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 routine servicing of commercial, military and light aircraft, in accordance with approved procedures. The learner will be required to select the appropriate tools and equipment to use, based on the servicing activities to be carried out, and to check that they are in a safe and serviceable condition. The learner will be required to manoeuvre the aircraft to the appropriate location and prepare the aircraft for work. The servicing activities will involve defuelling and refuelling, replenishing oxygen systems, replenishing oil systems, checking undercarriages and wheels, and completing servicing records. The learner's responsibilities will require them to comply with organisational policy and procedures for the servicing activities undertaken, and to report any problems 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 servicing techniques and procedures. The learner will understand the systems being serviced, and their application, and will know about the replenishment equipment and

fastening devices, 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 servicing 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 carry Out routine servicing of aircraft
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 servicing activities: • obtain and use the appropriate documentation (such as job instructions, aircraft servicing or maintenance schedule, 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 servicing 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 • follow safe practice/approved servicing techniques and procedures at all times • return all tools and equipment to the correct location on completion of the servicing 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 Follow the relevant maintenance schedules to carry out the required work 1.4 Carry out servicing work in compliance with one of the following standards: • Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA) • Ministry of Defence (MoD) • Federal Aviation Authority (FAA) • BS, ISO or BSEN standards and procedures

- customer standards and requirements
- company standards and procedures

1.5 Carry out the maintenance activities within the limits of their personal authority

1.6 Carry out the maintenance activities in the specified sequence and in an agreed timescale

1.7 Prepare the aircraft for work by carrying out all of the following:

- identifying defects from service logs
- checking electrical bonding
- towing
- marshalling
- parking
- securing
- removing access panels
- fitting required safety locks/pins

1.8 Carry out all of the following during de-fuelling and re-fuelling of the aircraft:

- remove and refit access panels and structures
- check fuel filter indicators
- clean/replace fuel filters
- check security and continuity of fuel equipment bonding
- re-fuel and de-fuel to correct fuel load and distribution

1.9 Carry out all of the following during replenishment of oxygen systems:

- apply appropriate safety precautions to prevent oil or grease contamination
- ensure electrical earth bonding of oxygen supply equipment
- monitor flow rates and storage pressures during replenishment

1.10 Carry out both of the following during replenishment of oil systems:

- check/replace filters
- drain and replace oil, or top up oil reservoirs, as appropriate

1.11 Inspect undercarriages and wheels by carrying out all of the following checks:

- tyre impact damage
- tyre inflation pressures
- tyre creep
- corrosion
- hydraulic leaks
- fastener security
- split-pin security

1.12 Report any instances where the servicing or 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 from the following:

- service schedule/log

- job cards
- aircraft service/flight log

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

Learning outcome
The learner will: 2. Know how to carry out routine servicing of aircraft
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions and procedures to be observed whilst carrying out the servicing 2.2 Explain the health and safety requirements of the work area in which they are carrying out the maintenance activities, and the responsibility these requirements place on them 2.3 Explain what authorisation they require to commence work on the aircraft 2.4 Describe the hazards associated with towing, parking, securing and servicing the aircraft, and explain how to minimise them and reduce any risks 2.5 Describe the hazards associated with working on and replenishing aircraft systems, and explain how they can be minimised 2.6 Explain what protective equipment they need to use for both personal protection and protection of the aircraft 2.7 Describe the maintenance schedules and servicing specifications that are used during servicing and maintenance, and explain the importance of following the procedures listed in these documents 2.8 Explain what replenishments need to be made and the methods of replenishment 2.9 Explain the electrical bonding specifications and their importance 2.10 Explain how to identify the fuels, lubricants and gases to be used, and how to ensure that systems are not contaminated 2.11 Explain the procedures for checking undercarriages and wheels 2.12 Describe the quality control procedures to be followed during the servicing procedures 2.13 Explain how to conduct any necessary checks to ensure the system integrity and functionality 2.14 Describe the problems that can occur with the servicing and maintenance activities, and explain how these can be overcome 2.15 Explain the importance of the correct securing and locking of connections 2.16 Explain the importance of tool control, and company tool control procedures 2.17 Explain how the replenishment equipment is cared for, connected, operated and controlled 2.18 Describe the methods and equipment used to manoeuvre aircraft and replenish aircraft systems, and explain how to check that the equipment is within its current certification dates 2.19 Describe the tools and equipment used in the servicing activities, and explain their calibration/care and control procedures. 2.20 Explain the importance of ensuring that, when the servicing is completed, the aircraft is free from dirt, swarf and foreign objects

2.21	Describe the disposal methods for waste oil, fuel and other liquids and waste
2.22	Describe the problems with the servicing procedures, and explain the importance of informing appropriate people of defects
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 extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 416 Carrying out routine servicing of aircraft

Supporting information

Guidance

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

2.5 (such as fuel, oxygen and oils)

Unit 423 Moulding acrylic aircraft components

UAN:	**D/601/4422**
Level:	3
Credit value:	50
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 023: Moulding Acrylic Aircraft 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 mould aircraft acrylics, in accordance with approved procedures. The learner will be required to use appropriate manufacturing drawings, specifications and documentation to produce the various types of component. The learner will be expected to produce the acrylic components using the specified/appropriate moulding process and techniques. The equipment will include air-circulating ovens, presses, trimming and automated cutting equipment. The products produced will include deep drawn, double curvature and convex/concave shapes. The learner's responsibilities will require them to comply with organisational policy and procedures for the manufacturing activities undertaken, and to report any problems with the sheet moulding activities, materials or equipment that they cannot personally resolve, or that are outside their personal 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 moulding procedures. The learner will understand the moulding procedures, and their application, and will know about the moulding equipment, materials, and consumables used, 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 moulding 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 mould acrylic aircraft 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 moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 moulding activities • obtain the correct materials for the moulding operations (batch number, colour, thickness, sheet size, surface texture, correctly protected) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition (part marked, cleared inspection, undamaged) • follow safe practice/approved moulding techniques and procedures at all times • return all tools and equipment to the correct location on completion of the moulding activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Follow the correct component drawing or any other related specifications for the component to be produced 1.4 Determine what has to be done and how this will be achieved 1.5 Obtain and prepare the appropriate tools, equipment and materials 1.6 Carry out the moulding or laying-up activities using the correct methods and techniques 1.7 Carry out two of the following moulding methods and techniques: • vacuum moulding • deep drawing • shape clamping

- positive pressure shaping
- stress relieving

1.8 Carry out all of the following operations during the moulding process:
- tool/equipment preparation
- setting and controlling temperatures
- sheet preparation
- trimming
- stress relieving
- sheet forming
- de-moulding

1.9 Produce a range of components with four of the following features:
- box sections
- cylindrical section
- convex shapes
- concave shapes
- single curvatures
- double curvatures

1.10 Produce components to the required specification

1.11 Produce components which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.12 Check that all the required operations have been completed to specification

1.13 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 mould acrylic aircraft components
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with acrylics 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 Explain what protective equipment they need to use for both personal protection and, where appropriate, protection of others 2.4 Describe the hazards associated with moulding acrylic materials, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.5	Describe the procedure for the safe disposal and correct separation of waste materials
2.6	Describe the layout of the area to give maximum throughput
2.7	Explain how to interpret the drawings, standards, quality control procedures and specifications used for the moulding activity, and how to carry out currency/issue checks on the documents they are working with
2.8	Explain the principles of deep drawing, concave/convex moulding, positive pressure moulding and stress relieving
2.9	Explain the different methods of heating materials and the temperature control methods
2.10	Describe the sheet profiling procedures and material trimming methods/procedures
2.11	Explain how the acrylic sheet is supplied
2.12	Explain the use of forming aids
2.13	Describe the methods of sheet trimming and sheet cleaning prior to moulding
2.14	Explain the preparation methods and procedures to be used to prepare the moulding surface
2.15	Explain the material cleaning methods and procedures to be applied
2.16	Explain the procedures for de-moulding, and first article inspection
2.17	Describe the quality control procedures to followed during the moulding operations
2.18	Explain the procedures for ensuring that they have the correct tools and equipment
2.19	Describe the methods and techniques for lifting, handling and supporting the components, equipment and materials during the moulding activities
2.20	Explain how to recognise moulding defects
2.21	Describe the tools and equipment used in the moulding activities, and explain their calibration, care, preparation and control procedures
2.22	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
2.23	Describe the problems that can occur with the moulding operations, and explain how these can be overcome
2.24	Explain what recording documentation needs to be completed for the moulding activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.25	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 423 Moulding acrylic aircraft components

Supporting information

Guidance

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

2.11 (such as colour, thickness, sheet size, surface texture, material protection)

2.16 (such as test samples, non-destructive testing (NDT) requirements)

2.20 (such as misalignment, distortion, foreign object damage, contamination and surface defects)

Unit 426 Producing aircraft composite assemblies

UAN:	**J/601/4432**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 026: Producing Aircraft Composite 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 produce aircraft composite assemblies from composite components and non-composite components, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to produce aircraft composite assemblies, using the correct techniques. The learner will produce a range of aircraft composite assemblies, incorporating a variety of features and using a range of techniques and processes. The learner's responsibilities will require them to comply with organisational policy and procedures for the assembly activities undertaken, and to report any problems with the assembly activities, equipment or materials 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 aircraft composite assembly techniques and procedures. The learner will understand the aircraft composite assembly techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring that

	the finished assembly is to the required specification. The learner will understand the safety precautions required when carrying out the assembly 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 produce aircraft composite 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 assembly activities: • obtain and use the appropriate documentation (such as job instructions, assembly drawings, planning and quality control documentation, material data sheets, 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 composite assembly activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved composite assembly techniques and procedures at all times • return all tools and equipment to the correct location on completion of the composite assembly 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 instructions, assembly drawings and any other specifications 1.4 Check that the specified components are available and that they are in a usable condition 1.5 Carry out all of the following activities when preparing for the assembly activity: • check that mouldings are correct and complete • check for any defects in the mouldings • check that components are correct and complete • check the availability of required ancillary materials • select the correct equipment for the activity • check that the equipment is suitable for use

- check for any defects in the components
- identify and protect the moulding and components in the work area

1.6 Use three of the following composite components in the aircraft assemblies:

- trim
- closing panels
- body panels
- tubes
- structural
- aerodynamic
- core materials
- sections
- inserts
- housings

1.7 Use three of the following non-composite components in the aircraft assemblies:

- brackets
- fixtures
- fittings
- trim
- tapes
- memory foam
- films

1.8 Use the appropriate methods and techniques to assemble the components in their correct positions

1.9 Produce composite assemblies that require four of the following methods to be used:

- fettling
- pinning
- clamping
- trial fitting
- aligning
- assembly jigs
- assembly sequences

1.10 Produce assemblies that incorporate two of the following features:

- loose fit tolerances
- close fit tolerances
- non-permanent fixing
- shape location
- joggle joins
- permanent fixing
- return joins
- overlap joins

1.11 Produce two of the following types of composite assembly:

- trial assemblies
- one-off assemblies

- batch assemblies
- assembly line

1.12 Secure the components using the specified connectors and securing devices

1.13 Produce composite assemblies that use three of the following joining methods:

- thread inserts
- quick-release fasteners
- mechanical fasteners
- click bonds
- anchor nuts
- rivets

1.14 Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.15 Produce a range of aircraft composite assemblies which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards
- company standards and procedures
- customer standards and requirements

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 produce aircraft composite assemblies

Assessment criteria

The learner can:

2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area

2.2 Describe the hazards associated with producing aircraft composite assemblies and with the materials, consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area

2.3 Explain what protective equipment is needed for personal protection and, where required, the protection of others

2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables

2.5 Explain the specific workshop environmental conditions the must be observed when assembling aircraft composite mouldings

2.6 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken

2.7 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and

	system of tolerancing
2.8	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.9	Explain the conventions and terminology used for assembly activities
2.10	Describe the types of component trimming/cutting methods and preparation methods available
2.11	Explain how to visually identify the cured aircraft composite materials
2.12	Describe the assembly operations, and their sequence
2.13	Describe the methods for handling composite assemblies throughout the assembly activities
2.14	Explain how to identify and rectify defects in aircraft composite assemblies
2.15	Describe the tools and equipment used in the assembly activities, and explain their care, preparation and control procedures
2.16	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 426 Producing aircraft composite assemblies

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as metric and imperial threads, rivet specifications, clearances, types of fittings)

Unit 427 Vacuum forming aircraft components

UAN:	**J/601/4446**
Level:	3
Credit value:	50
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 027: Vacuum Forming Aircraft 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 vacuum form aircraft components, in accordance with approved procedures. The learner will be required to use appropriate manufacturing drawings and specifications, together with other quality documentation, to produce the various types of component from thermoplastic sheet, fibre reinforced sheet and structural foam, using air circulating ovens, vacuum forming machines, trimming equipment and assorted tooling. The components produced will have the following features: male shapes, female shapes, double curvatures and stiffened mouldings. The learner's responsibilities will require them to comply with organisational policy and procedures for the vacuum forming moulding activities undertaken, and to report any problems with the moulding activities, equipment, materials or consumables 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 vacuum forming procedures. The learner will understand the vacuum forming procedures used, and their application, and will know about the vacuum moulding techniques, materials, tooling and consumables used, in adequate depth to provide

a sound basis for carrying out the activities, correcting faults and ensuring that the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the vacuum forming 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 vacuum form aircraft 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 vacuum forming activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 moulding activities • obtain the correct materials for the vacuum forming operations (batch number, colour, thickness, sheet size, composition, surface texture, correctly protected) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition (such as part marked, cleared inspection, undamaged) • follow safe practice/approved moulding techniques and procedures at all times • return all tools and equipment to the correct location on completion of the moulding activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Confirm that the equipment is set up correctly and is ready for use 1.4 Use three of the following types of equipment : • air circulating ovens • vacuum forming machines • tufnol tooling • metal tooling • wood tooling • trimming equipment

- composite tooling

1.5 Manipulate the machine controls safely and correctly in line with operational procedures

1.6 Carry out four of the following operations:

- bubble blowing to minimize webbing
- positioning of robbers
- tooling cleaning
- temperature control
- trimming techniques
- drying of sheet
- use of intensifiers
- sheet cleaning

1.7 Produce a range of components with three of the following features:

- double curvatures
- male shapes
- female shapes
- stiffened mouldings

1.8 Produce a range of components using all the following materials:

- thermoplastic sheet (such as polycarbonate, polysulphone, acrylic, polyvinyl chloride (PVC), ABS)
- fibre reinforced thermoplastic sheet
- structural foams (polyvinyl chloride (PVC), polymethate (Rohacell))

1.9 Produce components to the required specification

1.10 Produce components which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.11 Carry out quality sampling checks at suitable intervals

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

1.13 Shut down the equipment to a safe condition on conclusion of the machining activities

Learning outcome
The learner will: 2. Know how to vacuum form aircraft components
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with vacuum forming equipment 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 Explain what protective equipment they need to use for both personal protection and, where appropriate, protection of others

2.4 Describe the hazards associated with vacuum forming activities, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.5 Describe the procedure for the correct separation and safe disposal of waste materials

2.6 Describe the layout of the area to give maximum throughput

2.7 Explain how to interpret the drawings, standards, quality control procedures and specifications used for the vacuum forming activity, and how to carry out currency/issue checks on the documents they are working with

2.8 Explain the methods and techniques to be used during tool preparation

2.9 Explain the reasons for the use of intensifiers and the robber system

2.10 Describe the equipment checks, and the stores and kitting functions

2.11 Describe the methods of sheet trimming and sheet cleaning, prior to forming

2.12 Explain the principles of deep drawing, concave/convex moulding, positive pressure moulding and stress relieving

2.13 Describe the sheet profiling procedures and material trimming methods/procedures

2.14 Explain how the stock materials are supplied and stored

2.15 Explain the preparation methods and procedures applied to the moulding surface

2.16 Explain the merits of male/female moulding, de-moulding techniques, and temperature control procedures

2.17 Describe the methods and techniques for carrying out the de-moulding procedures and first article inspection

2.18 Describe the methods and techniques for lifting, handling and supporting the components, equipment and materials during the vacuum forming activities

2.19 Explain how to recognise vacuum forming defects

2.20 Describe the quality control procedures to be followed during the vacuum forming operations

2.21 Explain the procedures for ensuring that they have the correct tools and equipment

2.22 Describe the tools and equipment used in the vacuum forming activities, and explain their calibration, care, preparation and control procedures

2.23 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

2.24 Describe the problems that can occur with the vacuum forming operations, and explain how these can be overcome

2.25 Explain what recording documentation needs to be completed for the vacuum forming activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

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 427 Vacuum forming aircraft components

Supporting information

Guidance

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

2.14 (such as colour, thickness, sheet size, surface texture, material protection)

2.17 (such as test samples, non-destructive testing (NDT) requirements)

2.19 (such as misalignment, distortion, foreign object damage, contamination and surface defects)

Unit 428 Producing aircraft components by plastic injection moulding

UAN:	**D/601/4453**
Level:	3
Credit value:	62
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 028: Producing Aircraft Components by Plastic Injection Moulding (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 produce aircraft components by plastic injection moulding, in accordance with approved procedures. The learner will be required to check that the injection moulding machine is ready for the operations to be performed and that all the required materials and consumables are available. The learner will be expected to check that the mould tools are free from damage which could impair the quality of the mouldings produced, and that all services required to operate the machine are fully operational. The learner will be required to operate the injection moulding machine in line with safe working practices and approved procedures, and to monitor the moulding operations continuously, making any necessary adjustments to settings in order to ensure that the work output is to the required quality and accuracy. Meeting production targets will be an important issue, and their production records must show consistent and satisfactory performance. The learner's responsibilities will require them to comply with organisational policy and procedures for the plastic injection moulding activities undertaken, and to report any problems with the moulding 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 full responsibility for their actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying plastic injection moulding procedures. The learner will understand the plastic injection moulding process, and its application, and will know about the equipment, materials and consumables in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the completed mouldings are to the required specification.

The learner will understand the safety precautions required when operating the plastic injection moulding machines 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 produce aircraft components by plastic injection moulding
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 for the plastic injection moulding operations, to include carrying out all of the following: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 injection moulding activities • check that there are sufficient raw materials available and that they meet the component specification • ensure that there are appropriate facilities for storing the completed mouldings (where applicable) • follow safe practice/approved injection moulding techniques and procedures at all times • return all tools and equipment to the correct location on completion of the injection moulding activities • dispose of waste materials in accordance with approved

procedures
- leave the work area in a safe and appropriate condition on completion of the activities

1.3 Follow the correct component drawing or any other related specifications for the component to be produced

1.4 Determine what has to be done and how this will be achieved

1.5 Obtain and prepare the appropriate tools, equipment and materials

1.6 Prepare the injection moulding machine, to include carrying out all of the following:
- checking that the correct mould tool is located in the machine and is complete, clean and free from damage
- ensuring that mould surfaces are clean and free from damage
- checking that secondary mould tool components are clean and free from damage
- checking that all moulding parameters have been set correctly (such as temperature, pressure, speed/time, distance)
- checking that component delivery/collection mechanisms are working correctly (such as robots, conveyors, separators and collection chutes)
- ensuring that all guards, screens and safety mechanisms are in place and in good working order
- checking that all services are connected and all connections are in good order (such as water, electrical, pneumatic, hydraulic)
- checking that all machine controls are operational

1.7 Produce plastic injection mouldings, using two of the following types of mould tool:
- two plate tools
- three plate tools
- combination/composite tools
- split tools
- unscrewing tools

1.8 Use all of the following types of equipment:
- air circulating ovens
- injection moulding machine
- trimming equipment

1.9 Carry out the moulding or laying-up activities using the correct methods and techniques

1.10 Produce a range of components with two of the following features:
- double curvatures
- female shapes
- flat plank/test pieces
- male shapes
- multi-faceted
- internal cavities

1.11 Produce plastic injection mouldings from two of the following materials:
- acrylonitrile-butadiene-styrene (ABS)
- nylon

- polycarbonate
- polypropylene
- polystyrene
- polyethylene
- acetal
- other specific material

1.12 Carry out all of the following operations:
- material drying
- component de-moulding
- meltable core preparation
- component de-flashing and fettling
- injection moulding

1.13 Monitor the moulding operations, and make adjustments to the machine settings to deal with two of the following:
- flashing
- short shot
- distortion
- burning
- colour deviation

1.14 Produce components to the required specification

1.15 Complete visual inspection and segregation of mouldings according to company procedures, to include all of the following:
- mouldings which meet the required specification
- mouldings which have defects
- mouldings that require further investigation

1.16 Check that all the required operations have been completed to specification

1.17 Produce plastic injection mouldings which comply with one of the following quality and accuracy standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.19 Complete the relevant documentation, to include two of the following:
- production documentation
- quality control documentation
- records of machine settings

Learning outcome
The learner will: 2. Know how to produce aircraft components by plastic injection moulding
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with injection equipment 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 carrying out injection moulding activities and with the associated delivery and collection systems, 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, where appropriate, protection of others 2.5 Explain the emergency procedures that are in place to deal with a machine malfunction when operating the plastic injection moulding machine 2.6 Explain the safety mechanisms on the machine, and the procedure for checking that they function correctly. 2.7 Explain the operation of the machine controls in both hand and power modes, and how to stop the machine in an emergency 2.8 Explain the COSHH regulations relating to the materials used in the injection moulding activities 2.9 Explain how to obtain the necessary job instructions for the production operations, and how to interpret their information 2.10 Explain the basic parts and functions of a plastic injection moulding machine and moulds 2.11 Describe the various types of mould tool that are used, and their typical applications 2.12 Explain why it is important to check the moulds for damage or other non-conformance prior to starting up the injection moulding machine 2.13 Describe the different types of component delivery/collection system that are used on plastic injection moulding machines 2.14 Describe the various machine operating parameters that may require adjusting during the injection moulding activities, and explain how these are achieved 2.15 Explain the effects that changes to these settings will have on the quality of the components produced 2.16 Explain the different types of material used in the plastic injection moulding process 2.17 Explain what preparations need to be carried out on the materials in order to ensure that the completed components meet the required specification 2.18 Explain the temperature range of the material being moulded and the mould being used 2.19 Describe the methods of checking the finished mouldings to ensure that they are to the required specification 2.20 Explain how to identify moulding defects, their cause and methods

of prevention

2.21 Explain how to make adjustments to machine settings

2.22 Describe the methods and techniques for component de-flashing and fettling

2.23 Explain the control of weld lines, fibre orientation and shrinkage

2.24 Describe the methods and techniques for lifting, handling and supporting the components/equipment/materials during the injection activities

2.25 Explain how to recognise injection defects

2.26 Describe the quality control procedures used and inspection checks to be carried out on the mouldings produced, and the equipment that will need to be used

2.27 Describe the problems that can occur with the plastic injection moulding activities, and explain how these can be overcome

2.28 Explain why it is important to keep the plastic injection moulding equipment clean and free from damage, to practice good housekeeping of tools and equipment and to maintain a clean and unobstructed working area

2.29 Explain what recording documentation needs to be completed for the injection activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

2.30 Describe the extent of their own authority and explain to whom they should report if they have problems that they cannot resolve when working with plastic injection moulding machines

Unit 428 Producing aircraft components by plastic injection moulding

Supporting information

Guidance

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

2.8 (such as mould sprays, mould lubricants and moulding materials)

2.10 (to include mould location points, mould heating/cooling arrangements, machine controls, hydraulic, pneumatic and electricity supplies, material delivery and collection systems, guards and other safety devices)

2.14 (such as temperature, pressure, speed/timings and distance)

2.21 (to deal with such things as flashing, short shot, distortion and colour problems)

2.25 (such as misalignment, distortion, foreign object damage, contamination and surface defects)

Unit 430 Assembling aircraft transparencies

UAN:	**T/601/4474**
Level:	3
Credit value:	40
GLH:	91
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 030: Assembling Aircraft Transparencies (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 assemble aircraft transparencies, in accordance with approved procedures. The learner will be required to use appropriate manufacturing drawings, specifications and documentation to assemble aircraft transparencies ready for use. Assembly techniques will include the use of rubber edge sealing and bonding, mechanical fasteners and adhesive bonding, as applicable. The learner's responsibilities will require them to comply with organisational policy and procedures for the assembly activities undertaken, and to report any problems with the assembly activities, materials or 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying aircraft transparency assembly methods and procedures. The learner will understand the assembly methods used, and their application, and will know about the materials, tools and equipment used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the completed assembly is to the required

specification.

The learner will understand the safety precautions required when carrying out the assembly 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 assemble aircraft transparencies
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 assembly activity: • obtain and use the appropriate documentation (such as job instructions, aircraft assembly 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 assembly 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 assembly techniques and procedures at all times • return all tools and equipment to the correct location on completion of the assembly 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 Follow the relevant instructions, assembly drawings and any other specifications 1.4 Check that the specified components are available and that they are in a usable condition 1.5 Assemble transparencies using all of the following types of component: • moulded acrylic transparencies • moulded windscreen assemblies • moulded polycarbonate transparencies 1.6 Use the appropriate methods and techniques to assemble the components in their correct positions 1.7 Assemble aircraft transparencies using all of the following methods and techniques:

- rubber edge sealing and bonding
- mechanical fastener attachments
- adhesive bonding
- gasket sealing

1.8 Produce two the following types of aircraft transparency assembly:

- aircraft windows
- aircraft pilot's windscreens
- aircraft canopies
- other specific components

1.9 Secure the components using the specified connectors and securing devices

1.10 Check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification

1.11 Produce transparency assemblies which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to assemble aircraft transparencies
Assessment criteria
The learner can: 2.1 Explain the specific safety precautions to be taken whilst carrying out the assembly 2.2 Explain the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them 2.3 Explain what personal protective equipment and clothing needs to be worn during the assembly activities 2.4 Describe the hazards associated with producing aircraft transparency assemblies, and explain how to minimise them and reduce any risks 2.5 Explain how to extract and use information from engineering drawings and related specifications (to include symbols and

conventions to appropriate BS, ISO or BSEN standards, in relation to work undertaken)

2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

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 components, prior to fitting them into the assembly

2.9 Describe the assembly methods and procedures to be used, and explain the importance of adhering to these procedures

2.10 Explain how the components are to be aligned and positioned prior to securing, and the tools and equipment that are used

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 assembly, and why they must not use substitutes

2.13 Explain how to deal with components or fastening devices that are incorrectly assembled, damaged or having other faults

2.14 Explain the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with them

2.15 Explain the use of gaskets within the assembly activities, and the precautions/procedures that must be taken/observed when assembling them

2.16 Describe the quality control procedures to be followed during the assembly operations

2.17 Explain how to conduct any necessary checks to ensure the accuracy and quality of the assemblies produced

2.18 Explain how to recognise defects

2.19 Describe the methods and equipment used to transport, lift and handle the components, and how to check that the equipment is within its current certification dates

2.20 Explain how to check that the tools and equipment to be used are correctly calibrated and are in a safe and serviceable condition

2.21 Explain the importance of ensuring that all tools are used correctly and within their permitted operating range (

2.22 Explain the importance of ensuring that the completed assembly is free from dirt, swarf and foreign objects

2.23 Describe the problems that can occur with the assembly operations, and explain the importance of informing appropriate people of non-conformances

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 430 Assembling aircraft transparencies

Supporting information

Guidance

2.1 (including 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 (including jigs, fixtures and support trolleys)

2.18 (such as excess adhesives/sealants, ineffective fasteners, foreign object damage)

2.21 such as vacuum suckers, drilling and de-burring equipment, and applicator guns for adhesives)

Unit 439 Drilling and finishing holes in composite and/or metallic aircraft structures or components

UAN:	**M/601/4506**
Level:	3
Credit value:	40
GLH:	98
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 039: Drilling and Finishing Holes in Composite and/or Metallic Aircraft Structures or 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 produce and finish holes in composite and/or metallic aircraft structures or components, in accordance with approved procedures. The activities carried out will include the use of drilling machines and portable drills, using a range of cutters, as applicable to the type of hole and finish required. This will involve marking out, using the appropriate workholding arrangements, and checking that the finished holes are to the correct specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the drilling and hole finishing activities undertaken, and to report any problems with the activities, materials or 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's knowledge will provide a good understanding of their work, and will provide an informed approach to producing and finishing holes in aircraft structures or components. The learner will understand the

drilling and hole finishing processes used, and their application, and will know about the tooling and ancillary equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the drilling and hole finishing activities, correcting faults, and ensuring that the completed structures or components are to the required specification.

The learner will understand the safety precautions required when working with drilling machines, and with their associated tools and equipment, especially those for isolating the machine during tool mounting and setting, and when handling cutting tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibilities they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to drill and finish holes in composite and/or metallic aircraft structures or 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 drilling and finishing activities: • plan the drilling/finishing activities prior to beginning the work • obtain and use the appropriate documentation for the drilling/finishing activities (such as drawings, job instructions, specifications, aircraft standards) • 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 calibration date • obtain clearance to work on the aircraft, and ensure the safe isolation of equipment (such as mechanical, electricity, air or fluids), where appropriate • provide and maintain safe access and working arrangements for the area in which the drilling/finishing will take place • follow safe practice/approved drilling/hole finishing techniques and procedures at all times • deal with defects in materials, components and equipment, in accordance with specified procedures • dispose of waste items in a safe and environmentally acceptable manner, in line with company procedures • return all tools and equipment to the correct location on

completion of the activities
- leave the work area and assembly in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Confirm that the machine is set up and ready for the machining activities to be carried out

1.4 Produce and finish holes in aircraft structures or components, using six of the following:
- bench/pedestal drill
- portable drill
- 'spacematic' drill
- rackfeed drill
- pecker drill
- radial arm drill
- pistol pneumatic drill
- straight pneumatic drill
- angled pneumatic drill
- positive feed drill
- cold working pack (split sleeve and split mandrel)
- automated drills (such as vertical/horizontal plane and special as appropriate)

1.5 Use a range of workholding/guiding devices, to include five of the following:
- jigs/fixtures
- drill bars
- drill blocks
- slave bolts
- dowels
- clamps
- gripping pins
- jig pins
- ream blocks
- profile boards

1.6 Use five of the following types of marking-out/setting equipment:
- rules/tapes
- slip gauges
- approved aero markers
- jigs for marking out
- squares
- protractors
- feeler gauges
- scribers
- through skin sensor (TTS)
- Vernier instruments
- electronic feeler gauge
- dividers/compass
- templates

- laser tracking

1.7 Produce holes in aircraft structures or components, using three of the following types of drill bit:
- twist
- diamond coated
- cobalt
- core
- piloted carbide core

1.8 Manipulate the machine tool controls safely and correctly in line with operational procedures

1.9 Carry out all of the following during the production and finishing of the holes in the aircraft structures or components:
- mark out, position and secure the item to be drilled, in accordance with company procedures
- use the specified techniques and procedures to produce and finish holes
- select and use the correct cutting feeds and speeds
- use appropriate and adequate lubrication/coolant
- check that positional accuracy complies to specifications
- ensure that machined features are free from tool marks, burrs and sharp edges
- apply surface protection/coatings to finished holes on completion of the drilling activity (where appropriate)

1.10 Produce and finish holes in aircraft structures or components, to include six of the following:
- through
- blind
- stepped
- reamed
- counterbored
- threaded (insert)
- de-burring
- countersunk
- spot faced
- tapered
- bored
- dimpled
- holes with formed edges (such as radii)
- holes with clearance fit
- holes with interference fit

1.11 Produce and finish holes in two of the following materials:
- aluminium alloys
- titanium
- composites
- other specific ferrous, non-ferrous or non-metallic material

1.12 Carry out quality sampling checks at suitable intervals

1.13 Check that finished holes meet the required specification, using four of following:

- plug gauges
- hole gauges
- Vernier gauges
- countersink check bolts
- down-size dummy check bolts
- depth gauges
- de-burring/chamfer gauge
- dial test indicators
- surface comparator plates
- company-specific gauges

1.14 Produce components to the required quality and within the specified dimensional accuracy

1.15 Produce finished holes which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.17 Shut down the equipment to a safe condition on conclusion of the machining activities

Learning outcome
The learner will: 2. Know how to drill and finish holes in composite and/or metallic aircraft structures or components
Assessment criteria
The learner can: 2.1 Explain the health and safety requirements of the area in which they are producing and finishing holes 2.2 Explain the importance of wearing protective clothing and equipment, and of keeping the work area safe and tidy 2.3 Explain the specific health and safety precautions to be followed whilst producing and finishing holes 2.4 Describe the hazards associated with carrying out drilling and hole finishing activities on aircraft structures or components, and explain how to minimise them and reduce any risks 2.5 Explain the safety mechanisms on the equipment used, and the procedure for checking that they function correctly 2.6 Explain how to stop the equipment in both normal and emergency situations, and the procedure for restarting the equipment after it has been stopped in an emergency 2.7 Explain how to obtain and interpret drawings, standards, quality control procedures and specifications used for the drilling and finishing of holes 2.8 Explain how to carry out currency/issue checks on the drawings and

specifications they are using

2.9 Explain the importance of producing holes to the correct surface finish values, and the methods used to achieve this

2.10 Explain how surface finish values are measured and/or compared, and the type of equipment that is used

2.11 Explain the basic principles of limits and fits, and their relationship in determining the final hole size

2.12 Describe the methods, techniques and equipment used to mark out and position components prior to drilling and finishing holes

2.13 Describe the different types and applications of drilling equipment

2.14 Describe the types and application of hole cutting and finishing tools

2.15 Explain how to handle and store drills and finishing tools, safely and correctly

2.16 Describe the effects of clamping the workpiece in a jig/workholding device, and explain how this can cause distortion in the finished components/structures

2.17 Describe the different types and application of cutting fluids

2.18 Explain the cutting characteristics of different materials, and how this effects factors including selecting tool type and geometry, cutting speeds, lubrication and surface finish

2.19 Explain the principles and effects of cold working when finishing holes in aircraft structures or components

2.20 Describe the methods used to prevent corrosion on completion of drilling and finishing operations

2.21 Describe the quality control procedures used, inspection checks to be carried out on finished holes, and the equipment to be used

2.22 Explain what action needs to be taken in the event that holes fail to meet the specification

2.23 Describe the problems that can occur with the drilling activities, and explain how these can be overcome

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 439 Drilling and finishing holes in composite and/or metallic aircraft structures or components

Supporting information

Guidance

2.7 (such as BS, ISO or BSEN standards, symbols and terminology and other documents needed)

2.13 (such as bench/pedestal, portable, spacematic, rackfeed, pneumatic, pecker and positive feed)

2.14 (such as drills, reamers, counterbore, countersink and spot-face cutters)

Unit 441 Installing aircraft hydraulic systems

UAN:	**A/601/4508**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 041: Installing 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 install aircraft hydraulic systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes landing gear, wheel braking systems, flying controls, flaps, nose wheel steering, rotor brakes, slats, deck locks, and arrester mechanisms. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and components to be installed. The hydraulic components to be installed will include items such as pipework, control valves, reservoirs and supply tanks, pumps, cooling units, accumulators, cylinders and actuating mechanisms, mechanical and electrical controls, and safety devices. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate travel and/or working clearances, are tightened to the correct torque, and that they function as per the specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation 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 instructions and procedures. The learner will understand the hydraulic system, and its application, and will know about the components, tools and equipment used in the installation requirements, 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 installation 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow all relevant drawings and specifications for the installation

being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install two of the following aircraft hydraulic systems:

- landing gear
- nose wheel steering
- wheel braking system
- primary hydraulic supply and circuit
- flying controls
- flaps
- rotor brakes
- spoilers/airbrakes
- IFR hose/drum
- slats
- arrester mechanisms
- deck locks
- cargo door/ramp

1.7 Install hydraulic components which include five from the following:

- rigid pipework
- hoses
- oil reservoirs/supply tanks
- oil cooling units
- control valves
- accumulators
- pressure intensifier
- gauges
- seals
- filters
- safety devices
- pumps
- cylinders/actuating mechanisms
- mechanical controls (plungers, springs, rollers)
- electrical controls (solenoids, motors, pressure switches)

1.8 Apply installation methods and techniques to include three from:

- positioning and aligning
- torque setting and locking fasteners
- earth bonding
- setting travel or working clearance
- manual handling

1.9 Make three of the following types of mechanical securing connections:

- quick-release fasteners
- locking devices
- screws

- torque load bolts
- nuts and bolts
- pipe connections

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome

The learner will:

2. Know how to install aircraft hydraulic systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when working with hydraulic systems

2.2 Describe the hazards associated with installing hydraulic systems, and with the tools, materials and equipment used, and explain how to minimise them and reduce any risks

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

2.5 Explain how to interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 Describe the components to be installed, and explain their function within the particular hydraulic systems

2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.11 Explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved

2.12 Describe the quality control procedures to followed during the installation operations

2.13 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.14 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.15 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.16 Explain how to make pipe bends using fittings, and by hand bending, using approved forming equipment

2.17 Explain how to eliminate stress on pipework/connections and the importance of supporting at suitable intervals

2.18 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

2.19 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.20 Describe the procedure for the safe disposal of waste materials

2.21 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.22 Explain how to recognise installation defects

2.23 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.24 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.25 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

2.26 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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 441 Installing aircraft hydraulic systems

Supporting information

Guidance

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

2.2 (such as pressurised systems, fluids, mechanisms)

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

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

2.22 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)

Unit 442 Installing aircraft pneumatic systems

UAN:	**T/601/4510**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 042: Installing Aircraft Pneumatic 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 install aircraft pneumatic systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft and includes emergency blow-down systems, de-icing systems, air stairs, waste disposal systems, arrestor mechanisms, deck locks, air start systems, weapons systems, flying controls and other systems, 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 components to be installed. The pneumatic components to be installed will include items such as pipework, control valves, reservoirs and supply tanks, pumps, cooling units, accumulators, cylinders and actuating mechanisms, mechanical and electrical controls, and safety devices. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate travel and/or working clearances, are tightened to the correct torque, and that they function as per the specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation 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 minimum 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 instructions and procedures. The learner will understand the pneumatic system, and its application, and will know about the components, tools and equipment used and the installation requirements, 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 working on the aircraft pneumatic system, and with its 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 install aircraft pneumatic 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures

- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install two of the following aircraft pneumatic systems (either high or low pressure):

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

1.7 Install pneumatic components, including five of the following:

- rigid pipework
- hoses
- air/supply tanks
- compresser
- accumulators
- pressure intensifiers
- gauges
- control valves
- safety devices
- seals
- filters
- cylinders/actuating mechanisms
- mechanical controls (plungers, springs, rollers)
- electrical mechanisms (solenoids, indicators, motors, pressure switches)

1.8 Apply installation methods and techniques, to include three from the following:

- positioning and aligning
- torque setting and locking fasteners

- setting travel or working clearance
- earth bonding

1.9 Use three of the following types of mechanical securing devices:

- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick release fasteners
- pipe connectors

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to install aircraft pneumatic systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with hydraulic systems 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 installing pneumatic systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 Explain how to carry out currency/issue checks on the

specifications they are working with

2.7 Describe the components to be installed, and explain their function within the particular pneumatic system

2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.11 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

2.12 Describe the quality control procedures to be followed during the installation operations

2.13 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.14 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.15 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.16 Explain how to make pipe bends using fittings, and by hand bending, using approved forming equipment

2.17 Explain how to eliminate stress on pipework/connections, and the importance of supporting at suitable intervals

2.18 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

2.19 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.20 Describe the procedure for the safe disposal of waste materials

2.21 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.22 Explain how to recognise installation

2.23 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.24 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.25 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

2.26 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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 442 Installing aircraft pneumatic systems

Supporting information

Guidance

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

2.3 (such as pressurised systems, moving parts)

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

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

2.22 defects (such as leaks, poor seals, misalignment, ineffective fasteners and foreign object damage or contamination)

Unit 443 Installing aircraft de-icing systems

UAN:	**F/601/4512**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 043: Installing Aircraft De-Icing 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 install aircraft de-icing systems in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with warm air, fluid, electrical heating, flexible surface systems, ice detection units and other systems, 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 components to be installed. The de-icing components to be installed will include items such as flexible and rigid pipework, control valves, piccolo tubes, reservoirs and supply tanks, pumps, heating units, cylinders and actuating mechanisms, mechanical and electrical controls, and safety devices. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate travel and/or working clearances, are tightened to the correct torque and that they function as per the specification. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation 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 instructions and procedures. The learner will understand the de-icing system, and its application, and will know about the components, tools and equipment used and the installation requirements, 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 working on the aircraft de-icing system, and with its 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 install aircraft de-icing 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures

- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install two of the following aircraft de-icing systems:

- warm air
- electrical heating
- flexible surface
- fluid
- other systems

1.7 Install de-icing components which include five of the following:

- rigid pipework
- hoses
- air supply tanks
- control valves
- pumps
- seals
- heating elements
- filters
- fluid reservoirs
- ice detection units
- safety devices
- control units
- cylinders/actuating mechanisms
- mechanical controls (plungers, springs, rollers)
- piccolo tubes
- electrical mechanisms (such as solenoids, indicators, motors, switches)

1.8 Apply installation methods and techniques to include three from:

- positioning and aligning
- torque setting and locking fasteners
- setting travel or working clearance
- earth bonding

1.9 Use three of the following types of securing device:

- nuts and bolts
- locking devices
- pipe couplings
- screws
- torque load bolts
- quick-release fasteners
- electrical connectors

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

Learning outcome

The learner will:

2. Know how to install aircraft de-icing systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when working with de-icing systems

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 installing aircraft de-icing systems 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 engineering drawings and related specifications in relation to work undertaken

2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

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

2.8 Describe the components to be installed, and explain their function within the particular de-icing system

2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.10 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.11 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.12 Explain the torque loading requirements of the fasteners, and what

to do if these loadings are exceeded or not achieved

2.13 Describe the quality control procedures to followed during the installation operations

2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.15 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.17 Explain how to make pipe bends using fittings, and by hand bending, using approved forming equipment

2.18 Explain how to eliminate stress on pipework/connections, and the importance of supporting at suitable intervals

2.19 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

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

2.21 Describe the procedure for the safe disposal of waste materials

2.22 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.23 Explain how to recognise installation defects

2.24 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.25 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.26 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

2.27 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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

Unit 443 Installing aircraft de-icing systems

Supporting information

Guidance

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

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

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

2.23 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 444 Installing aircraft fuel systems

UAN:	**L/601/4514**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 044: Installing Aircraft Fuel 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 install aircraft fuel systems, in accordance with approved procedures. It includes the installation of fuel system components, such as main and auxiliary fuel tanks, fuel manifolds, fuel pipes (flexible and rigid), fuel pumps, change-over valves, flow control valves, bleed valves, fuel flow regulators, fuel filters, fuel and de-fuelling connections and in flight refuelling booms, as appropriate to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the installation operations required and components to be installed, and to check that they are in a safe and usable condition. In carrying out the installation operations, the learner will be required to follow laid-down procedures and specific installation techniques, in order to install the various components and systems. The installation activities will include making all necessary checks and adjustments to ensure the components are correctly orientated, positioned and secured according to specification, and that the installation is free from contamination and damage. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation are correctly accounted for on completion of the activities, and must complete all necessary job/task documentation 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 installation techniques and procedures. The learner will understand the aircraft fuel system being worked on, and its application, and will know about the various components, tools and equipment used and the installation techniques, 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 working on the aircraft fuel system, and with its 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 install aircraft fuel 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 installation activity: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow all relevant drawings and specifications for the installation being carried out 1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 Install, position and secure the equipment and components in

accordance with the specification

1.6 Install aircraft fuel system components to include six from the following:

- main fuel tanks
- flexible and rigid pipes
- fuel flow regulators
- in-flight refuelling boom
- drain valve
- change-over valves
- auxiliary fuel tank
- fuel manifold
- fuel filters
- fuel and de-fuel connections
- bleed valve
- pressure and return lines

1.7 Apply six of the following installation methods and techniques:

- achieving required torque
- positioning and aligning
- correct orientation
- using threaded devices
- material treatment
- left and right handing
- setting travel or clearance
- use of sealants
- earth bonding
- checking direction of flow
- bolt locking methods (split pins, wire locking, lock nuts, stiff nuts)

1.8 Check that all necessary connections to the equipment are complete

1.9 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.11 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to install aircraft fuel systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with aircraft fuel systems 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 installing aircraft fuel systems, and with the tools and equipment used, and 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 interpret the drawings, standards, quality control procedures and specifications used for the installation 2.6 Explain how to carry out currency/issue checks on the specifications they are working with 2.7 Describe the components to be installed, and explain their function within the particular aircraft fuel systems 2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used 2.11 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.12 Describe the quality control procedures to followed during the installation operations 2.13 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.14 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage 2.15 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities 2.16 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken 2.17 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure 2.18 Describe the procedure for the safe disposal of waste materials 2.19 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation 2.20 Explain how to recognise installation defects 2.21 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected 2.22 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

Unit 444 Installing aircraft fuel systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.7 (such as fuel flow, pipe work installation, gravity feed and other related systems)

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

2.20 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)

Unit 445 Installing aircraft environmental systems

UAN:	**D/601/4517**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 045: Installing 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 install aircraft environmental systems, in accordance with approved procedures and safe working practices. It includes the installation of oxygen equipment, cabin pressurisation equipment, therapeutic masks, air conditioning systems, pressurisation of bulkheads, pressure domes, door and window seals and demisting equipment, as appropriate to the aircraft type. The learner will be required to select the appropriate tools and equipment to use, based on the installation operations required, and to check that they are in a safe and serviceable condition. In carrying out the installation operations, the learner will be required to follow laid-down procedures and specific installation techniques, in order to install the various equipment and systems. The installation activities will include making all necessary checks and adjustments to ensure that the equipment is correctly orientated, positioned and secured according to specification, and that the installation is free from contamination and damage, and has an appropriate cosmetic appearance. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation are correctly accounted for, and must complete all necessary job/task documentation 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 installation techniques and procedures. The learner will understand the aircraft environmental system being worked on, and its application, and will know about the various components, tools and equipment used, and the installation requirements, 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 working on the aircraft environmental system, and with its 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved

procedures
- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install two of the following aircraft environmental systems:
- oxygen systems
- therapeutic masks
- air conditioning systems
- cabin heating and cooling
- cabin pressurisation systems
- pressurised bulkheads
- pressure domes
- door and window seals
- demisting equipment
- avionic cooling systems

1.7 Install four of the following type of components:
- pipes (rigid and flexible)
- face mask and allied equipment
- environmental seals and sealants
- valves (by-pass, shut-off, check)
- gauges and storage devices
- regulators
- accumulators
- charging bottles
- jumper braids
- bonding clips
- unions and couplings
- diffusers
- earthing straps

1.8 Apply three of the following installation methods and techniques:
- positioning and aligning
- torque setting
- locking fasteners
- earth bonding
- manual handling
- setting travel or working clearance

1.9 Use three of the following types of mechanical securing device:
- quick-release fasteners
- locking devices
- screws
- torque load bolts
- nuts and bolts

- pipe connectors

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome

The learner will:

2. Know how to install aircraft environmental systems

Assessment criteria

The learner can:

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

2.2 Explain the health and safety requirements of the work area they are carrying out the activities, and the responsibility these requirements place on them

2.3 Describe the hazards associated with installing environmental systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 Describe the components to be installed, and explain their function within the particular mechanical control system

2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.11	Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.12	Describe the quality control procedures to followed during the installation operations
2.13	Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.14	Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage
2.15	Describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.16	Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.17	Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.18	Describe the procedure for the safe disposal of waste materials
2.19	Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	Explain how to recognise installation defects
2.21	Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	Describe the problems that can occur with the installation operations, and explain how these can be overcome
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 extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 445 Installing 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 pressurised systems, fluids, mechanisms)

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

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

2.20 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 446 Installing flying control surfaces and systems

UAN:	**K/601/4519**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 046: Installing Flying Control Surfaces 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 install aircraft flying control surfaces and systems, in accordance with approved procedures. It includes the installation of flying control system components, such as control columns, rudder pedals, throttle boxes, flap selectors, air brake selectors, trim wheels, auxiliary controls, auto pilot systems, gradient boxes, torque tubes, cables and pulleys, turnbuckles, connecting rods, dampers, AFCS series and parallel actuators, mixers, levers, pivots, locks and stops. The flying control surface will include units associated with air brakes, flaps, ailerons, rudders, elevators, trim tabs, main rotor blades, tail rotor blades and stabilisers. The learner will be required to select the appropriate tools and equipment to use, based on the operations to be performed and components to be installed, and to check that they are in a safe and usable condition. In carrying out the installation operations, the learner will be required to follow laid-down procedures and specific installation techniques, in order to install the various components and systems. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly orientated, positioned and aligned, have the correct symmetry and control surface travel, are correctly rigged and that they function as per the specification.

The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation are correctly accounted for on completion of the activities, and must complete all necessary job/task documentation 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 installation techniques and procedures used. The learner will understand the flying control system being installed, and its function, and will know about the equipment, relevant components, alignment, adjustment and rigging methods, in adequate depth to provide a sound basis for carrying out the installation activities to the required specification.

The learner will understand the safety precautions required when working on the aircraft flying control system, and with its 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 install flying control surfaces 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 installation techniques and procedures at all times
- return all tools and equipment to the correct location on completion of the installation activities
- dispose of waste materials in accordance with approved procedures
- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Either: Install a range of flying control components for fixed wing aircraft, to include four of the following:

- rudder pedals
- flap selectors
- hydraulic components
- gradient boxes
- torque tubes
- turnbuckles
- control columns
- air brake selectors
- connecting rods
- control sticks
- levers
- mixer units
- trim wheels
- auto pilot systems
- locks and stops
- bell cranks
- AFCS series and parallel actuators
- auxiliary controls
- throttle boxes
- cables and pulleys
- pedals

Or: Install a range of flying control components for rotary wing aircraft, to include four of the following:

- gradient boxes
- torque tubes
- turnbuckles
- cables and pulleys
- connecting rods
- control sticks

- levers
- mixer units
- locks and stops
- bell cranks
- AFCS series and parallel actuators
- Pedals

1.7 Either: Install a range of flying control surfaces for fixed wing aircraft, to include three from the following:

- air brakes
- spoilers
- flaps
- tail plane
- ailerons
- canards
- elevators
- trim tabs
- rudders

Or: Install a range of flying control surfaces for rotary wing aircraft, to include two items from the following:

- main rotor blades
- stabilisers
- tail rotor blades
- trim tabs

1.8 Use installation methods and techniques which include four of the following:

- setting control surface travel
- checking and setting symmetry
- positioning and aligning components
- setting rigging
- making functional checks
- electrical bonding of components

1.9 Make three of the following types of connections:

- quick release fasteners
- electrical connections
- locking devices
- pipe connections
- torque load bolts
- nuts and bolts

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MOD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures

- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to install flying control surfaces and systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with control surfaces/systems 2.2 Describe the hazards associated with installing flying control surfaces and systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 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 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 engineering drawings and related specifications in relation to work undertaken 2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 Explain how to carry out currency/issue checks on the specifications they are working with 2.8 Describe the components to be installed, and explain their function within the particular control surfaces and systems 2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.10 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.11 Explain why securing devices need to be locked and labelled, and the different methods that are used 2.12 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.13 Describe the quality control procedures to be followed during the installation operations 2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.15 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16	Describe the methods of lifting, handling and supporting the components/equipment during the installation activities
2.17	Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken
2.18	Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.19	Describe the procedure for the safe disposal of waste materials
2.20	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
2.21	Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.22	Explain how to recognise installation defects
2.23	Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.24	Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.25	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
2.26	Describe the problems that can occur with the installation operations, and explain how these can be overcome
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 446 Installing flying control surfaces and systems

Supporting information

Guidance

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

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

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

2.22 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 447 Installing aircraft armament systems

UAN:	**H/601/4521**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 047: Installing Aircraft Armament 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 install aircraft armament systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with guns, missiles, rockets, torpedoes, bombs, depth charges and other systems, 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 components to be installed. The armament components to be installed will include items such as pipework, laser guidance, weapons carriers, weapons pylons, looms, fusing units, firing units, mechanical and electrical controls, and safety devices. The installation activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned, have appropriate travel and/or working clearances, and are tightened to the correct torque. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation 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 instructions and procedures. The learner will understand the armament system, and its application, and will know about the components, tools and equipment used, and the installation requirements, 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 working on the aircraft armament system, and with 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 install aircraft armament 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on

completion of the installation activities
- dispose of waste materials in accordance with approved procedures
- leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install two of the following aircraft armament systems:
- gun
- torpedo
- ordnance release system
- depth charge
- rocket
- bomb
- missile

1.7 Install armament components which include five of the following:
- pipework
- laser guidance
- looms
- weapons pylons
- firing units
- weapons carriers
- magazines
- control units
- electrical mechanisms (such as solenoids, indicators, motors, switches)
- fusing units
- cylinders/actuating mechanisms
- mechanical controls (such as plungers, springs, rollers)

1.8 Apply installation methods and techniques, to include three from:
- positioning and aligning
- torque setting and locking fasteners
- making electrical connections
- setting travel or working clearance
- earth bonding

1.9 Use three of the following types of securing device:
- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners
- plugs and sockets

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

Learning outcome

The learner will:

2. Know how to install aircraft armament systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when working with armament systems

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 installing aircraft armament systems, 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 engineering drawings and related specifications in relation to work undertaken

2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

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

2.8 Describe the components to be installed, and explain their function within the particular armament system

2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.10 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.11 Explain why securing devices need to be locked and labelled, and

the different methods that are used

2.12 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

2.13 Describe the quality control procedures to followed during the installation operations

2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.15 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.17 Explain how to make pipe bends using fittings, and by hand bending, using approved forming equipment

2.18 Explain how to eliminate stress on pipework/connections, and the importance of supporting at suitable intervals

2.19 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

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

2.21 Describe the procedure for the safe disposal of waste materials

2.22 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.23 Explain how to recognise installation defects

2.24 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.25 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.26 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

2.27 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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

Unit 447 Installing aircraft armament systems

Supporting information

Guidance

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

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

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

2.23 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 448 Installing aircraft assisted escape mechanisms

UAN:	**T/601/4524**
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 048: Installing Aircraft Assisted Escape Mechanisms (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 install aircraft assisted escape mechanisms, in accordance with approved procedures. It includes units and components associated with ejection seats, canopy jettison and fragmentation systems, parachute assemblies, evacuation chutes and other systems, 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 components to be installed. The assisted escape mechanism components to be installed will include items such as explosive devices, pipework, air bottles, hoses, seats, looms, mechanical and electrical controls, and safety devices. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate travel and/or working clearances, and are tightened to the correct torque. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation 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 in the installation 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 instructions and procedures. The learner will understand the assisted escape mechanism being installed, and its application, and will know about the components, tools and equipment used, and the installation requirements, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the installation is to the required specification.

The learner will understand the safety precautions required when working on the aircraft assisted escape mechanisms, in particular those associated with explosive devices for which personnel must be authorised and fully conversant.

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 install aircraft assisted escape mechanisms
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times

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

1.3 Follow all relevant drawings and specifications for the installation being carried out

1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install one of the following aircraft assisted escape systems:

- ejection seats
- parachute assemblies
- armed emergency doors
- canopy jettison/fragmentation systems
- evacuation chutes

1.7 Install assisted escape system components which include five of the following:

- pipework
- hoses
- ejector seats
- parachutes
- air bottles
- inflatable chutes
- explosive devices (authorised personnel only)
- cylinders/actuating mechanisms
- mechanical controls (plungers, springs, rollers)
- electrical mechanisms (solenoids, indicators, motors, switches)

1.8 Apply installation methods and techniques, to include three from:

- positioning and aligning
- torque setting and locking fasteners
- making electrical connections
- setting travel or working clearance
- earth bonding

1.9 Use three of the following types of securing device:

- nuts and bolts
- locking devices
- screws
- torque load bolts
- quick-release fasteners
- plugs and sockets

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- aircraft breakdown documentation
- history cards
- job cards
- aircraft flight log

Learning outcome
The learner will: 2. Know how to install aircraft assisted escape mechanisms
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when working with assisted escape systems and explosive devices 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 installing aircraft assisted escape systems, and explain how they can be minimised 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 engineering drawings and related specifications in relation to work undertaken 2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 Explain how to carry out currency/issue checks on the specifications they are working with 2.8 Describe the components to be installed, and explain their function within the particular assisted escape system 2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation 2.10 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.11 Explain why securing devices need to be locked and labelled, and the different methods that are used 2.12 Explain the torque loading requirements of the fasteners, and what

to do if these loadings are exceeded or not achieved

2.13 Describe the quality control procedures to followed during the installation operations

2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.15 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.17 Explain how to eliminate stress on pipework/connections, and the importance of supporting at suitable intervals

2.18 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

2.19 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.20 Describe the procedure for the safe disposal of waste materials

2.21 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.22 Explain how to recognise installation defects

2.23 Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.24 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.25 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

2.26 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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 responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 448 Installing aircraft assisted escape mechanisms

Supporting information

Guidance

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

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

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

2.22 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 449 Installing aircraft main engines

UAN:	**F/601/4526**
Level:	3
Credit value:	95
GLH:	259
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 049: Installing Aircraft Main Engines (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 install aircraft main engines, such as turbo prop, turbo jet, by-pass, turbo shaft and ducted fan, in accordance with approved procedures. The learner will be required to select the appropriate equipment and installation techniques, based on the operations to be made and the components to be installed. The aircraft main engine components to be installed will include air compressors, air intakes, combustion system, engine control units, torque tubes, fuel pipes, fire detection systems, exhaust units and equipment. The installation activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned, aligned, locked and fastened, and that correct sealants are used. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation of the aircraft main engines, and to report any problems with the installation activities, equipment or components 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's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the installation

techniques and procedures used. The learner will understand the aircraft engine being installed, and its application, and will know about the installation techniques, 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 installation 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 install aircraft main engines
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 correct part numbers are used, including (where appropriate) left or right handed parts • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow all relevant drawings and specifications for the installation being carried out 1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install one main engine from the following:
- turbo prop
- turbo jet
- by-pass
- ducted fan
- turbo-shaft
- piston

1.7 Assemble main engine components, to include three of the following:
- air Intake
- air compressor
- combustion system
- bearings
- engine control unit
- damper/connector arm
- turbine
- exhaust unit
- propelling nozzle
- shafts/gimble
- fire wire
- fire bottle

1.8 Use all the following installation methods and techniques:
- levelling and aligning
- sealing
- earth bonding
- taking ESD precautions (if applicable)
- securing and locking
- torque loading

1.9 Make three of the following types of connection:
- nuts and bolts
- locking devices
- screws
- electrical connections
- torque load bolts
- quick-release fasteners
- pipe connectors

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- aircraft flight log
- job cards

Learning outcome

The learner will:

2. Know how to install aircraft main engines

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when working with aircraft main engines

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 installing aircraft main engines, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 Explain the basic operating principles of the engine being installed, and the function of the various components within the system

2.8 Describe the components to be installed, and explain their function within the particular aircraft main engines

2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.10 Explain the importance of using the specified fasteners and locking devices for the particular installation, and why they must not substitute others

2.11 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.12 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

2.13 Describe the quality control procedures to followed during the installation operations

2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.15 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.16 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.17 Explain the use of seals, sealant, adhesives and anti-electrolysis

barriers, and the precautions to be taken

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

2.19 Describe the procedure for the safe disposal of waste materials

2.20 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.21 Explain how to recognise installation defects

2.22 Explain the importance of ensuring that the completed installation is free from foreign object debris, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.23 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.24 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

2.25 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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

Unit 449 Installing aircraft main engines

Supporting information

Guidance

2.1 1.1 (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.9 (such as threaded fasteners, special securing and locking devices)

2.21 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 450 Installing aircraft auxiliary engines

UAN:	**R/601/4529**
Level:	3
Credit value:	89
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 050: Installing Aircraft Auxiliary Engines (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 install aircraft auxiliary engines, such as auxiliary power units (APU) or ground turbine start (GTS units), in accordance with approved procedures. The learner will be required to select the appropriate equipment and installation techniques, based on the operations to be carried out and the components to be installed. The aircraft auxiliary engine components to be installed will include air intakes, engine control units, fuel pipes, damper/connector arms, exhaust units, propelling nozzles, shafts, fire wires, fire bottles and fire detection systems. The installation activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned, aligned, locked and fastened, and that correct sealants are used. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation of the aircraft auxiliary engines, and to report any problems with the installation activities, equipment or components 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 aircraft engine installation techniques and procedures. The learner will understand the aircraft engine being installed, and its application, and will know about the installation techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the completed installation is to the required specification.

The learner will understand the safety precautions required when carrying out the installation activities, and when working with 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 install aircraft auxiliary engines
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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow all relevant drawings and specifications for the installation being carried out 1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition

1.5 Install, position and secure the equipment and components in accordance with the specification

1.6 Install one of the following types of auxiliary engine:

- auxiliary power unit (APU)
- ground turbine start (GTS)

1.7 Assemble auxiliary engine components, to include three of the following:

- air Intake
- engine control unit
- exhaust unit
- damper/connector arm
- propelling nozzle
- shafts/gimble
- pipework
- fuel components
- fire wire
- fire bottle
- fire detection units
- electrical components

1.8 Use all the following installation methods and techniques:

- levelling and aligning
- sealing
- earth bonding
- torque loading
- taking ESD precautions
- securing and locking

1.9 Make three of the following types of connection:

- nuts and bolts
- pipe connections
- locking devices
- electrical connections
- screws
- torque load bolts
- quick-release fasteners

1.10 Check that all necessary connections to the equipment are complete

1.11 Produce installations which comply with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.13 Check that the installation is complete and that all components are free from damage

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

- build records
- log cards
- job cards
- aircraft flight log

Learning outcome

The learner will:

2. Know how to install aircraft auxiliary engines

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when installing aircraft auxiliary engines

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 installing aircraft auxiliary engines, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 Explain the basic operating principles of the auxiliary engine and equipment being installed, and its function within the aircraft system

2.8 Describe the components to be installed, and explain their function within the particular aircraft auxiliary engines

2.9 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.10 Explain the importance of using the specified fasteners and locking devices for the particular installation, and why they must not substitute others

2.11 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.12 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

2.13 Describe the quality control procedures to be followed during the installation operations

2.14 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.15 Describe the techniques used to position, align, adjust and secure the engine and its associated components to the aircraft without damage

2.16 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.17 Explain the use of seals, sealant, adhesives and anti-electrolysis

barriers, and the precautions to be taken

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

2.19 Describe the procedure for the safe disposal of waste materials

2.20 Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation

2.21 Explain how to recognise installation defects

2.22 Explain the importance of ensuring that the completed installation is free from foreign object debris, and of ensuring that any exposed components or pipe ends are correctly covered/protected

2.23 Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures

2.24 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

2.25 Describe the problems that can occur with the installation operations, and explain how these can be overcome

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

Unit 450 Installing aircraft auxiliary engines

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

2.9 (such as threaded fasteners, special securing and locking devices)

2.21 (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

Unit 451 Installing aircraft power transmission systems

UAN:	**R/601/4532**
Level:	3
Credit value:	89
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 051: Installing 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 install aircraft power transmission systems, in accordance with approved procedures. The learner will be required to select the appropriate equipment and installation techniques, based on the operations to be made and the components to be installed. The power transmission system components to be installed will include drive shafts, drive shaft supports, gearbox assemblies, couplings, mechanical fasteners, accelerometers, vibration monitoring equipment, and main and tail rotor assemblies. Installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned, aligned, locked and fastened, and that correct sealants are used. The learner's responsibilities will require them to comply with organisational policy and procedures for the installation of aircraft power transmission systems, and to report any problems with the installation 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 full 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

installation techniques and procedures. The learner will understand the power transmission system being installed, and its application, and will know about the installation techniques, 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 installation 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 install 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 installation activities: • obtain and use the appropriate documentation (such as job instructions, installation drawings, 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 installation 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 correct part numbers are used, including (where appropriate) left or right handed parts • follow safe practice/approved installation techniques and procedures at all times • return all tools and equipment to the correct location on completion of the installation activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition, free from foreign object debris on completion of the activities 1.3 Follow all relevant drawings and specifications for the installation being carried out 1.4 Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition 1.5 Install, position and secure the equipment and components in

accordance with the specification

1.6 Install aircraft engine power transmission gearbox systems, to include one from:
- intermediate gear box
- main gear box
- tail gear box
- nose gear box

1.7 Install rotor assembly systems, to include one from:
- main rotor assembly
- tail rotor assembly

1.8 Install power transmission system components, to include three from:
- drive shaft
- drive shaft support
- accelerometer
- flexi couplings
- couplings
- swash plate

1.9 Use all of the following installation methods and techniques:
- positioning and aligning
- checking symmetry
- checking/inspecting installation
- sealants/seals
- minor functional test
- manual handling
- electrical bonding

1.10 Make three of the following types of mechanical securing connection:
- wire locking
- nuts and bolts
- screws
- torque loaded bolts
- quick release fasteners
- pipe connections

1.11 Check that all necessary connections to the equipment are complete

1.12 Produce installations which comply with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific system requirements

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

1.14 Check that the installation is complete and that all components are free from damage

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

- build records
- job cards
- log cards
- aircraft flight log

Learning outcome

The learner will:

2. Know how to install 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 with power transmission systems

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 installing power transmission systems, 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 interpret the drawings, standards, quality control procedures and specifications used for the installation

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

2.7 Describe the components to be installed, and explain their function within the particular power transmission systems

2.8 Describe the various mechanical fasteners that will be used, and explain their method of installation

2.9 Explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others

2.10 Explain why securing devices need to be locked and labelled, and the different methods that are used

2.11 Explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved

2.12 Describe the quality control procedures to be followed during the installation operations

2.13 Explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

2.14 Describe the techniques used to position, align, adjust and secure the components to the aircraft without damage

2.15 Describe the methods of lifting, handling and supporting the components/equipment during the installation activities

2.16 Explain the use of seals, sealant, adhesives and anti-electrolysis barriers, and the precautions to be taken

2.17 Explain why electrical bonding is critical, and why it must be both mechanically and electrically secure

2.18 Describe the procedure for the safe disposal of waste materials

2.19	Explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
2.20	Explain how to recognise installation defects
2.21	Explain the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
2.22	Describe the tools and equipment used in the installation activities, and explain their calibration/care and control procedures
2.23	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
2.24	Describe the problems that can occur with the installation operations, and explain how these can be overcome
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 extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 451 Installing aircraft power transmission systems

Supporting information

Guidance

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

2.5 (including BS, ISO or BSEN schematics, symbols and terminology)

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

2.20 (such as leaks, poor seals, misalignment, ineffective fasteners and foreign object damage or contamination)

Unit 452 Testing installed aircraft engines

UAN:	**M/601/4537**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 052: Testing Installed Aircraft Engines (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 installed aircraft engines, in accordance with approved procedures, and includes testing both 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, 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, monitoring procedures are complied with, 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 engine test procedures. The learner will understand the engine being tested and the specific test schedule to be followed, and will know what the cabin/cockpit controls do and what the various 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 fuelling the aircraft 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 test installed aircraft engines
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 job instructions, ground test schedule, 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 • 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
- leave the aircraft and work area in a safe and appropriate condition, free from foreign object debris on completion of the testing activities

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 Test both of the following, as applicable to the aircraft type:

- main engines
- auxiliary engines (APU)

1.6 Undertake engine ground runs as listed in the engine test schedule, to include seven of the following checks:

- the ground start mechanisms operate correctly
- the APU cuts out at the correct time
- fuel flow is operating correctly
- engine pressure ratios are within specification
- engine temperature is within specification
- throttle/high pressure fuel flow operates smoothly
- the bleed air system functions correctly
- hydraulic pressures are attained
- maximum RPM is achieved
- fire detection and protection equipment is functioning

1.7 Deal with two of the following complexities during the engine tests:

- engine runs with no faults
- engine runs with faults
- engines with intermittent faults

1.8 Carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.9 Record the results of the tests in the appropriate format

1.10 Review and analyse the results of the ground run using four of the following, and carry out further tests if necessary:

- data sheets
- calibration records
- log cards/history sheet
- engine test schedule
- fault records
- maintenance manuals and records

Learning outcome
The learner will: 2. Know how to test installed aircraft engines
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 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 Explain the safety procedures that must be carried out before work is started on the aircraft 2.4 Explain what protective clothing and equipment needs to be worn 2.5 Describe the hazards associated with testing aircraft engines, and explain how to minimise them and reduce any risks 2.6 Explain what preparations need to be carried out on the aircraft prior to starting the engine tests 2.7 Explain how to ensure the aircraft is electrically bonded prior to fuelling and de-fuelling, and why this is so important 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 Describe the testing methods and procedures to be used to carry out the various engine tests 2.11 Explain the need to apply engine power in incremental stages, and to check all readings, temperatures and pressures at each stage 2.12 Explain how to record the results of each individual test, and the documentation that must be used 2.13 Explain from whom to seek authorisation if they need to alter or change the test procedures 2.14 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft 2.15 Describe the potential problems that can occur with the testing activities, and explain how they can be overcome 2.16 Describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these 2.17 Explain any required environmental controls relating to the testing 2.18 Explain what documentation needs to be completed at the end of the testing activities 2.19 Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 452 Testing installed aircraft engines

Supporting information

Guidance

2.3 (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 that all personnel are clear of the test area)

2.6 (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 453 Testing aircraft power transmission systems

UAN:	**A/601/4542**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 053: Testing 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. The learner will be required to test transmission systems including drive shafts, flexible couplings, accelerometers, gearbox assemblies (main, intermediate and tail), and main and tail rotor heads. 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 complexity of tests involved will include the functional testing of all power transmission systems, including rotor heads, drive trains and gear boxes, both with and without faults. The learner's responsibilities will require them to comply with organisational policy and procedures for the power transmission 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 and instruction, taking full 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 aircraft power transmission test procedures. The learner will understand the transmission system being tested, and its application, and will know about

the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing 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 test 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 power transmission systems: • obtain and use the appropriate documentation (such as job instructions, aircraft power transmission 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures • 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 Carry out setting and checking activities, using two from the following: • dial test indicator • laser alignment

- plumb and bob
- clinometers
- slip gauges
- go/no-go gauge
- optical site instruments
- using jigs/fixture

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

1.6 Test two aircraft power transmission systems from the following:

- 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 three of the following types of test:

- gear box alignment (main, tail, intermediate)
- drive shaft/high speed shaft alignment
- main rotor rigging
- tail rotor rigging
- ground run

1.8 Deal with two of the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use two of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)

- BS, ISO or BSEN procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems, using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test 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 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 Explain what safety procedures must be carried out before work is started on the aircraft 2.4 Describe the hazards associated with testing aircraft power transmission systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.5 Explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.6 Explain the correct operating procedures of the system being tested 2.7 Explain the electrical bonding specifications, and their importance 2.8 Explain how to obtain the required test schedules and specifications for the aircraft transmission system 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 Describe the testing methods and procedures to be used to carry out the various transmission tests 2.11 Describe the various types of equipment/component that make up the test equipment, and explain their selection for particular tests 2.12 Explain the calibration of test equipment (where applicable), and how to carry out currency/issue checks of documentation 2.13 Describe the methods of breaking down and testing systems, while ensuring that contamination of the system is avoided and that the system, equipment, surrounding airframe and components are not

damaged

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

2.15 Explain the fault finding techniques to be used if the system fails the tests

2.16 Explain how to reconnect system equipment when testing is completed

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 from if they need to alter or change the test procedures

2.19 Explain how to analyse the test results and make valid decisions about the acceptability of the aircraft

2.20 Describe the 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 453 Testing aircraft power transmission systems

Supporting information

Guidance

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

2.11 (such as clinometer, laser sight, optical sight, jigs and fixtures, slip gauges, go/no-go gauges)

Unit 454 Testing aircraft hydraulic systems

UAN:	**L/601/4545**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 054: Testing 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. The learner will be required to test aircraft hydraulic systems, including landing gear, flying controls, flaps, nose wheel steering, rotor brakes, slats, deck locks and arrester mechanisms. 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 learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft hydraulic system tests, 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 and instruction, taking full 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 aircraft hydraulic test procedures. The learner will understand the aircraft hydraulic system under test, and its application, and will know about the testing requirements, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system functions to the required specification.

The learner will understand the safety precautions required when carrying out the testing 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 test 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 hydraulic system: • 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures • 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 tools or test equipment which include three from the following: • hydraulic pumps • pressure devices • hydraulic testing rigs • flushing blocks • flushing pipes • bleeding equipment

- blanking equipment
- connecting equipment
- sampling devices

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

1.6 Test two of the following aircraft hydraulic systems:

- landing gear
- nose wheel steering
- wheel braking system
- flying controls
- flaps
- rotor brakes
- slats
- arrestor mechanisms
- deck locks

1.7 Carry out all of the following types of test:

- return line pressure test
- pressure line pressure test
- reduced system flush
- system flush
- fluid sampling/taking results
- leak test

1.8 Deal with two the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use two of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome

The learner will:

2. Know how to test 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

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

2.4 Explain what protective clothing and equipment needs to be worn, and where it can be obtained

2.5 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

2.6 Explain the correct operating procedures of the system being tested

2.7 Explain the electrical bonding specifications, and their importance

2.8 Explain how to obtain the required test schedules and specifications for the aircraft hydraulic system 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 Describe the testing methods and procedures to be used to carry out the various tests on the hydraulic systems

2.11 Explain what test equipment is to be used, its selection for the particular tests, the calibration of the test equipment, and the currency/issue checks that need to be carried out

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

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

2.14 Explain the need to apply test pressures in incremental stages, and to check all readings and pressures at each stage

2.15 Describe the fault finding techniques to be used if the system fails the tests

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	Describe the problems that can occur with the testing activities, and explain how they can be overcome
2.20	Describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid these
2.21	Explain any required environmental controls relating to the testing
2.22	Explain what documentation needs to be completed at the end of the testing activities
2.23	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 454 Testing aircraft hydraulic systems

Supporting information

Guidance

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

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

2.11 (where applicable)

Unit 455 Testing aircraft pneumatic systems

UAN:	**Y/601/4547**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 055: Testing Aircraft Pneumatic 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 systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes emergency blow-down systems, de-icing systems, air stairs, waste disposal systems, arrestor mechanisms, deck locks, air start systems, flying controls, weapon systems and other systems, 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 complexity of tests involved will include the testing of both pressure and return lines, system flushing, and systems with and without faults. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft pneumatic system 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 and instruction, taking personal responsibility for their own actions and for the quality and accuracy of the tests that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying aircraft pneumatic system test procedures. The learner

	will understand the pneumatic system under test, and its application, and will know about the test equipment and test techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system performs to the required specification. The learner will understand the safety precautions required when testing the aircraft pneumatic system, and with its 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 test aircraft pneumatic 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 systems:

- obtain and use the appropriate documentation (such as job instructions, aircraft pneumatic 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 safety procedures
- ensure that isolation procedures are followed and that safe working distance procedures are set up
- Carry out the tests, using the specified techniques and procedures
- 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 systems and equipment, using three of the

following tools or test equipment:

- air pumps
- pressure gauges/devices
- pneumatic test rigs
- priming equipment
- blanking equipment
- bleeding equipment
- 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 Test two of the following aircraft pneumatic systems (either high or low pressure):

- emergency blow-down systems
- de-icing systems
- air stairs
- waste disposal systems
- engine air start
- air intake shutters
- spoilers
- slats
- flaps
- flying controls
- nose wheel steering
- wheel braking
- arrestor mechanisms
- deck locks
- gun cocking
- weapon bay doors
- other systems (as appropriate)

1.7 Carry out four the following types of test:

- system charging
- system priming and bleeding
- system pressure test
- system sampling/taking results
- reduced system test
- system components tests
- air line vapour tests
- system functional tests
- leak test

1.8 Deal with two the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use two of the following fault finding techniques during the tests:
- half-split technique
- input-to-output technique
- six point technique

1.10 Carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four from:
- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome

The learner will:

2. Know how to test aircraft pneumatic systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when testing aircraft pneumatic systems

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

2.4 Describe the hazards associated with testing aircraft pneumatic systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.5 Explain what protective clothing and equipment to be worn whilst carrying out the testing activities

2.6 Explain where to obtain the necessary information regarding the testing of the aircraft pneumatic system being worked on

2.7 Explain the terminology used in aircraft pneumatic system testing procedures, and the use of power diagrams and associated symbols

2.8 Explain how to obtain the required test specifications for the systems they are working on, how to interpret them and how to check their currency/issue

2.9 Explain the basic operating principles of the pneumatic system

being tested, and the performance characteristics of the testing equipment

2.10 Explain the correct operating procedures of the system being tested, and the pressures used

2.11 Explain the electrical bonding specifications, and their importance to the system

2.12 Describe the various types of pipe and component that make up the aircraft pneumatic test equipment

2.13 Describe the methods of lifting, handling and manoeuvring test equipment to the desired location to aid test activities

2.14 Describe the types of test equipment to be used, and explain their selection for the particular tests

2.15 Explain any required environmental controls relating to the testing

2.16 Describe the methods of breaking down and testing systems, ensuring that: F.O.D ingress and contamination of system is avoided; system equipment and surrounding airframe and components are not damaged; direction of flow indicators and max pressure labels are observed; blanks and plugs are used when accumulators, filters, pneumatic power supplies are disconnected

2.17 Explain how to reconnect the system equipment when testing is completed, ensuring that pipes and connections are tightened correctly; clearance is maintained between other components, including flying controls and aircraft surfaces; ensuring that pipework is not damaged and is located in correct positions; carrying out visual checks on all components; checking the security of joints, and that the system is safe to pressurise

2.18 Describe the tools and equipment used in the test activities and explain its calibration requirements and care and control procedures for the tools and equipment

2.19 Explain the need for tool control, and why they must be able to account for all the tools and equipment used on completion of the test activity

2.20 Describe the procedure for safe disposal of waste materials and testing fluid; what to do with leaks and pipe bursts; ensuring that contamination of other aircraft systems is kept within acceptable levels when leaks occur; cleaning procedures for aircraft and work area when leaks and contamination occurs

2.21 Describe the fault finding techniques to be used if the system fails the tests

2.22 Explain how to analyse test results

2.23 Explain how to display/record the test results, and the documentation to be used

2.24 Explain the authorisation procedures for changes to test procedures

2.25 Describe the problems that may occur during the testing activities, and explain how they can be overcome and errors that may affect test results

2.26 Describe the extent of their own authority and explain from whom to seek help if they have problems that they cannot resolve

Unit 455 Testing aircraft pneumatic systems

Supporting information

Guidance

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

2.6 (such as system drawings and circuit diagrams, engineering drawings and related standards)

2.9 (such as looping out systems; performing specific testing activities; removal of foreign object debris (F.O.D); operating and test characteristics of the system and components being tested)

2.12 (such as valves; looping out equipment; blanks; mating equipment; return and pressure lines; pneumatic pumps; pneumatic rigs; actuators; motors; specific-to-type equipment)

Unit 456 Testing aircraft environmental systems

UAN:	**Y/601/4550**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 056: Testing 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 systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes the testing of oxygen equipment, cabin pressurisation equipment, therapeutic masks, air conditioning systems, pressurisation of bulkheads, pressure domes, cabin heating and cooling, avionic and electronic cooling, demisting equipment and other systems, 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 air pumps, pressure gauges/devices, test rigs, flushing blocks, flushing pipes, 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 testing the aircraft environmental systems, and to report any problems with the test activities, test equipment or components being tested, 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 and instruction, taking personal responsibility for their own actions and for the quality and accuracy of the tests that they carry out.

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

The learner will understand the safety precautions required when testing the aircraft environmental system and its associated 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 test 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 equipment 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures

- 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 and equipment, using three of the following tools or test equipment:

- air pumps
- pressure gauges/devices
- test rigs
- flushing equipment
- blanking equipment
- connecting equipment
- other test devices
- air compressors

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

1.6 Test two of the following aircraft environmental systems:

- oxygen system
- therapeutic masks
- pressure domes
- door and window seals
- avionic cooling systems
- aircraft air conditioning systems
- cabin pressurisation system
- demisting equipment
- bulkhead pressurisation system
- cabin heating and cooling system

1.7 Carry out three of the following types of test:

- line pressure test
- air flow tests
- cabin pressure test
- leak test
- oxygen mask deployment
- air temperature tests
- equipment functional test
- air line vapour tests
- bulkhead and dome pressure tests
- system functional test

1.8 Deal with two the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use three of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in compliance with one of the following standards:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD AQAP1)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:
- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test 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 health and safety requirements of the work area where they are carrying out the testing activities, and the responsibility these requirements place on them 2.3 Explain the safety procedures that must be carried out before work is started on the aircraft 2.4 Explain what protective clothing and equipment needs to be worn, and where it can be obtained 2.5 Describe the hazards associated with testing aircraft environmental systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.6 Explain the correct operating procedures of the system being tested 2.7 Explain the electrical bonding specifications, and their importance

2.8	Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken
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 the 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 the basic principle of operation of the system under test, and the function of the individual components within the system
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, its selection for the particular tests, the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out
2.14	Explain the need to apply pressures in incremental stages, and to check all readings and pressures at each stage
2.15	Explain the importance of ensuring pressure airflow is maintained, and the methods to detect leaks and faults with the system
2.16	Describe the fault finding techniques to be used if the system fails the tests
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 make valid decisions about the acceptability of the aircraft
2.20	Describe the problems that can occur with the testing activities, and explain how they can be overcome
2.21	Explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities
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 responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 456 Testing aircraft environmental systems

Supporting information

Guidance

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

2.8 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.11 (including fans and compressors, valves, heater elements, air distribution devices, emergency standby devices)

Unit 457 Testing aircraft de-icing systems

UAN:	**M/601/4554**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 057: Testing Aircraft De-Icing 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 de-icing systems, 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 operations to be performed and the systems to be tested. The complexity of tests involved will include the testing of units and components associated with warm air, fluid, electrical heating, flexible surface systems, ice detection units and other systems, as applicable to the aircraft type, and systems with and without faults. The learner's responsibilities will require them to comply with organisational policy and procedures for testing the aircraft de-icing system, and to report any problems with the testing activities, equipment or components 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 and instruction, taking personal responsibility for their own actions and for the quality and accuracy of the tests that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying aircraft de-icing system test procedures. The learner will understand the de-icing system under test, and its application, and will know about the test equipment and test techniques, in

adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when testing the aircraft de-icing system, and with its 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 test aircraft de-icing 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 de-icing systems: • obtain and use the appropriate documentation (such as job instructions, aircraft de-icing equipment 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures • 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 de-icing systems and equipment using three of the following tools or test equipment: • air pumps • pressure gauges/devices

- test rigs
- multimeter
- temperature gauges
- connecting equipment
- other test devices

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

1.6 Test two of the following aircraft de-icing systems:

- warm air
- fluid
- flexible surface
- electrical heating
- other systems

1.7 Carry out three the following types of test:

- line pressure test
- temperature checks
- system components tests
- functional checks
- continuity checks
- leak check

1.8 Deal with two of the following complexities during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use three of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft de-icing systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when testing aircraft de-icing systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials) 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 Explain the safety procedures that must be carried out before work is started on the aircraft 2.4 Explain what protective clothing and equipment needs to be worn during the testing activities, and where it can be obtained 2.5 Describe the hazards associated with testing aircraft de-icing systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.6 Explain the correct operating procedures of the system being tested 2.7 Explain the electrical bonding specifications, and their importance 2.8 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken 2.9 Explain how to obtain the required test schedules and specifications for the aircraft and de-icing 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 Explain what test equipment is to be used, its selection for the particular tests, the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.12 Explain why equipment control is critical, and what to do if a piece of equipment is unaccounted for on completion of the activities 2.13 Explain the basic principle of operation of the system under test, and the function of the individual components within the system 2.14 Describe the testing methods and procedures to be used to carry out the various de-icing system tests 2.15 Explain the need to apply tests in incremental stages, and to check all readings, temperatures and pressures at each stage 2.16 Describe the fault finding techniques to be used if the system fails the tests 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	Describe the 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 457 Testing aircraft de-icing systems

Supporting information

Guidance

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

2.8 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

Unit 458 Testing aircraft fuel systems

UAN:	**F/601/4560**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 058: Testing Aircraft Fuel 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 systems, in accordance with approved procedures. The learner will be required to test aircraft fuel systems, including fuel tanks, fuel manifolds, fuel pipes (flexible and rigid) and fuel filters. 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 complexity of tests involved will include fuel flow test operations, functional testing of fuel transfer procedures, system flushing, systems with and without faults, and sampling of fuel oil for test. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft fuel system 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 and instruction, 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 aircraft fuel system test procedures. The learner will understand the aircraft fuel system under test, and its application, and will know about aircraft fuel system testing, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that

	the tested system functions to the required specification. The learner will understand the safety precautions required when carrying out the testing 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 test aircraft fuel 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 systems: • obtain and use the appropriate documentation (such as job instructions, aircraft fuel equipment 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures • 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 systems equipment, using tools or test equipment which include three from: • fuel pumps • flushing equipment • bleeding equipment • blanking equipment

- sampling devices
- pressure devices
- fuel testing rigs
- connecting equipment

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

1.6 Test two of the following aircraft fuel systems:

- full system fuel flow
- reduced system fuel flow
- crossover/change-over tanks
- in-flight refuelling boom
- bleed valve
- fuel filters
- fuel drain systems
- fuel and de-fuel connections
- fuel jettison system
- auxiliary fuel tank

1.7 Carry out three of the following types of test:

- pressure line pressure test
- leak test
- fuel/de-fuel test
- reduced system flush
- system flush
- system fuel flow functional test
- fluid sampling/taking results

1.8 Deal with two of the following complexities during the testing activities:

- system with no faults
- system with faults
- system with intermittent faults

1.9 Use three of the following fault finding techniques during tests:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements

- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome

The learner will:

2. Know how to test aircraft fuel systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when testing fuel systems

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

2.4 Explain what protective clothing and equipment to be worn

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

2.6 Explain the correct operating procedures of the system being tested

2.7 Explain the electrical bonding specifications, and their importance

2.8 Explain how to obtain the required test schedules and specifications for the aircraft fuel system 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 Describe the testing methods and procedures to be used to carry out the various fuel system tests

2.11 Explain what test equipment is to be used, its selection for the particular tests, the calibration of test equipment, and the currency/issue checks that need to be carried out

2.12 Describe the methods of breaking down the system, and how to ensure that ingress and contamination of the system are avoided

2.13 Explain the procedure for reconnecting system equipment when testing is completed

2.14 Explain the need to apply pressure tests in incremental stages, and to check all readings and pressures at each stage

2.15 Describe the fault finding techniques to be used if the system fails the tests

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 make valid decisions about the acceptability of the fuel system
2.19	Describe the problems that can occur with the testing activities, and explain how they can be overcome
2.20	Describe the things that may cause errors or discrepancies in/with the test results, and explain how to avoid this
2.21	Explain any required environmental controls relating to the testing
2.22	Explain what documentation needs to be completed at the end of the testing activities
2.23	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 458 Testing aircraft fuel systems

Supporting information

Guidance

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

2.11 (where applicable)

Unit 459 Testing aircraft flying control surfaces and systems

UAN:	**T/601/4572**
Level:	3
Credit value:	55
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 059: Testing Aircraft Flying Control Surfaces 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 aircraft flying control surfaces and 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 systems to be tested. The flying control systems to be tested will be on either fixed or rotary wing aircraft, and will include items such as flaps, air brakes, autopilot systems, sticks and pedals, ailerons, rudders, main and tail rotors, trim tabs and stabilisers. 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, 'full and frees', ground running activities, and 'before and after' flight inspections and tests. The learner's responsibilities will require them to comply with organisational policy and procedures for the flying control surface 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 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 the testing

techniques and procedures used. The learner will understand the flying control system being tested, and its function, and will know about the equipment, relevant components, alignment, adjustment and rigging methods, in adequate depth to provide a sound basis for carrying out the testing activities to the required specification.

The learner will understand the safety precautions required when carrying out the testing activities, and with the tools and equipment used. 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 test aircraft flying control surfaces 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 testing of the aircraft flying control surfaces and systems: • obtain and use the appropriate documentation (such as job instructions, aircraft flying control surface 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests, using the specified techniques and procedures • 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 Set up and carry out the tests using the correct procedures and

within agreed timescales

1.5 Either: Test a range of flying control components for fixed wing aircraft, to include four of the following:

- rudder pedals
- flap selectors
- control columns
- air brake selectors
- trim wheels
- auto pilot systems
- auxiliary controls
- throttle boxes

Or: Test a range of flying control components for rotary wing aircraft, to include four of the following:

- gradient boxes
- torque tubes
- turnbuckles
- cables and pulleys
- connecting rods
- control sticks
- levers
- mixer units
- locks and stops
- bell cranks
- AFCs series and parallel actuators
- Pedals

1.6 Either: Test a range of flying control surfaces for fixed wing aircraft, to include three from the following:

- air brakes
- spoilers
- flaps
- tail plane
- ailerons
- canards
- elevators
- trim tabs
- rudders

Or: Test a range of flying control surfaces for rotary wing aircraft, to include two items from the following:

- main rotor blades
- stabilisers
- tail rotor blades
- trim tabs

1.7 Carry out flying control system and surface tests, to include three from the following:

- functional check
- full and free tests
- static friction check

- before flight checks
- use of safety locks
- ground run tests
- rigging check
- tension adjuster checks
- after flight checks

1.8 Deal with two of the following complexities during the testing activities:

- system with no faults
- system with faults
- system with intermittent faults

1.9 Use three of the following fault finding techniques during tests:

- six point
- half split
- input to output
- function testing
- equipment self diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests of the flying control system in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MOD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft flying control surfaces and systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need

to observe when testing aircraft control surfaces and systems

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

2.4 Explain what protective clothing and equipment needs to be worn during the testing activities, and where it can be obtained

2.5 Describe the hazards associated with testing flying control surfaces and systems, and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.6 Explain the correct operating procedures of the system being tested

2.7 Explain the electrical bonding specifications, and their importance

2.8 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken

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

2.10 Explain how to read and interpret the test schedules and specifications, and whom they can seek assistance from 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 flying control surfaces and system components

2.12 Explain what test equipment needs to be used, and its selection for the particular tests

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

2.14 Explain the basic principle of operation of the system under test, and the function of the individual components within the system

2.15 Explain the need to apply the tests in incremental stages, and to check all readings, movements and pressures at each stage

2.16 Explain the importance of ensuring that pressure is maintained, and the methods used to detect leaks and faults with the system

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 Describe the 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 459 Testing aircraft flying control surfaces and systems

Supporting information

Guidance

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

2.8 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

Unit 460 Testing aircraft armament systems

UAN:	**R/601/4577**
Level:	3
Credit value:	50
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 060: Testing Aircraft Armament 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 armament systems, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft, and includes equipment and components associated with guns, missiles, rockets, torpedoes, bombs, depth charges, and other systems, 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 complexity of tests involved will include the testing of guns, missiles, rockets, torpedoes, bombs, depth charge firing, release and guidance systems. The learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft armament system 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 and instruction, taking personal responsibility for their own actions and for the quality and accuracy of the tests that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying aircraft armament system test procedures. The learner will understand the armament system under test, and its application, and will know about

the test equipment and test techniques, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when testing the aircraft armament system, and with its 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 test aircraft armament 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 armament systems: • obtain and use the appropriate documentation (such as job instructions, aircraft armament equipment 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • Carry out the tests using the specified techniques and procedures • 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 armament systems and equipment, using three of the following tools or test equipment: • safety ohmmeter

- ‘special-to-type’ test rigs
- spring balance
- multimeter
- connecting equipment
- other test devices

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

1.6 Test two of the following aircraft armament systems:

- gun
- missile
- rocket
- bomb
- torpedo
- ordnance release system
- depth charge

1.7 Carry out three of the following types of test:

- continuity tests
- ‘no volts’ tests
- system components tests
- pull-off release tests
- alignment tests
- ‘special-to-type’ tests

1.8 Deal with two of the following levels of complexity during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use three of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests to one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four of the following:

- data sheets
- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome

The learner will:

2. Know how to test aircraft armament systems

Assessment criteria

The learner can:

2.1 Explain the specific safety practices and procedures that they need to observe when testing aircraft armament systems

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

2.4 Explain what protective clothing and equipment needs to be worn, and where it can be obtained

2.5 Describe the hazards associated with testing aircraft armament systems and with the tools and equipment used, and explain how to minimise them and reduce any risks

2.6 Explain the correct operating procedures of the armament system being tested

2.7 Explain the electrical bonding specifications, and their importance

2.8 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken

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

2.10 Explain how to read and interpret the 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 testing methods and procedures to be used to carry out the various tests on the armament and release system components

2.12 Explain what test equipment is to be used, and its selection for the particular tests

2.13 Explain the calibration of the test equipment, and the currency/issue checks that need to be carried out

2.14 Describe the fault finding techniques to be used if the system fails the tests

2.15 Describe the techniques, methods and procedures to be used during the tests

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

2.17	Explain the basic principle of operation of the system under test, and the function of the individual components within the system
2.18	Explain the need to apply the tests in incremental stages, and to check all readings, movements and pressures at each stage
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 make valid decisions about the acceptability of the aircraft
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 responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 460 Testing aircraft armament systems

Supporting information

Guidance

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

2.8 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.13 (where applicable)

Unit 461 Testing aircraft assisted escape systems

UAN:	**D/601/4579**
Level:	3
Credit value:	50
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 061: Testing Aircraft Assisted Escape 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 assisted escape systems, in accordance with approved procedures. It includes the testing of units and components associated with ejection seats, canopy jettison and fragmentation systems, parachute assemblies, evacuation chutes, armed emergency doors and other systems, 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 learner's responsibilities will require them to comply with organisational policy and procedures for the aircraft assisted escape system 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 and instruction, taking personal responsibility for their own actions and for the quality and accuracy of the tests that they carry out. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying test procedures for aircraft assisted escape systems. The learner will understand the escape system under test, and its application, and will know about the test equipment and test techniques, in adequate depth to provide a sound basis for carrying out the activities,

correcting faults and ensuring that the tested system performs to the required specification.

The learner will understand the safety precautions required when testing the aircraft assisted escape systems, in particular those associated with explosive devices for which personnel must be authorised and fully conversant. 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 test aircraft assisted escape 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 assisted escape systems: • obtain and use the appropriate documentation (such as job instructions, aircraft assisted escape equipment 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 safety procedures • ensure that isolation procedures are followed and that safe working distance procedures are set up • carry out the tests, using the specified techniques and procedures • 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 assisted escape systems and equipment, using three of the following tools or test equipment: • safety ohmmeter • multimeter

- ‘special-to-type’ test rigs
- air pressure gauges
- connecting equipment
- other test devices

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

1.6 Carry out specified checks to one of the following aircraft assisted escape systems, to ensure that correct procedural operation will occur:

- ejection seats
- parachute assemblies
- armed emergency doors
- canopy jettison/fragmentation systems
- evacuation chutes

1.7 Carry out all of the following types of test:

- ‘no volts’ check
- continuity checks
- system components tests
- pressure leakage checks
- visual Inspection

1.8 Deal with two of the following levels of complexity during the testing activities:

- equipment with no faults
- equipment with faults
- equipment with intermittent faults

1.9 Use three of the following fault finding techniques:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

1.10 Carry out tests in accordance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific equipment requirements

1.11 Record the results of the tests in the appropriate format

1.12 Review the results and carry out further tests if necessary

1.13 Review fault symptoms and history of problems using four from:

- data sheets

- calibration records
- log cards/history sheet
- aircraft documentation
- fault records
- maintenance records

Learning outcome
The learner will: 2. Know how to test aircraft assisted escape systems
Assessment criteria
The learner can: 2.1 Explain the specific safety practices and procedures that they need to observe when testing aircraft assisted escape systems and associated explosive devices 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 Explain the safety procedures that must be carried out before work is started on the aircraft 2.4 Explain what protective clothing and equipment needs to be worn, and where it may be obtained 2.5 Describe the hazards associated with checking and testing aircraft assisted escape mechanisms, and how to minimise them and reduce any risks 2.6 Explain the correct operating procedures of the system being tested 2.7 Explain the electrical bonding specifications, and their importance 2.8 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken 2.9 Explain how to obtain the required test schedules and specifications for the aircraft type being tested, and how to check their currency and validity 2.10 Explain how to read and interpret the 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 testing methods and procedures to be used to carry out the various tests on the assisted escape mechanisms and system components 2.12 Explain what test equipment is to be used, and its selection for the particular tests 2.13 Explain the calibration of the test equipment (where applicable), and the currency/issue checks that need to be carried out 2.14 Describe the fault finding techniques to be used if the system fails 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 activities 2.16 Explain the basic principle of operation of the system under test, and the function of the individual components within the system 2.17 Explain the need to carry out the tests in the specified sequence 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	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 control 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 responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 461 Testing aircraft assisted escape systems

Supporting information

Guidance

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

2.8 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.13 (where applicable)

Unit 493 Applying finishes to aircraft composite mouldings

UAN:	**L/601/4707**
Level:	3
Credit value:	46
GLH:	126
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 093: Applying Finishes to Aircraft Composite Mouldings (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 apply finishes to aircraft composite mouldings, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to apply finishes, using the correct techniques. The learner will apply finishes to aircraft composite mouldings using a range of techniques and processes. A variety of finishes will be applied to a range of resin and fibre materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the finishing activities undertaken, and to report any problems with the activities, equipment or materials 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 finishing techniques and procedures to aircraft composite mouldings. The learner will understand the finishing techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the finishing operations, 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 apply finishes to aircraft composite mouldings
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 finishing activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 composite finishing activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved mould finishing techniques and procedures at all times • return all tools and equipment to the correct location on completion of the mould finishing activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Check that the material surfaces to be treated are suitably prepared for the finishing operations to be carried out 1.4 Carry out all of the following activities when preparing for the finishing activity: • check that mouldings are correct and complete • check for any defects in the mouldings • check availability of ancillary materials required • select the correct equipment for the activity • check that the equipment is suitable for use • identify and protect the moulding in the work area 1.5 Prepare surfaces of composite mouldings, using two of the following methods: • abrading • bead blasting

- water cleaning
- solvent cleaning
- priming

1.6 Apply finishes to composite mouldings, using four of the following consumable materials:

- abrasives
- masking tapes
- masking films
- polishes
- thinners
- solvents
- stoppers
- fillers
- sealers
- primers
- cutting compounds
- cleaning agents

1.7 Check that the finishing equipment and treatment solutions are set up and maintained at satisfactory operating conditions and levels

1.8 Apply two types of finish to composite mouldings from:

- surface sealers
- primers
- top coats
- adhesive films
- UV coatings
- heatproof coatings
- speciality coatings
- flexible coatings

1.9 Apply finishes to composite mouldings, using three of the following:

- one-part finishes
- two-part finishes
- multiple coatings
- combination coats
- solvent based
- adhesive based
- water based
- single coatings

1.10 Carry out the treatment process in accordance with operating procedures and the component specification requirements

1.11 Apply finishes to composite mouldings, using two of the following techniques:

- cloth application
- brush
- spray
- laying films
- roller

1.12 Apply finishes suitable for two of the following resin types:
- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.13 Apply finishes suitable for two of the following fibre types:
- polyethylene
- glass
- aramid
- carbon

1.14 Check that the treated workpiece achieves the required characteristics and meets the finishing specification

1.15 Apply finishes to a range of mouldings in compliance with one of the following:
- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

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

1.17 Dispose of waste and excess materials in line with agreed organisational procedures

1.18 Shut down the finishing equipment to a safe condition on completion of the processing activities

Learning outcome
The learner will: 2. Know how to apply finishes to aircraft composite mouldings
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with applying finishes to aircraft composite materials, and with the consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area 2.3 Explain what protective equipment is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables 2.5 Explain the specific workshop environmental conditions that must be observed when applying finishes to aircraft composite

	mouldings
2.6	Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken
2.7	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.8	Explain the conventions and terminology used for applying finishes
2.9	Describe the different types of composite resin systems, fibres, reinforcements, and their merits
2.10	Describe the different finishes applied to aircraft composites, and their merits
2.11	Describe the correct methods of storage, handling and disposal of finishing materials
2.12	Explain the methods of preparation for applying different finishes
2.13	Explain the mixing ratios for two-part finishes, and the associated working times
2.14	Describe the methods of application for different finishes
2.15	Describe the problems that can occur during the finishing process
2.16	Explain how defects can be overcome during the finishing activity
2.17	Describe the tools and equipment used in finishing activities, and explain their care, preparation and control procedures
2.18	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 493 Applying finishes to aircraft composite mouldings

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.7 (in relation to currency, issue, meeting specification)

2.8 (such as surface keying, finish thickness, matt finish, gloss finish, treatment reactions)

2.15 (including defects such as contamination)

Unit 602 Producing aircraft composite mouldings using pre-preg laminating techniques

UAN:	**F/601/5188**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 202: Producing Aircraft Composite Mouldings using Pre-Preg Laminating Techniques (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 produce aircraft composite mouldings using pre-preg laminating techniques, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to produce various mouldings, using the correct pre-preg laminating production techniques. The learner will be expected to prepare a range of tooling, apply release agents, and prepare aircraft composite materials. The learner will produce a range of aircraft composite mouldings, incorporating a variety of features and using a range of techniques and processes. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the production activities undertaken, and to report any problems with the production activities, equipment or materials 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 pre-preg laminating techniques and procedures. The learner will understand the production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring that the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the moulding 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 produce aircraft composite mouldings using pre-preg laminating techniques
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 moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 pre-preg laminating activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved pre-preg laminating techniques and procedures at all times • return all tools and equipment to the correct location on completion of the pre-preg laminating activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Follow the correct component drawing or any other related specifications for the component to be produced 1.4 Determine what has to be done and how this will be achieved 1.5 Obtain and prepare the appropriate tools, equipment and materials 1.6 Carry out all of the following activities when preparing production tooling:

- check that tooling is correct and complete
- clean the tooling and remove resin buildups
- check for surface defects
- correctly apply sealers/release agents
- clean and store tooling suitably after use

1.7 Produce a range of mouldings using techniques for four of the following types of production tool:

- metal
- wet lay-up
- glass pre-preg
- tooling block
- carbon pre-preg
- female tooling
- male tooling
- multi-part tools
- matched tooling
- closed tooling

1.8 Carry out all of the following activities to prepare materials for production:

- obtain the correct materials for the activity
- thaw material removed from freezer storage
- identifying defects in pre-preg materials
- check that materials are fit for purpose and in life
- check the availability of required ancillary materials
- cut materials to the correct shape and orientation
- check the materials when provided in kit form
- identify and protect materials in the work area

1.9 Produce a range of mouldings using techniques for one type of resin from:

- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.10 Produce a range of mouldings using techniques for two types of fibre from:

- polyethylene
- glass
- aramid
- carbon

1.11 Produce a range of mouldings using techniques for two types of reinforcement from:

- continuous
- uni-directional
- braids
- woven
- multi-axis
- tapes

1.12 Produce a range of mouldings using techniques for two types of core material from:
- wood
- syntactic core
- expanding core
- foam
- nomex honeycomb
- aluminium honeycomb

1.13 Carry out the moulding or laying-up activities using the correct methods and techniques

1.14 Produce a range of mouldings using four of the following methods:
- production of ply templates
- nesting of ply templates
- vacuum de-bulk
- pressure de-bulk
- intensifiers
- shaped locators
- joining boards
- loose tooling
- others

1.15 Produce a range of mouldings incorporating two of the following in the lay-up:
- butt joins
- overlap joins
- staggered joins
- orientated plies
- inverted plies
- inserts

1.16 Produce a range of mouldings incorporating five of the following shape features:
- internal corners
- external corners
- double curvature
- concave surface
- convex surfaces
- return surfaces
- joggle details
- nett edges

1.17 When using core materials, use three of the following methods:
- core templates
- pre-shaping core
- core chamfers
- peel plies
- adhesive/resin films
- core splicing
- edge filling
- single stage curing

- multi-stage curing

1.18 Use one of the following for applying temperature during the cure cycle:
- oven
- heated tools/moulds
- autoclave
- heated press

1.19 Use one of the following for applying pressure during the cure cycle:
- pressure bags
- vacuum bags
- thermal mould expansion
- fibre tensioning

1.20 Where vacuum bags are used, use four of the following processes/methods:
- check vacuum integrity
- use of vacuum fittings
- surface bagging
- envelope bagging
- pleats and tucks
- multi-part envelope bags
- internal bagging
- through-tube bagging
- reusable bagging

1.21 Produce components to the required specification

1.22 Produce a range of mouldings in compliance with one of the following:
- BS, ISO or BSEN standards
- customer standards and requirements
- company standards and procedures
- recognised compliance agency/body's standards

1.23 Check that all the required operations have been completed to specification

1.24 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 produce aircraft composite mouldings using pre-preg laminating techniques
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken, and procedures used, when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with carrying out pre-preg laminating techniques, and with the aircraft composite materials, consumables, tools and equipment used, and explain how to

minimise these and reduce any risk in the work area

2.3 Explain what protective equipment (PPE) is needed for personal protection and, where required, the protection of others

2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables

2.5 Explain what specific workshop environmental conditions must be observed when producing aircraft composite mouldings using pre-peg laminating techniques

2.6 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken

2.7 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

2.8 Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents

2.9 Explain the conventions and terminology used for pre-preg laminating techniques

2.10 Describe the different types of resin systems, fibres, reinforcements, and their merits

2.11 Explain how to build up laminates, including orientation and balance of plies to minimise spring and distortion in aircraft composite mouldings

2.12 Describe the different core, insert and filler materials, and their merits

2.13 Explain how to identify both raw and finished aircraft composite materials

2.14 Explain how to identify materials by product codes

2.15 Describe the different types of production tooling used for producing aircraft composite mouldings, and their merits

2.16 Explain how to identify and rectify defects in production tooling

2.17 Explain how to prepare the patterns, moulds and tooling

2.18 Describe the correct methods of storage, thawing and handling of pre-preg materials

2.19 Describe the methods used in the application of pre-preg materials to tooling surfaces

2.20 Describe the correct methods of storage and handling of ancillary and consumable materials

2.21 Explain how to select and use ancillary and consumable materials

2.22 Describe the tools and equipment used in the pre-preg laminating activities, and their care, preparation and control procedures

2.23 Describe the problems that can occur during the lay-up process (including modifications to the ply lay-up, and defects such as contamination and distortion)

2.24 Explain how modifications and defects can be overcome during the pre-preg laminating activity

2.25 Describe the cure cycles

2.26 Explain the need for monitoring the cure cycle using thermocouples, probes, chart recorders and data logs

2.27 Explain the procedures and methods used for removing mouldings from production tooling

2.28 Explain how to identify defects in the aircraft composite moulding

2.29 Explain the care and safe handling of production tooling and aircraft

	composite mouldings throughout the production cycle
2.30	Describe the production controls used in the work area, and actions to be taken for unaccounted items
2.31	Explain how the aircraft composite moulding relates to its own quality documents, and the production tooling used
2.32	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 602 Producing aircraft composite mouldings using pre-preg laminating techniques

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm)

2.17 (including the correct selection and use of surface sealers and release agents)

2.18 (including monitoring temperature, storage life and out-life)

2.19 (including methods of tailoring and cutting)

2.21 (such as release films, breather fabrics, bagging films, tapes) to meet performance requirements (such as temperature and compatibility)

2.25 (including temperature and pressure ramps, dwell times, post curing)

2.28 (such as de-lamination, voids, contaminants)

Unit 603 Producing aircraft composite mouldings using wet lay-up techniques

UAN:	**J/601/5192**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 203: Producing Aircraft Composite Mouldings using Wet Lay-Up Techniques (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 produce aircraft composite mouldings using wet lay-up techniques, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to produce various mouldings using the correct wet lay-up production techniques. The learner will be expected to prepare a range of tooling, apply release agents and prepare aircraft composite materials. The learner will produce a range of aircraft composite mouldings, incorporating a range of features and using a range of application methods. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the production activities undertaken, and to report any problems with the production activities, equipment or materials 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 composite moulding wet lay-up techniques and procedures. The learner will understand the production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when carrying out the wet lay-up moulding 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 produce aircraft composite mouldings using wet lay-up techniques
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 moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 wet lay-up moulding activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved wet lay-up moulding techniques and procedures at all times • return all tools and equipment to the correct location on completion of the wet lay-up moulding activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Follow the correct component drawing or any other related specifications for the component to be produced 1.4 Determine what has to be done and how this will be achieved 1.5 Obtain and prepare the appropriate tools, equipment and materials 1.6 Carry out all of the following activities when preparing production tooling:

- check that tooling is correct and complete
- clean the tooling and remove resin build-ups
- check for surface defects
- correctly apply sealers/release agents
- clean and store tooling suitably after use

1.7 Carry out all of the following activities to prepare materials for production:

- obtain the correct materials for the activity
- check that the materials are fit for purpose and in life
- cut materials to the correct size and shape
- check quantities of resins (etc) are available
- identify and protect materials in the work area
- check correct measure and mix of resin/catalyst

1.8 Produce a range of mouldings using techniques for one type of resin from:

- polyester
- vinyl ester
- epoxy
- phenolic

1.9 Produce a range of mouldings using techniques for one type of fibre from:

- polyethylene
- glass
- aramid
- carbon

1.10 Produce a range of mouldings using techniques for two types of reinforcement from:

- roving
- braids
- tapes
- chopped strand
- continuous filament
- woven.

1.11 Produce a range of mouldings using techniques for one type of core material from:

- wood
- coremat
- foam
- honeycomb

1.12 Carry out the moulding or laying-up activities using the correct methods and techniques

1.13 Produce a range of mouldings using two of the following application techniques:

- spray application of fibre/resin
- application of a gel coat
- brush application of fibre/resin
- roller application of fibre/resin

- removal of voids and air pockets
- use of vacuum bagging
- use of bleed plies

1.14 Produce a range of mouldings incorporating two of the following in the lay-up:
- feathered joins
- overlap joins
- orientated plies
- inserts
- fixtures
- butt joins

1.15 Produce a range of mouldings incorporating three of the following shape features:
- internal corner
- external corner
- double curvature
- concave surface
- convex surface
- vertical surface

1.16 Produce components to the required specification

1.17 Produce a range of mouldings in compliance with one of the following:
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- recognised compliance agency/body's standards

1.18 Check that all the required operations have been completed to specification

1.19 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 produce aircraft composite mouldings using wet lay-up techniques
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with carrying out wet lay-up moulding techniques, and with the composite materials, consumables, tools and equipment used, and explain how to minimise these and reduce any risks in the work area 2.3 Explain what protective equipment (PPE) that is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables

2.5	Explain what specific workshop environmental conditions must be observed when producing aircraft composite mouldings using wet lay-up techniques
2.6	Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken
2.7	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.8	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.9	Explain the conventions and terminology used for wet lay-up techniques
2.10	Describe the different types of resin, fibre, reinforcement, and their merits
2.11	Describe the different core and insert materials, and their merits
2.12	Explain how to build up laminates, to minimise spring and distortion in aircraft composite mouldings
2.13	Explain how to visually identify both raw and finished aircraft composite materials
2.14	Describe the different types of production tooling used for producing aircraft composite mouldings
2.15	Explain how to identify and rectify defects in production tooling
2.16	Explain how to prepare the patterns, moulds and tooling
2.17	Describe the methods for handling, preparation and application of the reinforcing fibres and fabrics
2.18	Explain the correct methods of storage and handling of ancillary and consumable materials
2.19	Explain how to estimate the resin volume/weight required to wet-out the reinforcing fibres
2.20	Explain the mixing ratios for gel coats, resins and catalysts, and the associated working times
2.21	Describe the methods used in the application of the resin/fibre during the lay-up activity
2.22	Explain the cure cycles for pre-catalysed resin films
2.23	Describe the tools and equipment used in the lay-up activities and their care, preparation and control procedures
2.24	Describe the problems that can occur during the lay-up process
2.25	Explain how defects can be prevented/overcome during the lay-up activity
2.26	Describe the procedures and methods used for removing mouldings from production tooling
2.27	Explain how to identify defects in the aircraft composite moulding
2.28	Describe the care and safe handling of production tooling and aircraft composite mouldings throughout the production cycle
2.29	Explain the production controls used in the work area, and the actions to be taken for unaccounted items
2.30	Explain how the aircraft composite moulding relates to its own quality documents and the production tooling used
2.31	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 603 Producing aircraft composite mouldings using wet lay-up techniques

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as resin and fibre weights/volumes, material orientation, material identification, material tailoring, mixing ratios, gel times, exotherm, bleed plies)

2.12 (including orientation and balance of plies)

2.16 (including the correct use of surface sealers and release agents)

2.22 (including temperature and pressure ramps and dwell times)

2.24 (including defects such as contamination, resin/fibre rich areas, and distortion)

2.27 (such as de-lamination, voids, contaminants)

Unit 604 Producing aircraft composite mouldings using resin infusion laminating techniques

UAN:	**Y/601/5195**
Level:	3
Credit value:	86
GLH:	210
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 204: Producing Aircraft Composite Mouldings using Resin Infusion Laminating Techniques (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 produce aircraft composite mouldings using resin infusion laminating techniques, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to produce various mouldings, using the correct resin infusion laminating production techniques. The learner will be expected to prepare a range of tooling, apply release agents, and prepare aircraft composite materials. The learner will produce a range of aircraft mouldings, incorporating a variety of features and using a range of techniques and processes. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the production activities undertaken, and to report any problems with the production activities, equipment or materials 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 resin infusion laminating techniques and procedures. The learner will understand the production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring that the work output is to the required specification.

The learner will understand the safety precautions required when carrying out the moulding 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 produce aircraft composite mouldings using resin infusion laminating techniques
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 moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 resin infusion laminating activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved resin infusion laminating techniques and procedures at all times • return all tools and equipment to the correct location on completion of the resin infusion laminating activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Follow the correct component drawing or any other related specifications for the component to be produced 1.4 Determine what has to be done and how this will be achieved 1.5 Obtain and prepare the appropriate tools, equipment and materials

1.6 Prepare the tooling for production, to include carrying out all of the following:

- check that tooling is correct and complete
- clean tooling and remove resin build-ups
- check for surface defects
- correctly apply sealers/release agents
- clean and store tooling suitably after use

1.7 Prepare the materials for production, to include carrying out all of the following:

- obtain the correct materials for the activity
- either thaw material removed from freezer storage or check the correct measure and mix of resin/catalyst
- check that materials are fit for purpose and in life
- cut materials to the correct shape and orientation
- check the availability of required ancillary materials
- identify and protect materials in the work area
- obtain the correct infusion media and layout for the activity

1.8 Produce aircraft composite mouldings, using techniques for two types of resin from:

- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.9 Produce aircraft composite mouldings, using techniques for two types of fibre from:

- polyethylene
- glass
- aramid
- carbon
- hybrid

1.10 Produce aircraft composite mouldings, using techniques for three types of reinforcement from:

- uni-directional
- chopped strand
- woven
- multi-axis
- knitted
- tapes
- braids

1.11 Produce aircraft composite mouldings, using techniques for two types of core materials from:

- wood
- foam
- coremat
- syntactic core

1.12 Carry out the moulding or laying-up activities using the correct methods and techniques

1.13 Produce aircraft composite mouldings, using two of the following resin infusion methods:

- interlaminar distribution
- core channel distribution
- surface distribution
- pre-catalysed resin films

AND applying one of the following techniques:

- trial runs/tracking
- full scale runs
- repairs
- dry area rectification
- vacuum regulation
- resin flow regulation

1.14 Produce a range of mouldings incorporating five of the following shape features:

- internal corners
- external corners
- double curvature
- concave surface
- convex surfaces
- return surfaces
- joggle details
- nett edges

1.15 Produce aircraft composite mouldings incorporating four of the following in the lay-up:

- feathered joins
- butt joins
- overlap joins
- staggered joins
- orientated plies
- inverted plies
- inserts
- fixtures

1.16 Produce aircraft composite mouldings using techniques for six types of resin distribution media:

- interlaminar
- channelled core
- meshes
- mats/fabrics
- peel ply
- perforated hose
- spiral wrap
- braid
- flow channels
- manifolds

- networks
- bleed plies
- breather fabric

1.17 Use six of the following vacuum bagging processes/methods:

- check vacuum integrity
- use of vacuum fittings
- surface bagging
- envelope bagging
- internal bagging
- pleats and tucks
- reusable bagging
- leak detection
- leak rectification
- catch pots/tanks
- localised resin injection
- release and breather plies

1.18 Produce components to the required specification

1.19 Produce aircraft composite mouldings in compliance with one of the following:

- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- recognised compliance agency/body's standards

1.20 Check that all the required operations have been completed to specification

1.21 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 produce aircraft composite mouldings using resin infusion laminating techniques
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken, and procedures used, when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with carrying out resin infusion laminating techniques, and with the composite materials, consumables, tools and equipment used, and explain how to minimise these and reduce any risks in the work area 2.3 Explain what protective equipment (PPE) that is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables 2.5 Explain what specific workshop environmental conditions must be observed when producing aircraft composite mouldings using resin infusion laminating techniques

2.6	Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken
2.7	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.8	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.9	Explain the conventions and terminology used for resin infusion laminating techniques
2.10	Describe the different types of resin system, fibre, reinforcement, and their merits
2.11	Explain how to visually identify both raw and finished aircraft composite materials
2.12	Describe the different types of production tooling used for producing aircraft composite mouldings
2.13	Explain how to build up the laminates, to minimise spring and distortion in aircraft composite mouldings
2.14	Describe the different core and insert materials, and their merits
2.15	Describe the different types of resin distribution media, and their merits
2.16	Explain how to identify and rectify defects in production tooling
2.17	Explain the methods of preparation for patterns, moulds and tooling
2.18	Explain the methods for handling, preparation and application of the reinforcing fibres and fabrics
2.19	Explain the correct methods of storage and handling of ancillary and consumable materials
2.20	Explain the methods used in the positioning and application of the resin distribution media
2.21	Explain the mixing ratios for resins and catalysts, and the associated working times for two-part resin systems
2.22	Explain the cure cycles for pre-catalysed resin films
2.23	Describe the tools and equipment used in the resin infusion laminating activities, and explain their care, preparation and control procedures
2.24	Describe the problems that can occur during the lay-up process
2.25	Explain the procedures and methods used for removing mouldings from production tooling
2.26	Explain how to identify defects in the composite moulding
2.27	Describe the care and safe handling of production tooling and aircraft composite mouldings throughout the production cycle
2.28	Describe the production controls used in the work area, and actions to be taken for unaccounted items
2.29	Explain how the aircraft composite moulding relates to its own quality documents and the production tooling used
2.30	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 604 Producing aircraft composite mouldings using resin infusion laminating techniques

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as material orientation, material identification, distribution media, resin viscosity, flow paths, ply lay-up, vacuum bagging, resin and fibre weights/volumes, gel times, exotherm, bleed plies)

2.13 (including orientation and balance of plies)

2.17 (including the correct selection and use of surface sealers and release agents)

2.22 (including temperature and pressure ramps and dwell times)

2.24 (including defects such as contamination, incomplete wet out, vacuum leaks, flow restrictions)

2.26 (such as de-lamination, voids, contaminants)

Unit 605 Trimming aircraft composite mouldings using hand tools

UAN:	**H/601/5197**
Level:	3
Credit value:	46
GLH:	105
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 205: Trimming Aircraft Composite Mouldings using Hand Tools (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 trim aircraft composite mouldings using hand tools, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to trim various mouldings, using the correct trimming techniques. The learner will be expected to select the correct tools and equipment for the trimming activity. The learner will trim a range of aircraft composite mouldings incorporating a variety of features, and using cutting, sanding, drilling and polishing techniques and processes. Mouldings trimmed will include a range of resin and fibre materials. The learner's responsibilities will require them to comply with organisational policy and procedures for the trimming activities undertaken, and to report any problems with the trimming activities, equipment or materials 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 trimming techniques and procedures to aircraft composite mouldings. The learner will understand the trimming techniques used, and

their application, 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 trimming 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 trim aircraft composite mouldings using hand tools
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 trimming activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 composite mould trimming activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved mould trimming techniques and procedures at all times • return all tools and equipment to the correct location on completion of the mould trimming activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Carry out all of the following activities when preparing for the trimming activity: • check that the moulding is correct and complete • check for any defects in the moulding • select the correct equipment for the activity • check that the equipment is suitable for use • identify and protect the moulding in the work area 1.4 Follow relevant specifications for the component to be produced 1.5 Obtain the appropriate tools and equipment for the shaping operations and check that they are in a safe and usable condition 1.6 Mark out mouldings using two of the following methods:

- scriber
- height gauge
- moulded scribe lines
- centre punch
- trimming templates
- chinagraph
- paint pens

1.7 Trim mouldings using techniques for two of the following resins types:

- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.8 Trim mouldings using techniques for two of the following fibre types:

- polyethylene
- glass
- aramid
- carbon

1.9 Shape the materials using appropriate methods and techniques

1.10 Cut mouldings using two the following methods:

- cutting wheels/discs
- saws
- routers
- trim jigs

1.11 Sand mouldings using three of the following methods:

- rubbing blocks
- diamond files
- pencil grinders
- disc sanders
- belt sanders

1.12 Use hand drill or pedestal drill to drill mouldings, using three of the following methods:

- drill jigs
- hole saws
- counterbores
- countersinks
- drill bits

1.13 Polish mouldings using two of the following methods:

- wet sanding
- cutting compound
- polishing compound
- rubbing block
- orbital sander

- polisher

1.14 Trim mouldings that require, or incorporate, eight of the following features:
- straight edges
- curved edges
- flat surfaces
- polished surfaces
- shaped surfaces
- radius corners
- returns
- nett edges
- joggle details
- removal of join lines
- multiple holes
- multiple hole sizes
- countersinks
- counterbores
- further lay-up stages
- inserts to be drilled
- inserts to be tapped
- solid cores
- honeycomb cores
- edge filling

1.15 Check that all the required shaping operations have been completed to the required specification

1.16 Trim a range of aircraft mouldings in compliance with one of the following:
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- recognised compliance agency/body's standards

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 trim aircraft composite mouldings using hand tools
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with trimming aircraft composite mouldings and with the materials, consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area 2.3 Explain what protective equipment (PPE) that is needed for personal protection and, where required, the protection of others

2.4	Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables
2.5	Explain what specific workshop environmental conditions must be observed when trimming aircraft composite mouldings
2.6	Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken
2.7	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.8	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.9	Explain the conventions and terminology used for trimming activities
2.10	Describe the different types of manual and power tool, and their merits
2.11	Describe the different types of cutting tool and abrasive, and their merits
2.12	Describe the different types of material used in cutting tools and abrasives, and their merits
2.13	Describe the different types of resin, fibre, reinforcement, and their merits
2.14	Explain how to visually identify the cured aircraft composite materials
2.15	Explain how to identify and rectify defects in composite mouldings
2.16	Describe the methods used in the trimming of aircraft composite mouldings
2.17	Explain the operations and their sequence when preparing for trimming activities
2.18	Explain the methods for handling aircraft composite mouldings throughout the trimming activities
2.19	Describe the tools and equipment used trimming activities, and explain their care, preparation and control procedures
2.20	Explain the care and safe handling of aircraft composite mouldings throughout the trimming cycle
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 605 Trimming aircraft composite mouldings using hand tools

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as scribe lines, sanding grades, types of cutting tools, speeds)

Unit 606 Identifying defects in aircraft composite mouldings

UAN:	**Y/601/5200**
Level:	3
Credit value:	30
GLH:	52
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 206: Identifying Defects in Aircraft Composite Mouldings (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 identify and deal with defects in aircraft composite mouldings, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to identify and deal with defects in aircraft composites mouldings. The learner will be able to identify a range of defects in aircraft composite mouldings using various methods and techniques. Defects will be identified in a range of mouldings with a variety of resin and fibre materials. 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 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 identifying defects in aircraft composite mouldings, and to making decisions on what action needs to be taken. The learner will understand aircraft composite materials, and their application, and will know about defects in adequate depth to provide a sound basis for dealing with the defects in line

	with organisation practice and procedures. The learner will understand the safety precautions required when working with the aircraft composite mouldings and when using 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 identify defects in aircraft composite mouldings
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 inspection activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 composite inspection activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved mould inspection techniques and procedures at all times • return all tools and equipment to the correct location on completion of the inspection activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Identify defects with regard to the product or asset specification 1.4 Identify defects in aircraft composite mouldings, using four of the following methods: • touch • sound • visual • measurement • mechanical tests • coordinate measuring machine (CMM) • non-destructive testing (NDT) • stage inspection 1.5 Identify defects in five of the following types of aircraft composite moulding:

- trim
- closing panels
- housings
- body panels
- tubes
- sections
- sandwich panels
- structural
- aerodynamic
- moulds
- jigs
- CFRP
- Invar 36

1.6 Identify defects applicable to two of the following resin types:

- polyester
- vinyl ester
- epoxy
- phenolic
- bismaleimide
- cyanate ester

1.7 Identify defects applicable to two of the following fibre types:

- polyethylene
- glass
- aramid
- carbon

1.8 Identify eight of the following types of defect in aircraft composite mouldings:

- incomplete curing
- dimensional
- tolerances
- ply orientation
- wrong join type
- surface finish
- distortion
- blisters
- bridging
- de-lamination
- wrinkles
- broken fibres
- splintering
- voids
- dents or ‘dings’
- dis-bonds
- resin rich areas
- incorrect material
- excessive adhesive

- damaged cores
- wrong inserts
- insert positions
- impact damage

1.9 Check that the actions recommended to rectify the defect comply with one of the following:

- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- recognised compliance agency/body's standards

1.10 Assess the defects and determine action required to return the product or asset to specified condition

1.11 Report recommendations for action to the appropriate people promptly and in accordance with organisational procedures

1.12 Record details of defects in accordance with quality assurance and control systems and procedures

Learning outcome
The learner will: 2. Know how to identify defects in aircraft composite mouldings
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with inspecting aircraft composite mouldings and with the materials, consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area 2.3 Explain what protective equipment is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables 2.5 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken 2.6 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents 2.8 Explain the conventions and terminology used when identifying and rectifying defects 2.9 Explain the failure modes for various aircraft composite mouldings, and what can contribute to these 2.10 Describe the different types of composite resin system, fibre, reinforcement, and their merits 2.11 Describe the different methods of production for aircraft composite mouldings, and their merits 2.12 Describe the different methods of trimming aircraft composite mouldings, and their merits

2.13	Describe the different methods of producing aircraft composite assemblies, and their merits
2.14	Describe the different bonding agents, methods used, and their merits
2.15	Explain the correct methods of storage and handling of aircraft composite materials
2.16	Describe the tools and equipment used for various activities associated with aircraft composite mouldings
2.17	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 606 Identifying defects in aircraft composite mouldings

Supporting information

Guidance

2.5 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.7 (in relation to currency, issue, meeting specification)

2.8 (such as dis-bonds, de-lamination, resin injection, resin voids, core potting, repair patches)

Unit 607 Repairing aircraft composite mouldings

UAN:	**D/601/5201**
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 207: Repairing Aircraft Composite Mouldings (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 aircraft composite mouldings, in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to bond advanced aircraft composites materials, using the correct techniques. The learner will be expected to identify the method of repair to be used and select suitable repair materials. The learner will repair a range of aircraft composite mouldings with various defects using a range of methods. Mouldings repaired will include a range of resin and fibre materials. 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, equipment or materials 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 produce. The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying composite moulding repair procedures. The learner will understand the repair techniques used, and their application, 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 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 repair aircraft composite mouldings
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 repair activities: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 composite mould repair activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved mould repair techniques and procedures at all times • return all tools and equipment to the correct location on completion of the mould repair activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities 1.3 Follow the relevant specifications for the component to be repaired 1.4 Repair a range of mouldings in compliance with one of the following: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • recognised compliance agency/body's standards 1.5 Prepare the component for repair 1.6 Carry out all of the following activities when preparing for the repair activity: • check that the mouldings are correct and complete • identify the method of repair to be used • check the availability of required ancillary materials

- select the correct equipment for the activity
- check that the equipment is suitable for use
- identify what needs to be repaired
- identify and protect the moulding and repair materials in the work area

1.7 Carry out the repairs within agreed timescale using approved materials and components and methods and procedures

1.8 Repair defects in five of the following types of composite mouldings:

- trim
- closing panels
- housings
- body panels
- tubes
- sections
- sandwich panels
- structural
- aerodynamic
- moulds
- jigs
- CFRP
- Invar 36

1.9 Repair defects in composite mouldings using four of the following methods:

- localised curing
- fettling
- surface filling
- relieving distortion
- separation of bonds
- bonding
- resin injection
- wet-lay patching
- pre-preg patching
- core patching
- insert/core potting
- repair patches/kits

1.10 Repair defects using techniques/materials applicable to two of the following resins types:

- polyester
- epoxy
- bismaleimide
- cyanate ester
- phenolic
- vinyl ester

1.11 Repair defects using techniques/materials applicable to two of the following fibre types:

- polyethylene

- glass
- aramid
- carbon

1.12 Repair eight of the following types of defect in composite mouldings:

- incomplete curing
- dimensional
- tolerances
- surface finish
- distortion
- blisters
- bridging
- de-lamination
- broken fibres
- voids
- dis-bonds
- dents or 'dings'
- excessive adhesive
- damaged cores
- wrong inserts
- insert positions
- impact damage

1.13 Check that the repaired component meets the specified operating conditions

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

Learning outcome
The learner will: 2. Know how to repair aircraft composite mouldings
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with repairing aircraft composite mouldings and with the materials, consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area 2.3 Explain what protective equipment that is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables 2.5 Explain what specific workshop environmental conditions the must be observed when repairing aircraft composite mouldings 2.6 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken 2.7 Explain how to interpret first and third angle drawings, imperial and

	metric systems of measurement, workpiece reference points and system of tolerancing
2.8	Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents
2.9	Explain the conventions and terminology used when repairing composite mouldings
2.10	Explain the failure modes for various aircraft composite mouldings, and what can contribute to these
2.11	Describe the different types of composite resin system, fibre, reinforcement, and their merits
2.12	Describe the different methods of production for aircraft composite mouldings, and their merits
2.13	Describe the different methods of trimming aircraft composite mouldings, and their merits
2.14	Describe the different methods of producing aircraft composite assemblies, and their merits
2.15	Describe the different bonding agents, methods used, and their merits
2.16	Explain the correct methods of storage and handling of aircraft composite materials
2.17	Describe the tools and equipment used for various activities associated with repairing aircraft composite mouldings
2.18	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 607 Repairing aircraft composite mouldings

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as dis-bonds, de-lamination, resin injection, resin voids, core potting, repair patches)

Unit 608 Bonding aircraft composite materials

UAN:	**K/601/5203**
Level:	3
Credit value:	30
GLH:	52
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 208: Bonding Aircraft Composite Materials (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 join aircraft metallic and composite components and materials (such as cured panels, moulded components, base materials), in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to bond advanced aircraft composites materials, using the correct techniques. The learner will produce a range of bonded aircraft composite materials and mouldings, incorporating a variety of features and using a range of techniques and processes. The learner's responsibilities will require them to comply with organisational policy and procedures for the bonding activities undertaken, and to report any problems with the bonding activities, equipment or materials 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 aircraft composite bonding techniques and procedures. The learner will understand the bonding techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and

ensuring that the work produced is to the required specification.

The learner will understand the safety precautions required when carrying out the aircraft composite bonding 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 bond aircraft composite materials
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 bonding activities: • obtain and use the appropriate documentation (such as job instructions, assembly drawings, planning and quality control documentation, material/adhesive data sheets, 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 composite bonding activities • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition • follow safe practice/approved composite bonding techniques and procedures at all times • return all tools and equipment to the correct location on completion of the composite bonding 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 Carry out all of the following activities when preparing for the bonding activity: • check that the mouldings are correct and complete • check for any defects in the mouldings • check that the bonding materials are within life • check the availability of required ancillary materials • select the correct equipment for the activity • check that the equipment is suitable for use • identify and protect the moulding and bonding materials in the work area • check that the bonding materials are correct and complete

- correctly prepare the materials for bonding
- correctly prepare the joint surfaces and check that they mate properly to make a sound joint possible
- ensure that the joint is held rigidly secure during the curing period

1.4 Follow the relevant bonding procedure specification and job instructions

1.5 Check that the materials to be bonded and bonding agents comply with the specification

1.6 Use techniques for bonding two of the following materials to the composite moulding:

- wood-based materials
- metals
- ceramics
- plastics
- other composites

1.7 Bond composite mouldings using techniques for two of the following:

- one-part pastes
- contact adhesives
- two-part pastes
- film adhesives
- syntactic films

1.8 Bond composite mouldings using adhesives suitable for two of the following fibre types:

- polyethylene
- glass
- aramid
- carbon
- other specific types

1.9 Bond composite mouldings using adhesives suitable for two of the following resin types:

- polyester
- epoxy
- phenolic
- bismaleimide
- cyanate ester
- vinyl ester

1.10 Correctly prepare the parent materials and bonding agents in line with the bonding specification

1.11 Prepare bonding surfaces using four of the following methods:

- peel plies
- templates
- laser ablation
- abrading
- bead blasting
- water cleaning
- solvent cleaning

- dry fitting
- acid etching
- priming
- surface masks

1.12 Carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations

1.13 When bonding composite mouldings, use three of the following methods:

- dry fitting
- bonding sequences
- shimming materials
- mixing adhesives
- wetting-out by brush
- applicator gun
- laying film adhesives
- oven curing
- heated press

1.14 Bond composite mouldings using techniques for two of the following:

- sandwich panels
- butt joins
- overlap joins
- joggle joins
- return joins

1.15 Bond composite mouldings using techniques for two of the following:

- flat surfaces
- shaped surfaces
- internal surfaces
- external surfaces

1.16 Ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly

1.17 During curing, retain the bond using two of the following:

- weighting down
- bonding jigs
- pinning joins
- pressure bagging
- clamping
- press
- vacuum bagging

1.18 Achieve bonds of the required quality and within the specified dimensional accuracy

1.19 Bond a range of mouldings in compliance with one of the following:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)

- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures
- specific material/joint requirements

1.20 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 bond aircraft composite materials
Assessment criteria
The learner can: 2.1 Explain the health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area 2.2 Describe the hazards associated with bonding aircraft composite mouldings and with the materials, consumables, tools and equipment used, and explain how to minimise them and reduce any risks in the work area 2.3 Explain what protective equipment that is needed for personal protection and, where required, the protection of others 2.4 Explain the application of COSHH regulations in relation to the storage, use and disposal of aircraft composite materials and consumables 2.5 Explain what specific workshop environmental conditions must be observed when bonding aircraft composite mouldings 2.6 Explain how to extract and use information from engineering drawings and related specifications in relation to work undertaken 2.7 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.8 Describe the quality procedures used in the workplace to ensure production control, and the completion of such documents 2.9 Explain the conventions and terminology used for bonding 2.10 Describe the different types of composite resin system, fibre, reinforcement, and their merits 2.11 Describe the different bonding agents, and their merits 2.12 Explain the correct methods of storage and handling of bonding agents 2.13 Explain what material preparations are required, and the equipment and consumables that are used 2.14 Describe the methods of preparing the components and producing a keying surface 2.15 Explain the importance of working to organisational and bonding agent manufacturers' instructions whilst carrying out the preparation and bonding activities 2.16 Describe the methods and techniques used for bonding the materials 2.17 Explain the basic characteristics of the adhesives that are to be used 2.18 Explain the use of adhesives and solvents, and precautions to be taken

2.19	Explain the mixing procedures and ratios for two-part pastes, and the associated working times
2.20	Describe the methods of application for different bonding agents
2.21	Explain the type and suitability of adhesives; setting or curing requirements; and time, strength and appearance
2.22	Describe the methods of retaining the bond during curing, and their merits
2.23	Describe the bonding agent equipment
2.24	Explain the procedures for cleaning off surplus adhesive and tidying up the appearance of joints
2.25	Explain the effects of the environment on the bonding process
2.26	Describe common causes of defects associated with the bonding processes, and explain how to avoid them
2.27	Explain the reasons for checking that components are assembled in the correct sequence, are positioned dimensionally accurately and to the correct orientation, in accordance with the specifications prior to bonding
2.28	Explain how to check that completed joints are firm, sound and fit for purpose
2.29	Explain how to identify and rectify bond defects
2.30	Describe the problems that can occur during the bonding process
2.31	Explain how defects can be prevented/overcome during the bonding activity
2.32	Describe the extent of their own responsibility and explain to whom they should report if they have problems that they cannot resolve

Unit 608 Bonding aircraft composite materials

Supporting information

Guidance

2.5 (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)

2.6 (to include symbols and conventions to appropriate BS, ISO or BSEN standards)

2.8 (in relation to currency, issue, meeting specification)

2.9 (such as gel points, cure times, bond thickness, bond strength, peel strength)

2.14 (such as re-activation, degreasing, priming procedures and alocrome procedures)

2.16 (such as gluing, impact, chemical and thermal reaction techniques, bagging and positive pressure techniques)

2.23 (such as holding vessels, brushes, stirrers and spatulas, scrapers, knives, clamps and weights)

2.25 (such as temperature, humidity, cleanliness)

2.28 (such as types of failure mode, effect of poor pressure application, the effect of inadequate curing)

2.30 (including defects such as contamination and distortion)

Unit 611 Setting plastic injection moulding machines for production of aircraft components

UAN:	**K/601/6111**
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 211: Setting Plastic Injection Moulding Machines for Production of Aircraft 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 check and set up plastic injection moulding machines, for the production of components used in aircraft manufacture, in accordance with approved procedures. The learner will obtain the correct mould tools for the production activity and check that they are free from damage or non-conformance which could impair the quality of the mouldings produced. The learner will be expected to mount the moulds in the machines, using safe and approved techniques and procedures. The learner will need to check that all services required to operate the machine are connected and fully operational. The learner will be required to set all the machine operating conditions and test all the delivery/collection and safety systems which are in place on the machine, and to confirm that they are operational. The learner's responsibilities will require them to comply with organisational policy and procedures for the setting of the plastic injection moulding machines, and to report any problems with the plastic injection moulding machines, materials or equipment in use, that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, 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 show a good understanding of their work, and will provide an informed approach to the setting of plastic injection moulding machines. The learner will understand the different types of moulding tool used, how the moulds are located and secured to the machine, and how the machine conditions are set to achieve the optimum results. The learner's knowledge will enable them to identify any faults in the moulds, the machine or the connected services, and they will understand the actions that are required to correct these faults.

The learner will understand the safety precautions required when setting up plastic injection moulding machines 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 set plastic injection moulding machines for production of aircraft 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 setting up of the plastic injection moulding machines: • obtain and use the appropriate documentation (such as job instructions, drawings, planning and quality control documentation, material data sheets, 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 injection moulding activities • obtain the correct materials for the moulding operations (correctly sealed, colour, size, composition) • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition (part marked, cleared inspection, undamaged) • follow safe practice/approved injection moulding setting-up techniques and procedures at all times • return all tools and equipment to the correct location on completion of the injection moulding activities • dispose of waste materials in accordance with approved procedures • leave the work area in a safe and appropriate condition on completion of the activities

1.3 Follow the relevant material processing specification and job instructions for the processing operations being performed

1.4 Determine what processing operations are to be performed and how the equipment will be prepared and set up to achieve this

1.5 Prepare the machine for use, to include carrying out all of the following:

- checking that mould tools are free from damage and are correctly and securely mounted
- ensuring that all machine services are connected and operational (such as water, electrical, pneumatic, hydraulic)
- setting the mould tool heating and cooling arrangements
- setting and checking that the material feed systems are operating correctly
- setting and checking that all machine safety mechanisms and features are operating correctly (such as guards, emergency stop)
- setting the mould protection pressure safety conditions
- setting up the machine operating conditions to suit the moulds being produced
- checking that all the machine controls function correctly

1.6 Mount and secure two of the following types of mould tool, using the correct location devices:

- two plate tools
- three plate tools
- combination/composite tools
- split tools
- unscrewing tools

1.7 Prepare and set two of the following component delivery/collection systems:

- robotic
- conveyor
- separators
- collection chute/bins

1.8 Check that any consumables required are available and that they are suitable for the work to be carried out

1.9 Check the materials used during the production cycle, to include all of the following:

- the required materials are available in sufficient quantities
- the materials meet the component specification
- the materials have been correctly prepared and mixed for the moulding operation

1.10 Produce plastic injection mouldings using two of the following materials:

- acrylonitrile-butadiene-styrene (ABS)
- nylon
- polycarbonate
- polypropylene
- polystyrene
- polyethelene

- acetal
- other specific material

1.11 Set the equipment operating parameters to achieve the required material property changes and processing specification

1.12 Set and adjust all of the following moulding parameters to meet the component specification:

- temperature
- pressure
- speed/timings
- distance

1.13 Make adjustments to the machine settings to deal with three of the following component defects:

- flashing
- short shot
- distortion
- burning
- colour deviation

1.14 Set the plastic injection moulding machines in compliance with one of the following standards:

- Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
- Ministry of Defence (MoD)
- Federal Aviation Authority (FAA)
- BS, ISO or BSEN standards and procedures
- customer standards and requirements
- company standards and procedures

1.15 Visually inspect sample/trial mouldings, and identify two of the following:

- mouldings which meet the required specification
- mouldings which have defects
- mouldings that require further investigation

1.16 Complete the relevant documentation, to include two of the following:

- production documentation
- quality control documentation
- records of machine settings

1.17 Check that all safety mechanisms are in place and that the equipment is set correctly for the required operations

1.18 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 set plastic injection moulding machines for production of aircraft components
Assessment criteria
The learner can: 2.1 Describe the hazards and specific safety precautions to be taken

when checking and setting plastic injection moulding machines and associated delivery and collection systems, and explain how to minimise them and reduce any risks

2.2 Explain the emergency procedures that are in place to deal with a machine malfunction when setting up the plastic injection moulding machine

2.3 Explain the COSHH regulations relating to the materials used in the injection moulding activities

2.4 Explain what personal protective equipment (PPE) to be used, and how to obtain it

2.5 Explain how to obtain the necessary job instructions for the machine setting operations, and how to interpret their information

2.6 Describe the basic parts and functions of plastic injection moulding machines and moulds

2.7 Describe the various types of mould tool that are used, and explain their typical applications

2.8 Explain why it is important to check the moulds for damage or other non-conformance, prior to mounting them to the machine

2.9 Explain the various methods that are used to locate the moulds and associated parts in the injection moulding machine

2.10 Describe the different types of component delivery/collection system that are used on plastic injection moulding machines, and their setting-up requirements

2.11 Explain what machine operating parameters require setting up, and how these are achieved

2.12 Explain the effects that changes to theses settings will have on the quality of the components produced

2.13 Describe the different types of material used in the plastic injection moulding process

2.14 Explain what preparations need to be carried out on the materials in order to ensure that the completed components meet the required specification

2.15 Explain the temperature range of the material being moulded and of the mould being used

2.16 Describe the methods of checking the finished mouldings to ensure that they are to the required specification

2.17 Explain how to identify moulding defects, their cause and methods of prevention

2.18 Explain how to make adjustments to machine settings (to deal with such things as flashing, short shot, distortion and colour problems)

2.19 Describe the company quality control checks to be carried out on the prepared injection moulding machine

2.20 Explain why it is important to keep the plastic injection moulding equipment clean and free from damage, to practice good housekeeping of tools and equipment, and to maintain a clean and unobstructed working area

2.21 Describe the extent of their own authority and explain to whom they should report if they have problems that they cannot resolve when using plastic injection moulding machines

Unit 611 Setting plastic injection moulding machines for production of aircraft components

Supporting information

Guidance

2.3 (such as mould sprays, mould lubricants and moulding materials)

2.6 (to include mould location points; mould heating/cooling arrangements; machine controls; hydraulic, pneumatic and electricity supplies; material delivery and collection systems; guards and other safety devices)

2.11 (such as temperature, pressure, speed/timings and distance)

2.19 (such as cleanliness, completeness, freedom from foreign bodies, damage or defects)

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.

City & Guilds

Believe you can

www.cityandguilds.com

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).

Published by City & Guilds, a registered charity established to promote education and training

City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)844 543 0000
F +44 (0)20 7294 2413
www.cityandguilds.com