QUALIFICATION HANDBOOK

Level 3 NVQ Diploma in Aeronautical Engineering (Avionic Component Overhaul) (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 (Avionic Component Overhaul)	1789-31	600/1575/5

Version and date	Change detail	Section
1.1 November 2012	• Formatting (not allowing sentences to split between two pages) • Word 'radar' in learning outcome one changed to lower case	• Units 001, 403, 404 • Unit 576
1.2 September 2018	• Changed from a seven to a nine	• Unit 001assessment criteria 2.3

Contents

1 Introduction

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

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

Structure

To achieve the **Level 3 Diploma in Aeronautical Engineering (Avionic Component Overhaul)**, learners must achieve **20** credits from the mandatory units and a minimum of **120** 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			
J/601/5113	574	Overhauling components of aircraft navigational and computing equipment	125
T/601/5138	575	Overhauling components of aircraft communication equipment	150
A/601/5139	576	Overhauling components of aircraft radar equipment	150
M/601/5140	577	Overhauling components of aircraft radar equipment	135
T/601/5141	578	Overhauling components of aircraft electrical equipment	150

Unit accreditation number	City & Guilds unit	Unit title	Credit value
F/601/5143	579	Overhauling components of aircraft indication and gauging equipment	125
R/601/5146	580	Overhauling components of aircraft electrical equipment	125
Y/601/5147	581	Overhauling components of aircraft pitot static equipment	125
D/601/5148	582	Overhauling components of aircraft passive warning and optical/surveillance systems	120
T/601/6127	614	Rebuilding aircraft gas turbine engines assemblies after overhaul	150

2 Centre requirements

Approval

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

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

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

Resource requirements

Physical resources and site agreements

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

Centre staffing

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

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

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

Assessors and internal verifier

Assessor requirements to demonstrate effective assessment practice

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

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

Assessor technical requirements

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

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

Assessors must also be:

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

Verifier requirements (internal and external)

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

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

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

Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation.

Continuing professional development (CPD)

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

Candidate entry requirements

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

The Semta Engineering Manufacture apprenticeship framework suggests that:

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

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

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

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

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

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

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

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

Age restrictions

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

3 Delivering the qualification

Initial assessment and induction

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

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

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

Support materials

The following resources are available for this these qualifications

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

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence. City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: **www.cityandguilds.com/eportfolios**.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. *Recording forms* are available on the City & Guilds website. Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

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

Carrying out assessments

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

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

Minimum performance evidence requirements

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

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

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

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

Performance evidence must be a combination of:

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

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

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

Assessing knowledge and understanding

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

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

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

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

Witness testimony

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

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

Recognition of prior learning (RPL)

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

RPL is allowed and is also sector specific.

5 Units

Availability of units

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

Structure of units

These units each have the following:

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

Unit 001 Complying with statutory regulations and organisational safety requirements

UAN:	**A/601/5013**
Level:	2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment. The learner will be expected to comply with all relevant regulations that apply to their area of work, as well as their general responsibilities as defined in the Health and Safety at Work Act. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises. The learner will also be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and equipment that they use, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual

lifting and carrying techniques.

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

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

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

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

1.6 recognise and control hazards in the workplace

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

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

1.8 use correct manual lifting and carrying techniques

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

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

1.10 apply safe working practices and procedures to include:

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

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

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

Unit 001 Complying with statutory regulations and organisational safety requirements

Supporting information

Guidance

2.1 (such as The Management of Health and Safety at Work Regulations, Workplace Health and Safety and Welfare Regulations, Personal Protective Equipment at Work Regulations, Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Display Screen at Work Regulations, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations)

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

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

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

Unit 002 Using and interpreting engineering data and documentation

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

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

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

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

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

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

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

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

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

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

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

1.9 report any inaccuracies or discrepancies in documentation and specifications.

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

2.16	describe the meaning of the different symbols and abbreviations found on the documents that they use
2.17	describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve.

Unit 002 Using and interpreting engineering data and documentation

Supporting information

Guidance

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

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

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

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

Unit 403 Working efficiently and effectively in engineering

UAN:	**K/601/5055**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard: working efficiently and effectively in engineering (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition. On completion of the engineering activity, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used. In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management. The learner will also be expected to review objectives and targets for their personal development and make recommendations to, and communicate any

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

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

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas they need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

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

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

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

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

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

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

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

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

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

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

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

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

1.11 make recommendations for improving to two of the following:

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

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

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

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

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

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

Unit 403 Working efficiently and effectively in engineering

Supporting information

Guidance

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

Unit 404 Reinstating the work area on completion of activities

UAN:	**K/601/4228**
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from national occupational standard aeronautical engineering Unit 004: Reinstating the work Area on completion of activities (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to reinstate the work area, in accordance with approved procedures. The learner will be required to follow the correct procedures for the safe storage of finished products and surplus materials, and to correctly identify and separate all waste materials and ensure that they are removed to their designated locations. The learner will also need to ensure that all tools, equipment and documents used are accounted for and returned to the appropriate places. Tidying of the work area will be of prime importance and includes office and clean working area environments, workshops, staging and platforms, internal areas of aircraft such as wings, tanks and fuselage sections, and areas that are airside. The learner's responsibilities will require them to comply with organisational policy and procedures for the activities undertaken, and to report any problems with the reinstatement activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality of the work they carry out. The learner's knowledge will provide a good understanding of their work, and provide an informed approach to applying the required procedures. The learner will understand the need for reinstating the work areas, and will

know about the storage requirements of the products, equipment, materials, documentation and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required standard and ensuring that the work area is reinstated satisfactorily.

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

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

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

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

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

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

Learning outcome

The learner will:

2. know how to reinstate the work area on completion of activities

Assessment criteria

The learner can:

2.1 explain the specific safety practices and procedures they need to observe when reinstating the work area

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

2.3 describe the hazards associated with reinstating the work area, and explain how to minimise them and reduce any risks

2.4 explain the safe working practices and procedures to be followed when carrying out the various activities

2.5 explain what personal protective clothing and equipment needs to be worn, and where this can be obtained

2.6 explain why work areas need to be restored to a set standard, and what these requirements are

2.7 describe the types of work area that will need to be restored

2.8 Exp[lain the importance of tool and equipment control, and why this is critical within the aerospace industry

2.9 explain the meaning of 'foreign object debris', and why it is vital to ensure that this does not occur or is removed

2.10 describe the stores procedures for tools and equipment, documentation and surplus or waste materials

2.11 explain what materials will need to be stored and disposed of, and why they need to be segregated, correctly identified and labelled

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

Unit 404 Reinstating the work area on completion of activities

Supporting information

Guidance

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

2.4 (such as lifting and handling techniques)

2.7 (such as office environments, computer aided design (CAD) environment, technical/clean room environment, workshops, test areas, stages and platforms and aircraft areas such as wing, tank, fuselage, airside section areas)

2.12 (such as colour coded, labelled)

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

Unit 574 Overhauling components of aircraft navigational and computing equipment

UAN:	**J/601/5113**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 174: Overhauling components of aircraft navigational and computing equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft navigational and computing equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment such as distance measuring equipment (DME), very high frequency omnidirectional range (VOR), instrument landing system (ILS), auto direction finder (ADF), global positioning system (GPS), Doppler, tactical air navigation (TACAN), homing, inertial navigation system, Decca and compass, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted

authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 overhauling procedures to aircraft navigational and computing equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft navigational and computing equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhaul: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and

check that they are in a safe and usable condition and within current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- ensure that the equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the navigational and computing equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on three of the following types of aircraft navigational equipment:
- distance measuring equipment (DME)
- very high frequency omnidirectional range (VOR)
- instrument landing system (ILS)
- auto direction finder (ADF)
- global positioning system (GPS)
- tactical air navigation (TACAN)
- inertial navigation system
- microwave landing system (MLS)
- re-transmission systems
- Doppler
- homing
- gyro
- Decca
- Compass
- computing sub-systems

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:
- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly

- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- re-instating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on three of the following navigational equipment components:

- aerials
- transmitter units
- receiver units
- power supply units
- microwave/acoustic generators
- processors
- amplifiers
- satellite beacons
- transponders
- analogue/digital converters (A-D/D-A)
- compensation units
- transducers
- control units
- navigation display units (including 'head-up')
- computers
- interface units

1.9 replace a range of navigational equipment components, to include eight of the following:

- switches
- relays
- gaskets
- breakers/contacts
- printed circuit boards
- electronic components (such as resistors, capacitors)
- plugs/sockets/terminations
- batteries
- fuses
- desiccant

- filament lamps/light emitting diodes
- transformers
- armatures
- wires/cables
- wiring harness (complete)
- fairings/panels
- chassis components
- transparencies/lenses
- screws/bolts/washers

1.10 carry out checks and tests on the overhauled equipment, to include three of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage standing wave ratio (VSWR) checks
- signal injection tests
- power output
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft navigational equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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

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 overhaul components of aircraft navigational and computing equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft navigational equipment 2.2 describe the hazards associated with overhauling aircraft navigational equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both personal protection and protection of the navigational equipment 2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft navigational systems, and other documents needed in the overhauling process 2.5 explain how to carry out currency/issue checks on the specifications they are working with 2.6 explain the terminology used in aircraft navigational equipment, and the use of system diagrams and associated symbols 2.7 describe the basic principles of operation of the aircraft navigational equipment being overhauled, and the performance characteristics and function of the components within the equipment 2.8 explain the techniques used to remove components from aircraft navigational equipment, without damage to the components or surrounding structure 2.9 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections 2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement 2.11 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.13 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.14 explain the need to correctly label and store components, and to check that replaced components have the correct part/identification markings 2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul 2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure 2.17 describe the quality control procedures to be followed during the overhauling operations

2.18	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.19	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.20	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul
2.23	describe the tools and equipment used in the overhauling activities, and 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 574 Overhauling components of aircraft navigational and computing equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 575 Overhauling components of aircraft communication equipment

UAN:	**T/601/5138**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 175: Overhauling components of aircraft Communication equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft communication equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment such as intercom (clear), intercom (secure), high frequency (HF) radio, very high frequency (VHF) radio, ultra high frequency (UHF) radio, cockpit voice recorder, aircraft communication address reporting system (ACARS), crash position indicators, digital data links, secure radio links, flight entertainment systems, satellite communications (SATCOM), and selective calling (SELCAL), as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and

equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft communication equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhaul activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft communication equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area

- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- ensure that the equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the communication equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on three of the following types of aircraft communication equipment:

- VHF radio
- intercom (clear)
- intercom (secure speech)
- secure radio links
- HF radio
- UHF radio
- aircraft communication address reporting system (ACARS)
- cockpit voice recorder
- SATCOM
- digital data links
- flight entertainment systems
- SELCAL
- crash position indicators
- telecommunications

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:

- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly

- checking components for serviceability
- replacing all 'lifed' items (such as seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- re-instating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on three of the following communication equipment components:

- power supply units
- aerials
- receiver units
- satellite beacons
- transponders
- antenna switching units
- tuning units
- transmitter units
- transformers
- control units
- intercom station boxes

1.9 replace a range of communication equipment components, to include eight of the following:

- batteries
- switches
- fuses
- relays
- circuit breakers
- printed circuit boards
- electronic components (such as resistors, capacitors)
- transformers
- unit trays
- headsets
- instruments/gauges/
- indicators
- filament lamps/light emitting diodes
- wires/cables
- plugs/sockets/terminations

- speakers
- microphone units
- chassis components
- gaskets/seals
- screws/bolts/washers

1.10 carry out checks and tests on the overhauled equipment, to include five of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage standing wave ratio (VSWR) checks
- signal injection tests
- power output
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft communication equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation in accordance with organisational requirements

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

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

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

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 overhaul components of aircraft communication equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft communication equipment 2.2 describe the hazards associated with overhauling aircraft communication equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both personal protection and protection of the communication equipment 2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft communication systems, and other documents needed in the overhauling process 2.5 explain how to carry out currency/issue checks on the specifications they are working with 2.6 explain the terminology used in aircraft communication equipment, and the use of system diagrams and associated symbols 2.7 describe the basic principles of operation of the aircraft communication equipment being overhauled, and the performance characteristics and function of the components within the equipment 2.8 explain the techniques used to remove components from aircraft communication equipment, without damage to the components or surrounding structure 2.9 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections 2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement 2.11 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.13 explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved 2.14 explain the need to label and store components correctly and to check that replaced components have the correct part/identification markings 2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul 2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment without damage to the components or surrounding structure 2.17 describe the quality control procedures to be followed during the overhauling operations 2.18 explain the procedures for ensuring that they have the correct

tools, equipment, components and fasteners for the activities

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

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

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

2.22 explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

2.23 describe the tools and equipment used in the overhauling 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 overhauling activities

2.25 describe the problems that can occur with the overhauling operations, and explain how these can be overcome

2.26 explain how to recognise defects

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

2.28 describe the procedure for the safe disposal of waste materials and scrap components

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

Unit 575 Overhauling components of aircraft communication equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 576 Overhauling components of aircraft radar equipment

UAN:	**A/601/5139**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 176: Overhauling components of aircraft radar equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft radar equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment such as surveillance radar (including supplementary surveillance radar), weather radar, and obstacle warning systems (such as enhanced ground proximity warning systems EGPWS), traffic collision and avoidance systems (TCAS), towed radar decoys, radar (radio) altimeter, tactical air navigation (TACAN), identification friend or foe (IFF), Doppler and radar jamming devices, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally

resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft radar equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and for ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft radar equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area

- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- ensure that the equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the radar equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on the following types of aircraft radar equipment:

either one of the following:

- surveillance radar
- radar jamming

or three of the following:

- towed radar decoys
- radar (radio) altimeter
- Doppler
- enhanced ground proximity warning system (EGPWS)
- supplementary surveillance radar
- obstacle warning systems
- identification friend or foe (IFF)
- tactical air navigation (TACAN)
- weather radar/predictive wind shear
- traffic collision avoidance system (TCAS)

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:

- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability

- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- reinstating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on three of the following radar equipment components:

- scanners
- aerials
- transformers
- transmitter units
- computers
- transponders
- radar displays
- receiver units
- processors
- control units
- microwave generators
- intermediate frequency unit (IFU)
- power supply units (PSU)
- winches
- waveguides
- radar packs
- coolant units

1.9 replace a range of radar equipment components, to include eight of the following:

- batteries
- switches
- fuses
- relays
- transformers
- circuit breakers
- printed circuit boards
- electronic components (resistors, capacitors, etc)
- instruments/gauges/indicators
- desiccant units

- filament lamps/light emitting diodes
- wires/cables
- plugs/sockets/terminations
- chassis components
- screws/bolts/washers
- coolants

1.10 carry out checks and tests on the overhauled equipment, to include five of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage standing wave ratio (VSWR) checks
- pressure/leak test
- signal injection tests
- power output
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft radar equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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

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 overhaul components of aircraft radar equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft radar equipment 2.2 describe the hazards associated with overhauling aircraft radar equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risk 2.3 explain what protective equipment they need to use for both personal protection and protection of the radar equipment 2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft radar systems, and other documents needed in the overhauling process 2.5 explain how to carry out currency/issue checks on the specifications they are working with 2.6 explain the terminology used in aircraft radar equipment, and the use of system diagrams and associated symbols 2.7 describe the basic principles of operation of the aircraft radar equipment being overhauled, and the performance characteristics and function of the components within the equipment 2.8 explain the techniques used to remove components from aircraft radar equipment, without damage to the components or surrounding structure 2.9 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking-in of the connections 2.10 describe the various mechanical fasteners that are used, and explain their methods of removal and replacement 2.11 explain the importance of using the specified fasteners for the particular installation, and why they must not substitute others 2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.13 explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved 2.14 explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings 2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul 2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure 2.17 describe the quality control procedures to be followed during the overhauling operations 2.18 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities 2.19 explain the methods of lifting, handling and supporting the components/equipment during the overhauling activities

2.20	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul
2.23	describe the tools and equipment used in the overhauling 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 576 Overhauling components of aircraft radar equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 577 Overhauling components of aircraft indication and gauging equipment

UAN:	**M/601/5140**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 177: Overhauling components of aircraft indication and gauging equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft indication and gauging equipment in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of indication and gauging equipment associated with powerplant and auxiliary power; engine fuel and lubrication; flying controls; fluid power; wheels, brakes and steering; transmission systems; aircraft fuel systems; environmental control systems; ice and rain protection and airframe systems and components, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and

equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft indication and gauging equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft indication and gauging equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements

for the overhauling area

- obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- ensure that the equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the indication and gauging equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on three of the following types of indication and gauging equipment:

- power plant (such as main engine power, auxiliary power, thrust reverse, propeller, starting, monitoring, fire)
- engine fuel, lubrication, air, cooling, control systems
- fluid power (such as hydraulic power generation, undercarriage, pneumatic or vacuum pressure)
- flying controls (such as flaps/slats, elevators, ailerons/tailerons, horizontal stabiliser, spoilers/speed brakes, wing sweep, reaction controls, rudder, rotor)
- wheels, brakes, steering
- transmission systems (such as main and auxiliary gear boxes)
- aircraft fuel systems (such as supply, contents, transfer, venting system, fuel jettison, refuelling and defuelling)
- environmental control systems (such as pressure control, heating and ventilation, equipment air conditioning)
- ice and rain protection systems (such as windshield, engine protection, pitot static protection, ice accretion)
- fuselage (such as access panels, cargo doors, boundary layer and suction doors)

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:

- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level

- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged/defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on three of the following aircraft indication and gauging equipment components:

- transmitters (such as position, flow, pressure, level)
- actuators
- motors
- capacitance units
- displays
- generators (such as pulse, speed/tacho)
- computers
- gauges/indicators

1.9 replace a range of aircraft indication and gauging equipment components, to include six of the following:

- switches (such as micro, proximity)
- fuses
- relays
- transformers
- printed circuit boards
- electronic components (such as resistors, capacitors)
- transducers/sensors
- plugs/sockets/terminations
- circuit breakers
- input and follow-up potentiometers
- batteries
- desiccant units
- filament lamps/light emitting diodes
- screws/bolts/washers
- wires/cables

1.10 carry out checks and tests on the overhauled equipment, to include four of the following:

- visual inspection for completeness and freedom from damage

or foreign objects
- soak test
- bonding tests
- signal injection tests
- comparison check
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft indication and gauging equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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 overhaul components of aircraft indication and gauging equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft indication and gauging equipment 2.2 describe the hazards associated with overhauling aircraft indication and gauging equipment, and with the tools and equipment used,

	and explain how they can be minimised
2.3	explain what protective equipment they need to use for both personal protection and protection of the aircraft indication and gauging equipment
2.4	explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in avionic indication and gauging systems, and other documents needed in the overhauling process
2.5	explain how to carry out currency/issue checks on the specifications they are working with
2.6	explain the terminology used in aircraft indication and gauging equipment, and the use of system diagrams and associated symbols
2.7	describe the basic principles of operation of the aircraft indication and gauging equipment being overhauled, and the performance characteristics and function of the components within the equipment
2.8	explain the techniques used to remove components from aircraft indication and gauging equipment, without damage to the components or surrounding structure
2.9	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections
2.10	describe the various mechanical fasteners that are used, and explain their method of removal and replacement
2.11	explain the importance of using the specified fasteners for the installation, and why they must not substitute others
2.12	explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
2.13	explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
2.14	explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings
2.15	explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul
2.16	explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure
2.17	describe the quality control procedures to be followed during the overhauling operations
2.18	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.19	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.20	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul
2.23	describe the tools and equipment used in the overhauling 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 577 Overhauling components of aircraft indication and gauging equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 578 Overhauling components of aircraft electrical equipment

UAN:	**T/601/5141**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 178: Overhauling components of aircraft electrical equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft electrical equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with power generation, emergency power backup equipment, power distribution, flying controls, ECS, fuel systems, undercarriage, pitot/static, lighting, weapons, engine control and countermeasures, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are

removed from the work area, 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 appropriate overhauling procedures to aircraft electrical equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft electrical equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • where appropriate, apply electrostatic discharge (ESD) protection procedures • carry out the overhauling activities, using approved

techniques and procedures at all times
- ensure that the electrical equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the electrical equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on five of the following types of aircraft electrical equipment:
- fuel systems
- undercarriage
- flying controls
- lighting
- engine control
- pitot/static
- weapons
- environmental control systems
- countermeasures
- AC main power generation equipment
- emergency power backup equipment
- power distribution equipment
- DC power generation equipment
- secondary/standby power generation equipment

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:
- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged/defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)

- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- reinstating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on five of the following aircraft electrical equipment components:

- generators
- alternators
- inverters
- rectifier units
- actuator motors
- controllers
- regulators
- transformer
- changeover relays
- main contactors
- air conditioning equipment

1.9 replace a range of aircraft electrical equipment components, to include eight of the following:

- switches
- fuses
- relays
- transformers
- transducers/sensors
- under-voltage phase sequence units
- printed circuit boards
- electronic components (such as resistors, capacitors)
- batteries (such as one shot or flight control DC batteries)
- batteries (other)
- circuit breakers
- wires/cables
- plugs/sockets/terminations
- screws/bolts/washers

1.10 carry out checks and tests on the overhauled equipment, to include five of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage checks
- signal injection tests

- comparison check
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft electrical equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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 overhaul components of aircraft electrical equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft electrical equipment 2.2 describe the hazards associated with overhauling aircraft electrical equipment, and with the tools and equipment used, and how to minimise them and reduce any risks 2.3 explain what protective equipment that they need to use for both personal protection and protection of the aircraft electrical equipment 2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical

layouts, specifications, symbols used in aircraft electrical systems, and other documents needed in the overhauling process

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

2.6 explain the terminology used in aircraft electrical equipment, and the use of system diagrams and associated symbols

2.7 describe the basic principles of operation of the aircraft electrical equipment being overhauled, and the performance characteristics and function of the components within the equipment

2.8 explain the techniques used to remove components from aircraft electrical equipment, without damage to the components or surrounding structure

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

2.10 describe the various mechanical fasteners that are used, and their method of removal and replacement

2.11 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

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

2.14 explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings

2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

2.17 describe the quality control procedures to be followed during the overhauling operations

2.18 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

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

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

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

2.22 explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

2.23 describe the tools and equipment used in the overhauling 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 overhauling activities

2.25 describe the problems that can occur with the overhauling operations, and explain how these can be overcome

2.26 explain how to recognise defects

2.27 explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance

	of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 578 Overhauling components of aircraft electrical equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 579 Overhauling components of aircraft pitot static equipment

UAN:	**F/601/5143**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 179: Overhauling components of aircraft pitot static equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft pitot static equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with height, speed, rate of climb, navigation, auto-pilot, flying control surfaces, ice and rain protection, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft pitot static equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft pitot static equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • where appropriate, apply electro-static discharge (ESD) protection procedures • carry out the overhauling activities, using approved

techniques and procedures at all times
- ensure that the pitot static equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the pitot static equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out overhauling activities to unit level on aircraft pitot static equipment from five of the following systems:
- rate of climb
- air speed indication
- aircraft height indication
- navigation
- auto-pilot
- oxygen drop-out
- flying controls (such as flaps, elevators, ailerons/tailerons, spoilers, wing sweep, reaction controls, rudder, rotor, airbrakes, horizontal stabiliser, artificial feel, gust alleviation, modal suppression)
- engine control systems (such as FADEC, FAFC, EEC)
- environmental control systems (such as pressure control)
- ice and rain protection systems (such as pitot static protection, ice accretion)

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:
- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (such as seals, dust caps)
- replacing all damaged/defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as pressure, flow, voltage)
- making mechanical connections
- soldering electrical connections

- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on five of the following aircraft pitot static equipment components:

- airspeed indicators
- altitude indicators
- rate of climb indicators
- cabin altitude alerter
- heaters
- static ports
- transducer units
- digital displays
- analogue/digital converters
- pitot probes/pressure heads
- air data computers/modules
- mach meters

1.9 replace a range of pitot static equipment components, to include eight of the following:

- switches (such as micro, proximity)
- fuses
- relays
- printed circuit boards
- electronic components (such as resistors, capacitors)
- transformers
- transducers/sensors
- filament lamps/light emitting diodes
- plugs/sockets/terminations
- circuit breakers
- moisture drains/traps
- rigid pipes
- flexi-pipes/hoses
- batteries
- desiccant units
- screws/bolts/washers
- wires/cables

1.10 carry out checks and tests on the overhauled equipment, to include five of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- sense and leak tests
- bonding tests

- signal injection tests
- comparison check
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft pitot static equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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

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

Learning outcome
The learner will: 2. Know how to overhaul components of aircraft pitot static equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling pitot static equipment 2.2 describe the hazards associated with overhauling pitot static equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both personal protection and protection of the pitot static equipment 2.4 explain how to extract and use information from equipment

manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in pitot static systems, and other documents needed in the overhauling process

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

2.6 explain the terminology used in pitot static equipment, and the use of system diagrams and associated symbols

2.7 describe the basic principles of operation of the pitot static equipment being overhauled, and the performance characteristics and function of the components within the equipment

2.8 explain the techniques used to remove components from pitot static equipment, without damage to the components or surrounding structure

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

2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

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

2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

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

2.14 explain the need to correctly label and store components, and to check that replaced components have the correct part/identification markings

2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

2.17 describe the quality control procedures to be followed during the overhauling operations

2.18 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

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

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

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

2.22 explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

2.23 describe the tools and equipment used in the overhauling 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 overhauling activities

2.25 describe the problems that can occur with the overhauling operations, and explain how these can be overcome

2.26 explain how to recognise defects

2.27 explain what recording documentation needs to be completed for

	the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 579 Overhauling components of aircraft pitot static equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 580 Overhauling components of aircraft passive warning and optical/surveillance systems

UAN:	**R/601/5146**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 180: Overhauling components of aircraft passive warning and optical/surveillance systems (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft passive warning and optical surveillance equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft and covers a range of equipment associated with acoustics, sound navigation and ranging (SONAR), radar homing & warning receivers (RHWR), collision and ground avoidance, wet, digital, video and infra-red cameras, recording and LASER systems, as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner

must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 overhauling procedures on aircraft passive warning and optical surveillance equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft passive warning and optical/surveillance 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 overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within

current certification/calibration date
- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the passive warning and optical surveillance equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on three of the following types of aircraft passive warning and optical surveillance equipment:
- acoustics
- air data recording
- collision avoidance (radar)
- ground avoidance (radio altimeter)
- video recording systems
- LASER systems
- sound navigation and ranging (SONAR)
- radar homing and warning receivers (RHWR)
- camera systems (wet film, digital or infra-red)

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:
- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections

- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- re-instating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on three of the following passive warning and optical surveillance equipment components:

- buoys
- aerials
- satellite beacons
- transponders
- display units
- transformers
- recording devices (cockpit, video, air data)
- receiver units
- transmitter units
- processors
- cameras
- power supply unit (PSU)
- interface units
- control units
- other specific components

1.9 replace a range of passive warning and optical surveillance equipment components, to include five of the following:

- switches
- relays
- gaskets
- filament lamps/light emitting diodes
- printed circuit boards
- electronic components (such as resistors, capacitors)
- plugs/sockets/terminations
- batteries
- fuses
- desiccant
- breakers/contacts
- transformers
- armatures
- wires/cables
- wiring harness (complete)
- instruments/gauges/indicators
- fairings/panels
- chassis components

- film or digital modules
- screws/bolts/washers

1.10 carry out checks and tests on the overhauled equipment, to include four of the following:
- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage standing wave ratio (VSWR) checks
- signal injection tests
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft passive warning and optical surveillance equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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 overhaul components of aircraft passive warning and optical/surveillance systems
Assessment criteria
2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft passive

warning and optical surveillance equipment

2.2 describe the hazards associated with overhauling aircraft passive warning and optical surveillance equipment, and with the tools and equipment used, and explain how they can be minimised

2.3 explain what protective equipment that they need to use for both personal protection, and protection of the passive warning and optical surveillance equipment

2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft passive warning and optical surveillance systems, and other documents needed in the overhauling process

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

2.6 explain the terminology used in aircraft passive warning and optical surveillance equipment, and the use of system diagrams and associated symbols

2.7 describe the basic principles of operation of the aircraft passive warning and optical surveillance equipment being overhauled, and the performance characteristics and function of the components within the equipment

2.8 explain the techniques used to remove components from aircraft passive warning and optical surveillance equipment, without damage to the components or surrounding structure

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

2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.11 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

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

2.14 explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings

2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

2.17 describe the quality control procedures to be followed during the overhauling operations

2.18 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

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

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

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

2.22	explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul
2.23	describe the tools and equipment used in the overhauling 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 580 Overhauling components of aircraft passive warning and optical/surveillance systems

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 581 Overhauling components of aircraft flight guidance and control equipment

UAN:	**Y/601/5147**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 191: Overhauling components of aircraft flight guidance and control equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft flight guidance and control equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with fly by wire, gyros, autopilot, flight director, angle of attack, turn and slip, and AFCS (Automatic Flying control system), as applicable to the aircraft types. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and

materials used in the overhauling activities are removed from the work area, 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 overhauling procedures to aircraft flight guidance and control equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft flight guidance and control equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • where appropriate, apply electrostatic discharge (ESD)

protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the flight guidance and control equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on three of the following types of aircraft flight guidance and control equipment:
- fly by wire
- autopilot
- flight director
- turn and slip indication
- gyros
- automatic flying control system (AFCS)
- angle of attack/stall warning
- nose wheel steering
- main gear steering

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:
- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque

- re-instating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on five of the following flight guidance and control equipment components:

- computers
- controllers
- air data units
- detectors/position sensors
- receiver units
- gyros(rate and vertical)
- trim units
- actuators
- transformers
- stick position cancellers
- attitude heading and reference system (AHRS)
- Inertial Reference Unit (IRUs)
- primary or secondary embedded GPS and INS (EGI)

1.9 replace a range of flight guidance and control equipment components, to include eight of the following:

- switches
- relays
- gaskets
- breakers/contacts
- filament lamps/light emitting diodes
- electronic components (such as resistors, capacitors)
- instruments/gauges/indicators
- plugs/sockets/terminations
- batteries
- fuses
- desiccant
- printed circuit boards
- transformers
- armatures
- wires/cables
- wiring harness (complete)
- fairings/panels
- chassis components
- aerials
- screws/bolts/washers

1.10 carry out checks and tests on the overhauled equipment, to include four of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test

- bonding tests
- signal injection tests
- power output
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft flight guidance and control equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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

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 overhaul components of aircraft flight guidance and control equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft flight guidance and control equipment 2.2 describe the hazards associated with overhauling aircraft flight guidance and control equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both

personal protection and protection of the flight guidance and control equipment

2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft flight guidance and control systems, and other documents needed in the overhauling process

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

2.6 explain the terminology used in aircraft flight guidance and control equipment, and the use of system diagrams and associated symbols

2.7 describe the basic principles of operation of the aircraft flight guidance and control equipment being overhauled, and the performance characteristics and function of the components within the equipment

2.8 explain the techniques used to remove components from aircraft flight guidance and control equipment, without damage to the components or surrounding structure

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

2.10 describe the various mechanical fasteners that are used, and explain their method of removal and replacement

2.11 explain the importance of using the specified fasteners for the installation, and why they must not substitute others

2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them

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

2.14 explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings

2.15 explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul

2.16 explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure

2.17 describe the quality control procedures to be followed during the overhauling operations

2.18 explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities

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

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

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

2.22 explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul

2.23 describe the tools and equipment used in the overhauling 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 581 Overhauling components of aircraft flight guidance and control equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 582 Overhauling components of aircraft internal and external lighting equipment

UAN:	**D/601/5148**
Level:	3
Credit value:	120
GLH:	315
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 182: Overhauling components of aircraft internal and external lighting equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft internal and external lighting equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and covers a range of equipment associated with electro-luminescence (EL), emergency lighting, night vision (NVG), utility lighting, spot/search lighting, anti-dazzle lighting, external lighting systems, flood lighting and cabin lighting, as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner

must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft lighting equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft internal and external lighting equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date

- where appropriate, apply electrostatic discharge (ESD) protection procedures
- carry out the overhauling activities, using approved techniques and procedures at all times
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the lighting equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.5 carry out the overhaul to the agreed level, using the correct tools and techniques

1.6 carry out the overhauling activities to unit level on five of the following types of aircraft lighting equipment:

- electro-luminescence (EL)
- emergency lighting
- night vision goggles (NVG)
- spot/search lighting
- anti-dazzle lighting
- external lighting systems
- flood lighting
- cabin lighting
- utility lighting

1.7 carry out all of the following activities, as applicable to the equipment being overhauled:

- cleaning parts prior to dismantling
- pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged/defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices

- tightening fastenings to the required torque
- weather sealing lighting unit assemblies
- re-instating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.8 carry out overhauling activities to component level on five of the following aircraft lighting equipment components:

- spot/search light (complete unit)
- taxi/landing lamp (complete unit)
- strobe light/beacon light
- power supplies
- junction box
- transformer
- rheostats
- utility light
- rectifier units
- inverters
- control units
- navigation light

1.9 replace a range of aircraft lighting equipment components, to include eight of the following:

- switches
- fuses
- relays
- transformers
- transducers/sensors
- printed circuit boards
- terminal blocks
- batteries (other)
- circuit breakers
- wires/cables
- plugs/sockets/terminations
- filament lamps
- light emitting diodes
- strip lights
- screws/bolts/washers
- electronic components (such as resistors, capacitors)
- batteries (such as one shot or flight control DC batteries)
- under-voltage phase sequence units

1.10 carry out checks and tests on the overhauled equipment, to include four of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests

- voltage checks
- comparison check
- continuity checks
- standard serviceability test
- 'special-to-type' tests

1.11 overhaul aircraft lighting equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

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

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

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

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 overhaul components of aircraft internal and external lighting equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft lighting equipment 2.2 describe the hazards associated with overhauling aircraft lighting equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both personal protection and protection of the aircraft lighting

	equipment
2.4	explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft lighting systems, and other documents needed in the overhauling process
2.5	explain how to carry out currency/issue checks on the specifications they are working with
2.6	explain the terminology used in aircraft lighting equipment, and the use of system diagrams and associated symbols
2.7	describe the basic principles of operation of the aircraft lighting equipment being overhauled, and the performance characteristics and function of the components within the equipment
2.8	explain the techniques used to remove components from aircraft lighting equipment, without damage to the components or surrounding structure
2.9	describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking in of the connections
2.10	describe the various mechanical fasteners that are used, and explain their method of removal and replacement
2.11	explain the importance of using the specified fasteners for the installation, and why they must not substitute others
2.12	explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them
2.13	explain the torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
2.14	explain the need to label and store components correctly, and to check that replaced components have the correct part/identification markings
2.15	explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul
2.16	explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure
2.17	describe the quality control procedures to be followed during the overhauling operations
2.18	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.19	explain the use of weather seals, sealant and 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	explain how to conduct any necessary checks and adjustments to ensure the system integrity, accuracy and quality of the overhaul
2.22	describe the tools and equipment used in the overhauling 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 overhauling activities
2.24	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.25	explain how to recognise defects
2.26	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance

	of marking and identifying specific pieces of work in relation to the documentation
2.27	describe the procedure for the safe disposal of waste materials and scrap components
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 582 Overhauling components of aircraft internal and external lighting equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.25 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Unit 614 Overhauling components of aircraft avionic equipment

UAN:	**T/601/6130**
Level:	3
Credit value:	125
GLH:	336
Relationship to NOS:	This unit has been derived from national occupational standard Aeronautical Engineering Unit 214: Overhauling components of aircraft avionic equipment (Suite 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for science, engineering and manufacturing
Aim:	This unit covers the skills and knowledge needed to prove the competences required to carry out overhauling activities on components of aircraft avionic equipment, in accordance with approved procedures. The equipment to be overhauled will have been removed from the aircraft, and the overhauling activities may take place in a workshop or hangar. It covers equipment used in both fixed wing and rotary winged aircraft, and includes a range of equipment such as communication, radar, electrical, pitot static, passive warning and optical surveillance, flight guidance and control, navigation and computing and lighting systems as applicable to the aircraft type. The overhauling activities will include carrying out all necessary safety checks, dismantling the equipment to unit or component level, inspecting and checking all components for damage and wear, replacing all 'lifed' items and worn/faulty components or units, reassembling the equipment and carrying out all necessary tests/checks. The learner's responsibilities will require them to comply with organisational policy and procedures for the overhauling activities undertaken, and to report any problems with the overhauling activities, or with the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner must ensure that all tools, equipment and materials used in the overhauling activities are removed from the work area, 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 appropriate overhauling procedures to aircraft avionic equipment. The learner will understand the dismantling and reassembly methods and procedures used, and their application. The learner will know how the equipment functions, the common faults encountered, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the overhauling activities and for ensuring that the overhauled equipment meets the required specification.

The learner will understand the safety precautions required when carrying out the overhauling activities. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcome
The learner will: 1. Be able to overhaul components of aircraft avionic equipment
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following during the overhauling activities: • obtain and use the appropriate documentation (such as job instructions, aircraft manuals and overhauling documentation, technical instructions, and other relevant maintenance documentation) • adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work • provide and maintain safe access and working arrangements for the overhauling area • obtain the correct tools and equipment for the activity, and check that they are in a safe and usable condition and within current certification/calibration date • where appropriate, apply electrostatic discharge (ESD) protection procedures • carry out the overhauling activities, using approved

techniques and procedures at all times
- ensure that the equipment is maintained free from damage and foreign objects
- return all tools and equipment to the correct location on completion of the activities
- leave the work area and the radar equipment in a safe and appropriate condition, free from foreign object debris on completion of the activities

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

1.4 carry out the overhauling activities to unit level on three of the following types of aircraft avionic equipment:
- communication
- radar
- electrical
- pitot static
- passive warning and optical/surveillance
- flight guidance and control
- navigation and computing
- internal and external lighting

1.5 establish the components to be removed and, where appropriate, mark/label components to aid re-assembly

1.6 replace a range of avionic equipment components, to include eight of the following:
- batteries
- switches
- breakers/contacts
- fuses
- relays
- transformers
- circuit breakers
- printed circuit boards
- electronic components (such as resistors, capacitors)
- unit trays
- instruments/gauges/indicators
- transducers/sensors
- moisture drains/traps
- aerials
- terminal blocks
- desiccant units
- filament lamps/light emitting diodes
- wires/cables
- plugs/sockets/terminations
- speakers
- microphone units
- chassis components
- screws/bolts/washers

- coolants
- gaskets/seals
- headsets
- pipes/hoses
- film/digital modules
- transparencies/lenses
- other specific components

1.7 carry out the overhaul to the agreed level, using the correct tools and techniques

1.8 carry out all of the following activities, as applicable to the equipment being overhauled:

- cleaning parts prior to dismantling
- carrying out pre-disassembly checks and tests
- disconnecting and de-soldering electrical connections
- removal of earth bonding
- removal of conformal coating
- removing cable securing devices
- removing bolt securing devices and mechanical fasteners
- dismantling equipment to unit/sub-assembly level
- dismantling units to component level
- marking/labelling of components to aid reassembly
- checking components for serviceability
- replacing all 'lifed' items (seals, dust caps)
- replacing all damaged or defective components
- reassembling equipment
- setting and adjusting/calibrating replaced components (such as power output, voltage)
- making mechanical connections
- soldering electrical connections
- carrying out earth bonding
- installing cable securing devices
- tightening fastenings to the required torque
- reinstating conformal coating
- securing components using mechanical fasteners and threaded devices
- applying locking and retaining devices (such as circlips, pins, wire locking)

1.9 carry out overhauling activities to component level on three of the following avionic equipment components:

- transmitter/receiver
- computer
- recorder/camera
- scanner
- aerial
- displays/indicators
- control unit
- signal generator

- interface unit
- power supply
- switching unit
- tuning unit
- transducer
- lighting unit
- transformer
- rectifier
- inverters
- amplifier
- inertial navigation/gyros
- actuators
- generator/alternator
- contactor
- other specific component

1.10 carry out checks and tests on the overhauled equipment, to include five of the following:

- visual inspection for completeness and freedom from damage or foreign objects
- soak test
- bonding tests
- voltage standing wave ratio (VSWR) checks
- pressure/leak test
- comparison check
- signal injection tests
- power output
- continuity checks
- standard serviceability test
- 'special-to-type' tests
- voltage checks

1.11 overhaul aircraft avionic equipment 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
- aircraft manufacturer's requirements

1.12 ensure that all removed components are correctly identified and stored in the correct location

1.13 report any instances where the overhauling activities cannot be fully met, or where there are identified defects outside the planned overhauling schedule

1.14 complete the relevant documentation, in accordance with organisational requirements

1.15 complete the relevant paperwork, to include one from the

following, and pass it to the appropriate people:

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

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

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 overhaul components of aircraft avionic equipment
Assessment criteria
The learner can: 2.1 explain the safe working practices and procedures and the specific safety precautions to be taken when overhauling aircraft radar equipment 2.2 describe the hazards associated with overhauling aircraft avionic equipment, and with the tools and equipment used, and explain how to minimise them and reduce any risks 2.3 explain what protective equipment they need to use for both personal protection and protection of the avionic equipment 2.4 explain how to extract and use information from equipment manuals, history/maintenance reports, charts, circuit and physical layouts, specifications, symbols used in aircraft radar systems, and other documents needed in the overhauling process 2.5 explain how to carry out currency/issue checks on the specifications they are working with 2.6 explain the terminology used in aircraft avionic equipment, and the use of system diagrams and associated symbols 2.7 describe the basic principles of operation of the aircraft avionic equipment being overhauled, and the performance characteristics and function of the components within the equipment 2.8 explain the techniques used to remove components from aircraft avionic equipment, without damage to the components or surrounding structure 2.9 describe the various types of electrical connector that are used, methods of unlocking, orientation indicators, and locating and locking-in of the connections 2.10 describe the various mechanical fasteners that are used and explain their method of removal and replacement 2.11 explain the importance of using the specified fasteners for the particular piece of equipment, and why they must not substitute others 2.12 explain why securing devices need to be locked and labelled, and the different methods that are used to remove and install them 2.13 explain the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved 2.14 explain the need to label and store components correctly, and to

	check that replaced components have the correct part/identification markings
2.15	explain the procedure for obtaining replacement parts, materials and other consumables necessary for the overhaul
2.16	explain the techniques used to position, align, adjust and secure the replaced components to the equipment, without damage to the components or surrounding structure
2.17	describe the quality control procedures to be followed during the overhauling operations
2.18	explain the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
2.19	explain the methods of lifting, handling and supporting the components/equipment during the removal and replacement activities
2.20	explain the use of seals, sealant and adhesives and anti-electrolysis barriers, and the precautions to be taken
2.21	explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
2.22	explain how to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the overhaul
2.23	describe the tools and equipment used in the overhauling 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 overhauling activities
2.25	describe the problems that can occur with the overhauling operations, and explain how these can be overcome
2.26	explain how to recognise defects
2.27	explain what recording documentation needs to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
2.28	describe the procedure for the safe disposal of waste materials and scrap components
2.29	describe the extent of their own responsibility, and explain to whom they should report if they have problems that they cannot resolve

Unit 614 Overhauling components of aircraft avionic equipment

Supporting information

Guidance

2.1 (to include wearing protective clothing and equipment; lifting and handling techniques; safe working practices and procedures with regard to working on aircraft navigational equipment; procedures and guidelines which satisfy current regulations such as HASAWA, COSHH and other work related legislation and guidelines)

2.8 (such as de-soldering components, applying electro-static discharge (ESD) protection procedures)

2.10 (such as threaded fasteners, special securing devices)

2.26 (such as poor seals, misalignment, incorrectly seated plugs and sockets, ineffective fasteners, foreign object damage or contamination)

Appendix 1 Relationships to other qualifications

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see **www.cityandguilds.com/functionalskills**
- Essential Skills (Northern Ireland) – see **www.cityandguilds.com/essentialskillsni**
- Essential Skills Wales – see **www.cityandguilds.com/esw**

Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on **www.cityandguilds.com**.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

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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).

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