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Advisory Circular

AC 145-3(0)

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SPECIALIST MAINTENANCE QUALIFICATIONS

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1. REFERENCES

- 1 *Civil Aviation Safety Regulations* 1998 (CASR 1998) Part 145 and its Manual of Standards (MOS).

2. PURPOSE

This Advisory Circular (AC) provides information pertaining to employee qualifications for specialist maintainers.

3. STATUS OF THIS AC

This is the first AC to be issued on this subject.

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations.

This AC has been approved for release by the Executive Manager Standards Development and Future Technology Division.

4. ACRONYMS

AC	Advisory Circular
AMC	Acceptable Means of Compliance
AME	Aircraft Maintenance Engineer
AMO	Approved Maintenance Organisation
AQF	Australian Qualifications Framework
AS/NZS	Australian Standard/New Zealand Standard
ATA	Air Transport Association
AWS	American Welding Standard
CAR	Civil Aviation Regulations 1988
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CRS	Certificate of Release to Service
FAA	Federal Aviation Administration (USA)
HAZ	Heat Affected Zone
IFE	In-Flight Entertainment
LAME	Licensed Aircraft Maintenance Engineer
MOS	Manual of Standards
MTO	Maintenance Training Organisations
NAA	National Aviation Authority
NANDTB	National Aerospace Non Destructive Testing Board
NATA	National Association of Testing Authorities
NDT	Non-Destructive Testing
UTS	Ultimate Tensile Strength

5. BACKGROUND

5.1 A CASR Part 145 Approved Maintenance Organisation (AMO) may issue an authorisation to employees to provide maintenance certifications for specialist maintenance tasks or processes. The AMO can only utilise the services of specialist maintainers if their exposition includes procedures for confirming the qualifications of the employee and sourcing or providing any training required by the specialist maintainer in accordance with the requirements of the Part 145 MOS.

5.2 Specialist maintenance is that maintenance described in paragraph 145.A.30 (f) of the Part 145 MOS and is one or more of the following:

- non-destructive testing;
- welding;
- borescope inspections;
- composite repairs;
- in-flight entertainment equipment that requires specialist software management; or
- other maintenance approved by CASA as specialist maintenance.

Note: *Specialist maintenance only applies to specialised maintenance tasks or processes carried out in a Part 145 AMO and does not apply in a Civil Aviation Regulations 1988 (CAR 1988) 30 organisation.*

5.3 Regulation 145.015 of CASR 1998 allows the Part 145 MOS to detail the requirements in relation to employee qualifications. This AC details the Acceptable Means of Compliance (AMC) for specialist maintenance qualifications.

6. QUALIFICATIONS

6.1 Training. Specialist maintenance tasks are not necessarily covered by the competency based training that leads to a CASR Part 66 Aircraft Maintenance Engineers licence as specialist maintenance normally requires an extra depth of training and experience.

6.2 Employees that are to be authorised by the AMO in accordance with paragraph 145.A.35 (g) of the Part 145 MOS, to carry out specialist maintenance, must first be trained, assessed and qualified in accordance with the standards and procedures included within the AMO's exposition and have up-to-date knowledge and an adequate understanding of the following relevant to the employee's duties:

- technology relevant to the person's function in the AMO;
- human factors principles;
- the aircraft or aeronautical products to be maintained;
- airworthiness implications and requirements relevant to any maintenance for which he or she is to certify;
- the AMO's procedures; and
- the regulations under which he or she will be providing maintenance services.

6.3 Training for Authorisations. Before authorising a person for specialist maintenance, an AMO must ensure Aircraft Basic and General Familiarisation courses or equivalent in-house instruction has been provided to specialist maintenance employees for each aircraft type that maintenance is provided for by the AMO, with training and assessment procedures for each aircraft type detailed in the AMO's exposition.

6.4 Training course theory elements should follow the type training and assessment standards of each Air Transport Association (ATA) chapter outlined in Appendix III of the Part 66 MOS to a minimum type training standard of level 1.

6.5 The training syllabus should be focused on a general overview of aircraft basics for ground handling, servicing and standard practices, mechanical, powerplant, and structural and aircraft systems, including electrical aspects of each aircraft type.

6.6 On completion of the training course the student should be able to:

- provide a simple description of the whole subject, using common words, examples, and typical terms, and identify safety precautions related to the airframe, its systems and powerplant;
- identify aircraft manuals, and maintenance practices important to the airframe, its systems and powerplant;
- define the general layout of the aircraft's major systems;
- define the general layout and characteristics of the powerplant; and
- identify special tooling and test equipment used with the aircraft.

6.7 A specialist maintenance employee must be provided with continuation training at least every 24 months following initial commencement as a specialist maintainer, as outlined under paragraph 145.A.35 (e) of the Part 145 MOS.

6.8 Authorisation. To provide maintenance certifications for specialist maintenance a person must first be authorised by an AMO in accordance with section 145.A.35 of the Part 145 MOS. The specialist maintenance employee is only permitted to certify for tasks consistent with the scope and limits that are specified on the authorisation. The qualification and authorisation requirements apply whether or not the person holds a Part 66 licence – and the authorisation by the Part 145 AMO can be added to other authorisation granted to the licence holder.

6.9 The authorisation issued by the AMO may be granted for a period of not more than two years and is valid only to the extent that the employee's underlying qualification remains valid (some qualifications are subject to re-examination requirements). Validity is also dependant on the specialist maintainers continued employment by the AMO.

6.10 Maintenance Certification. If the specialist maintenance authorisation is issued by the AMO to a qualified employee, then that person can both carry out the specialist maintenance and perform maintenance certifications for completion of that maintenance in accordance with section 145.A.30 of the Part 145 MOS.

6.11 Certificate of Release to Service. Following the completion of specialist and other maintenance tasks the aircraft must be released back to service by the provision of a Certificate of Release to Service (CRS). Under section 66.A.20 of the Part 66 MOS, a CRS after specialist maintenance can only be issued by one of the following:

- A Category B1 licence holder working for a Part 145 AMO endorsed with a subcategory may issue a CRS for aircraft covered by a subcategory endorsed on the licence, after maintenance of the aircraft, if the maintenance was not base maintenance carried out on a large aircraft;
- A Category B2 licence holder working for a Part 145 AMO may issue a CRS for aircraft covered by the licence if the maintenance was not base maintenance carried out on a large aircraft; and
- A Category C licence holder working for a Part 145 AMO may issue a CRS for base maintenance carried out on a large aircraft for the aircraft in its entirety, if:
 - the maintenance was carried out on a large aircraft; and
 - the Category C holder's licence is endorsed with the type rating for the large aircraft.

6.12 The AMC to confirm specialist maintenance qualifications are detailed within this AC as follows:

- Annex A — Non-destructive testing;
- Annex B — Welding;
- Annex C — Borescope inspections;
- Annex D — Composite repairs;
- Annex E — In-flight entertainment equipment that requires specialist software management; and
- Annex F — Other maintenance approved by CASA as specialist maintenance.

6.13 These AMCs are the minimum training requirements for each specialist maintenance task for an employee of an AMO to be authorised as a specialist maintenance certifying employee. The employee will be required to complete type specific training and assessment for each aircraft and component for which an authorisation is issued by the AMO.

Executive Manager
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APPENDIX A**NON-DESTRUCTIVE TESTING****Background**

Non-Destructive Testing (NDT) inspections (other than liquid dye penetrant visual inspections) carried out during the course of maintenance by a Part 145 AMO can only be performed by personnel trained and qualified to national standards recognised by the National Aerospace Non Destructive Testing Board (NANDTB) or as approved by CASA, and assessed as competent for the purposes of the authorisation, to perform detailed NDT inspection tasks. The AMO's authorisation will be only issued and endorsed for the NDT methods appropriate to the person's training and experience. The four basic levels of certification are Level 1-Limited, Level 1, Level 2 and Level 3.

National Aerospace Non Destructive Testing Board

The NANDTB describes requirements for company based NDT training and qualification systems.

The NANDTB was established to produce a national standard (Australian Standard (AS) AS 3669) for the qualification of NDT technicians. NANDTB undertook a revision of AS 3669 in 2006 to ensure it aligned with both the European and American NDT Standards EN 4179 (European) and NAS 410 (American). In May 2009 the NANDTB adopted EN 4179 and NAS 410 in lieu of AS 3669 as the standard for employee based training and qualification.

This standard contains detailed requirements for the following common NDT methods:

- Liquid penetrant (PT)
- Magnetic particle (MT)
- Eddy current (ET)
- Ultrasonic (UT)
- Radiography (RT)
- Thermography (IRT)
- Shearography (ST)

Further information about NANDTB can be obtained from their website: <http://www.ndtboard.com/>.

Authorisation

An AMO may authorise an employee as a specialist maintainer for NDT tasks or processes under section 145.A.35 of the Part 145 MOS. The holder of an NDT authorisation may only carry out those types of NDT inspection methods which are specified on the employee's NDT qualification for which he/she is authorised to do so. The certification authorisation remains in force for a maximum period of two years and only while the underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. An NDT authorisation may be renewed without requalification for NDT techniques provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the method and continues to possess an adequate standard of visual acuity.

Competency

Authorisation of employees to any level of NDT can only be made by the Part 145 AMO, and the AMO must ensure the person is competent in the inspection methods and procedures before they are authorised to carry out that work.

AMC1 – NDT Specialist Maintainer (NANDTB and CASA recognised qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to certify for NDT tasks is to confirm that they have successfully completed training that meets the NANDTB and CASA recognised requirements of the EN 4179/NAS 410 Standard for employer based training and qualifications. The NANDTB and CASA recognises the following qualifications as meeting the requirements of the EN 4179/NAS 410 Standard Level 1 and 2 main NDT methods, for theory and practical:

- Royal Australian Air Force NDT
- PCN Aero
- PCN General-Appendix A
- EN 473
- ISO 9712 – Aerospace
- AS 3998 – Multi-sector
- AS 3998 – Aerospace
- ASNT TC-1A

AMC2 – NDT Specialist Maintainer (previous CASA authorisation)

A person previously issued with an airworthiness authority by CASA under Regulation 33B of CAR 1988 to conduct NDT of aircraft and aircraft components may continue to be utilised for NDT tasks, provided the holder has maintained proficiency and familiarity with the NDT method, and can be authorised by an AMO as a specialist maintainer.

AMC3 – NDT Specialist Maintainer (foreign National Aviation Authority or foreign employer authorisation)

A person who holds or previously held an NDT qualification certified under EN 4179/ NAS 410, or another NDT qualification program recognised by CASA and the NANDTB, and was authorised by a foreign country's National Aviation Authority (NAA) or by a foreign employer to perform NDT tasks, may be utilised for NDT tasks and be authorised by an AMO as a specialist maintainer.

Note: *If an underlying qualification is subject to a requalification requirement then the holder of the qualification must gain that requalification prior to being authorised.*

APPENDIX B**WELDING – AIRCRAFT MANUAL WELDING –
APPROVALS AND QUALIFICATION****Background**

To carry out welding work on an Australian aircraft, a person must satisfactorily meet the training, qualification and competency requirements set down by CASA.

Qualification includes the successful completion of an Australian Qualification Framework (AQF) recognised course of practical and theoretical training in the particular type of manual welding and parent metal group qualification sought; and passing the applicable welding test(s) requirements set out in the CASA Welding Syllabus (refer to Appendix G of this AC).

Welding Examinations

As part of the exam process, the welder will need to prepare the appropriate test sample(s). The organisations employee, who supervises the applicants preparation of weld test pieces, must be authorised to do so under the AMO's exposition. The organisation will submit the samples to a National Association of Testing Authorities (NATA) accredited Weld Testing Agency for examination.

NATA's website (<http://www.nata.asn.au/accreditation>) provides an online directory of its accredited facilities and includes the facilities contact details and information about the scope of their accreditation.

On successful completion of the exam(s) and assessment of the weld test pieces, the AMO may issue the applicable welding authorisation to the employee. In addition, holders of an aircraft welding authorisation issued by the AMO and endorsed with a Braze Welding permission must successfully complete a braze weld test procedure in accordance with Appendix G of this AC.

Note: A welding authority issued by CASA (under Regulation 33D of CAR 1988) may be used as the basis of issuing an authorisation by the Part 145 AMO.

Authorisation

An AMO may authorise an employee as a specialist maintainer for aircraft welding under section 145.A.35 of the Part 145 MOS. The holder of an aircraft welding authorisation may only carry out those types of welding processes which are specified on the employee's welding qualification for which he/she is authorised to do so. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. To remain qualified the specialist maintainer must successfully complete the aircraft welding examinations specified in Annex G of this AC. Requalification is required prior to re-issue of the specialist maintenance authorisation.

Competency

CASA or the AMO may at any time require a specialist maintainer for welding to undergo welding tests in order to ascertain the persons competency as a welder. If the specialist maintainer does not achieve a satisfactory standard the authorisation may be suspended wholly or in part until such time as holder successfully passes the appropriate weld tests.

AMC1 – Welding Specialist Maintainer (AQF or equivalent qualification and CASA welding test)

An AMC for an AMO to authorise a person as a specialist maintainer to certify for aircraft manual welding is to confirm that they hold AQF or equivalent recognised qualification for practical and theoretical training in the particular type of manual welding and parent metal group qualification sought; and to have passed the applicable welding test(s) set out in the CASA Welding Syllabus (refer to Appendix G of this AC).

AMC2 – Welding Specialist Maintainer (Foreign qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for aircraft manual welding is to recognise the following qualifications currently recognised by CASA and issued by:

- the Civil Aviation Authority (United Kingdom) (BCAR Subsection A8–10 — Approval of Welders); or
- a welder certification issued within the preceding two years by a Federal Aviation Administration approved maintenance organisation whose approval includes welding of aircraft.

AMC3 – Welding Specialist Maintainer (equivalent qualification)

An AMO may consider equivalent welding qualifications for the issue of an aircraft welding authorisation without requiring the applicant to undergo the welding training and examination if:

- the equivalent qualifications are current/valid authorisations; and
- the applicant can provide appropriate supporting documentary evidence, such as a qualification document and authenticated associated employment records.

AMC4 – Welding Specialist Maintainer (employer issued qualification)

In the case of employer-issued welding certifications, CASA will require documentary evidence that the certification was assessed and issued in accordance with an appropriate standard. Acceptable standards are listed below:

- AS/NZS 3992 – Welding and Brazing Qualification
- AWS B2.1 – Specification for Welding Procedure and Performance Qualification
- AWS B2.2 – Specification for Brazing Procedure and Performance Qualification
- AWS C3.4 – Specification for Torch Brazing
AWS D17.1 – Specification for Fusion Welding for Aerospace Applications

The welding authorisation should only be made valid for the remaining period prior to the expiry of the current/valid equivalent authorisation and underlying qualification.

APPENDIX C**BORESCOPE INSPECTIONS****Background**

Within a Part 145 AMO, borescope inspections carried out on aircraft system components and engines has been classified as specialist maintenance. Personnel performing borescope inspections must be appropriately qualified and competent to carry out that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for borescope inspections under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. A borescope authorisation is may be renewed without re-qualification for borescope methods provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the method.

Competency

In addition to holding the required AQF qualifications, an AMO would consider a person to be competent in performing this specialist maintenance task if the person is able to apply hand skills, use maintenance documentation/publications and apply borescope inspection techniques. Application of the skills would be required on aircraft system components and engines on fixed or rotary wing aircraft or in a workshop environment. In all instances all relevant safety procedures need to be adhered to.

AMC1 – Borescope Inspections Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for borescope inspections is to confirm they have completed the following requisite AQF competency unit from the Aeroskills training package.

MEA366A: Perform Borescope Inspections

This competency unit forms part of the elective component of the Certificate IV in Aeroskills (mechanical) training package, and is intended for qualified aircraft maintenance engineers seeking authorisation from a Part 145 AMO to perform borescope inspections on aircraft system components and engines. It covers the elements of competency required to set up and use a borescope to perform remote visual inspections required by applicable maintenance data.

This unit is applied, in conjunction with units relating to the inspection, testing and troubleshooting of applicable aircraft engines, to perform and assess the results of remote visual inspections using a borescope. Applications include piston engines and gas turbine engines either installed in aircraft or in workshops.

AMC2 – Borescope Inspections Specialist Maintainer (previous CASA authorisation)

A Part 66 licence holder previously employed to carry out and certify for this task via holding a relevant licence under regulation 31 of the CAR 1988, may continue to be utilised for borescope tasks and be authorised by an AMO as a specialist maintainer.

AMC3 – Borescope Inspections Specialist Maintainer (foreign NAA or foreign employer authorisation)

A person who holds or previously held an ICAO Annex 1 Aircraft Maintenance Licence issued by a foreign country's National Aviation Authority (NAA) and endorsed to carry out borescope inspections, or a foreign employer authorisation to carry out borescope inspections, and whose licence or authorisation is recognised by CASA, may continue to be utilised for borescope tasks and be authorised by an AMO as a specialist maintainer.

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APPENDIX D**COMPOSITE REPAIRS****Background**

Within a Part 145 AMO, maintenance carried out to the composite structure of aircraft has been classified as specialist maintenance. Personnel providing maintenance certifications for maintenance of the composite structure of aircraft must be appropriately qualified and competent to carry out that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for composite repairs under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. A composites authorisation is normally renewed without re-qualification for composite methods provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with maintenance of composites.

Competency

In addition to holding the required AQF qualifications, an AMO would consider a person to be competent in performing this specialist maintenance task if the person is able to apply hand skills, use maintenance documentation and publications, applicable materials, tools and methods to inspect aircraft structure, identify damage and deterioration, and repair aircraft composite structures and components while applying all relevant safety procedures.

AMC1 – Composite Repairs Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for maintenance of composite structures is to confirm that that person has completed the following requisite AQF competency units from the Aeroskills training package.

MEA339B: Inspect, repair and maintain aircraft structures

This competency unit forms part of the elective component of the Certificate IV in Aeroskills (Mechanical) training package, and is also a competency unit required (as per Appendix IV of Part 66 MOS) to gain a B1 licence.

This unit is intended for the holder of a category B1 licence issued under Part 66 of CASR 1998 seeking authorisation from a Part 145 AMO to inspect, repair and maintain aircraft structure. It requires application of procedures and techniques associated with the inspection and maintenance of aircraft structure and with the performance of a limited range of metal and composite repairs.

**MEA405B: Repair/modify aircraft composite material structure/components; and
MEA401B: Inspect aircraft structures**
(MEA401B is a prerequisite of MEA405B)

These competency units form part of the core component of the Certificate IV in Aeroskills (Structures) training package. They cover the competencies required for the inspection, repair or modification of fixed and rotary wing aircraft structural components, in particular pressurised aircraft, that are made from composite materials either on-aircraft or in the workshop. Inspection of damage and assessment of composite components/structures for impact damage and fatigue is provided.

Note: MEA401B also forms part of the elective component of the Certificate IV in Aeroskills (Mechanical) training package.

AMC2 – Composite Repairs Specialist Maintainer (previous CASA authorisation)

An AMO may authorise a person as a specialist maintainer to carry out and certify for maintenance of composite structures and components if that person, who at any time before 27th June 2011 previously held an aircraft maintenance engineer licence issued under Regulation 31 of CAR 1988 that was also endorsed with a category airframes Group 7 rating, as outlined under subparagraph 7A.1 of CAO 100.5. The original CASA authorisation can be taken to be the underlying qualification.

AMC3 – Composite Repairs Specialist Maintainer (foreign NAA or foreign employer authorisation)

A person who holds or previously held an ICAO Annex 1 Aircraft Maintenance Licence issued by a foreign country's NAA and endorsed to carry out composite repairs, or a foreign employer authorisation to carry out composite repairs, and whose licence or authorisation is recognised by CASA, may continue to be utilised for composite repair tasks and be authorised by an AMO as a specialist maintainer. The foreign authorisation can be taken to be the underlying qualification.

AMC4 – Composite Repairs Specialist Maintainer (foreign qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for maintenance of composite structures and components if that person holds one of the CASA recognised overseas qualifications listed under sub subparagraphs 7A.1 (b) (iv) (B) and (C) of CAO 100.5 and outlined below:

- a. a Transport Canada AME licence endorsed with an "S" rating; or
- b. a New Zealand AME licence endorsed with an aeroplane Group 4 rating;

AMC5 – Composite Repairs Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for maintenance of composite structures and components if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing composite maintenance, as outlined under sub subparagraph 7A.1 (b) (iv) (D) of CAO 100.5.

APPENDIX E**IN-FLIGHT ENTERTAINMENT EQUIPMENT THAT REQUIRES SPECIALIST SOFTWARE MANAGEMENT****Background**

Within a Part 145 AMO, maintenance to in-flight entertainment (IFE) equipment that requires specialist software management has been classified as specialist maintenance. Personnel performing maintenance to IFE equipment must be appropriately qualified and competent to *provide maintenance certifications for* that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for IFE maintenance under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. An IFE authorisation is normally renewed without re-qualification for IFE specialist software management, provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with maintenance of IFE.

Competency

In addition to holding the required AQF qualifications, an AMO would consider a person to be competent in performing this specialist maintenance task if the person is able to apply hand skills and use maintenance documentation and publications in the removal and installation of a limited range of aircraft electrical and avionic system components and general electrical hardware fitted to fixed or rotary wing aircraft.

AMC1 – IFE Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for IFE maintenance is to confirm that that person has completed the following requisite AQF competency units from the Certificate II in Aircraft Line Maintenance training package.

MEA264A: Remove and install aircraft electrical/avionic components during line maintenance; and MEA265A: Remove and install general aircraft electrical hardware

These competency units form part of the core component of the Certificate II in Aircraft Line Maintenance training package, and include competencies required for removal and installation of a limited range of aircraft electrical and avionic system components and general electrical hardware found in systems of both fixed and rotary wing aircraft.

Along with the applicable IFE equipment training, an employee can be issued a specialist maintenance authorisation to carry out limited maintenance on the aircraft.

AMC2 – IFE Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out IFE maintenance, and whose authorisation is recognised by CASA, may continue to be utilised for IFE maintenance tasks and be authorised by an AMO as a specialist maintainer. The original CASA authorisation can be taken to be the underlying qualification.

AMC3 – IFE Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for IFE maintenance if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing IFE maintenance.

IFE Training Courses

CASA will recognise aircraft manufacturers Aircraft Basic and General Familiarisation training courses as the basis for IFE training and qualification for personnel issued with an authorisation by an AMO to carry out IFE maintenance.

An AMO must ensure Aircraft basic and General Familiarisation courses are made available to IFE specialist maintenance employees for each aircraft type that maintenance is provided for by the AMO, with training and assessment procedures for each type of IFE detailed in the AMOs exposition.

Technical training by the IFE manufacturer on particular software for an IFE system is an assumed prerequisite to becoming an IFE specialist maintainer.

APPENDIX F

**OTHER MAINTENANCE APPROVED BY CASA
AS SPECIALIST MAINTENANCE****Interior Furnishings****Background**

Within a Part 145 AMO, maintenance to aircraft interior furnishings has been classified as specialist maintenance. Personnel performing maintenance to aircraft interior furnishings must be appropriately qualified and competent to carry out that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer to carry out maintenance to aircraft interior furnishings under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Aircraft interior furnishings maintenance would normally be renewed without re-qualification for aircraft interior furnishing maintenance provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to the individual being formally trained, assessed and qualified in accordance with standards and procedures included within the AMO's exposition for the particular specialist maintenance task, an AMO would consider a person to be competent in performing this specialist maintenance task if the person is able to apply hand skills, use maintenance documentation and publications, applicable materials, tools and methods for the removal, installation, identification of damage and deterioration, and the carrying out of repairs to the various aircraft interior furnishings, while applying all relevant safety procedures.

AMC1 – Aircraft Interior Furnishings Specialist Maintainer (approved course of training)

An acceptable means of compliance for an AMO to authorise a person as a specialist maintainer to carry out and certify for maintenance to aircraft interior furnishings is for an individual to have successfully completed a course of formal training, or a period of relevant practical experience, or both, conducted by the AMO, designed to convey detailed knowledge of aircraft interior furnishings, to enable the individual to safely perform maintenance to those interior furnishings.

AMC2 – Aircraft Interior Furnishings Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to perform maintenance to aircraft interior furnishings, and whose authorisation is recognised by CASA, may continue to be utilised for these maintenance tasks and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Aircraft Interior Furnishings Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for maintenance to aircraft interior furnishings if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing that type of maintenance.

Aircraft Surface Finishing**Background**

Within a Part 145 AMO, aircraft surface finishing has been classified as specialist maintenance. Personnel performing aircraft surface finishing maintenance must be appropriately qualified and competent to carry out that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for aircraft surface finishing under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Aircraft surface furnishing maintenance would normally be renewed without re-qualification provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

An AMO would consider a person to be competent in performing these specialist maintenance tasks through completion of the required competency units that result in a Certificate II, Certificate III or Certificate IV qualification for surface finishing. The units of competency that comprise these qualifications are a mix of core units that are applicable to all employment streams at the various certificate levels plus a number of elective structures and mechanical technical stream units that relate to aircraft surface finishing and minor repairs that provide optional multi-skilling.

AMC1 – Aircraft Surface Finishing Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for aircraft surface finishing is to confirm that person has completed one of the AQF training packages for aircraft surface finishing outlined below, that leads to either a Certificate II, Certificate III or Certificate IV qualification for aircraft surface finishing.

MEA20610: Certificate II in Aircraft Surface Finishing

MEA30110: Certificate III in Aircraft Surface Finishing

MEA40910: Certificate IV in Aircraft Surface Finishing

Units of competency provided in the training packages for these AQF Certificate courses comprise a mix of core and elective units. The Certificate II qualification provides a significant number of credits towards surface finishing qualifications at Certificate III and IV levels, and the common units also provide credit towards other Aeroskills qualifications.

These AQF Certificate qualifications would be applicable to employees of aircraft maintenance organisations or specialist aircraft surface finishing organisations who are involved in the stripping of old finishes and in the preparation of aircraft and/or aeronautical component surfaces for the application of paint and other specialist surface finishes including but not limited to; application of decals, stencils, registration markings, national markings and organisational logos. A range of component removal and installation tasks related to surface finishing tasks, and some minor repairs may also be performed.

AMC2 – Aircraft Surface Finishing Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out maintenance to aircraft surface finishing, and whose authorisation is recognised by CASA, may continue to be utilised for these maintenance tasks and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Aircraft Surface Finishing Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for aircraft surface finishing if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing aircraft surface finishing.

Shot Peening**Background**

Within a Part 145 AMO, shot peening has been classified as specialist maintenance. Personnel performing shot peening must be appropriately qualified and competent to carry out that specialist maintenance task and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for shot peening under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Shot peening maintenance would normally be renewed without re-qualification for shot peening provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to gaining a Statement of Attainment for the AQF elective competency unit for shot peening, an AMO would consider a person to be competent in performing this specialist maintenance task through the application of hand skills and the use of relevant process documentation to shot peen aircraft and/or aeronautical components.

AMC1 – Shot Peening Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for shot peening of aircraft and/or aeronautical components is to confirm that person has completed the following AQF competency unit for shot peening from the Aeroskills MEA11 training package.

MEA368A: Shot peen aircraft components

This elective competency unit is offered as part of the training package for the component workshop maintenance stream of the AQF Aeroskills Certificate IV (Mechanical) qualification.

This competency unit, on completion, would result in a Statement of Attainment for shot peening.

AMC2 – Shot Peening Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out shot peening of aircraft and/or aeronautical components, and whose authorisation is recognised by CASA, may continue to be utilised for this maintenance task and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Shot Peening Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for shot peening of aircraft and/or aeronautical components if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing shot peening.

Electroplating/Anodising

Background

Within a Part 145 AMO, electroplating and/or anodising has been classified as specialist maintenance. Personnel performing electroplating and/or anodising must be appropriately qualified and competent to carry out these specialist maintenance tasks and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for electroplating and/or anodising under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Electroplating and/or anodising maintenance would normally be renewed without re-qualification for the electroplating and/or anodising maintenance provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to gaining a Statement of Attainment for the AQF elective competency units for electroplating and/or anodising of aluminium alloys, an AMO would consider a person to be competent in performing these specialist maintenance tasks through the application of hand skills and the use of relevant process documentation and through a combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship which resulted in a Certificate III or Certificate IV qualification in an allied trade.

AMC1 – Electroplating/Anodising Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for electroplating and/or anodising of aluminium alloy aeronautical components is to confirm that person has completed the following AQF competency units that make up the Skill Sets for electroplating and/or anodising from the Aeroskills MEA11 training package.

Skill Set: Electroplate aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07001B	Perform operational maintenance of machines equipment
MEM08001B	Perform wire, jig and barrel load/unload work
MEM08003C	Perform electroplating operations
MEM08018B	Electroplate engineering coatings
MEM13003B	Work safely with industrial chemicals and materials
MEM18001C	Use hand tools
MEM15004B	Perform inspection

Skill Set: Produce anodised film on aluminium alloy components

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM08002C	Pre-treat work for subsequent surface coating
MEM08006B	Produce clear and/or coloured and/or sealed anodised film on aluminium

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on the electroplating of aeronautical product component parts, and on the production of anodised film on aluminium alloy components. These Skill Sets, on completion, would result in a Statement of Attainment for electroplating and/or anodising of aluminium alloy aeronautical components.

AMC2 – Electroplating/Anodising Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out electroplating and/or anodising of aluminium alloy aeronautical components, and whose authorisation is recognised by CASA, may continue to be utilised for this maintenance task and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Electroplating/Anodising Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for electroplating and/or anodising of aluminium alloy aeronautical components if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing electroplating and/or anodising.

Metal Spraying**Background**

Within a Part 145 AMO, metal spraying has been classified as specialist maintenance. Personnel performing metal spraying must be appropriately qualified and competent to carry out these specialist maintenance tasks and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for metal spraying under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Metal spraying maintenance would normally be renewed without re-qualification for metal spraying provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to gaining a Statement of Attainment for the AQF elective competency units for metal spraying, an AMO would consider a person to be competent in performing this specialist maintenance task through the application of hand skills and the use of relevant process documentation and through a combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship which resulted in a Certificate III or Certificate IV qualification in an allied trade.

AMC1 – Metal Spraying Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for metal spraying is to confirm that person has completed the following AQF competency units that make up the Skill Sets for metal spraying from the Aeroskills MEA11 training package.

Skill Set: Metal spray aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM08002C	Pre-treat work for subsequent surface coating
MEM08004B	Finish work using wet, dry and vapour deposition methods
MEM13003B	Work safely with industrial chemicals and materials

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops for metal spraying operations.

AMC2 – Metal Spraying Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out metal spraying, and whose authorisation is recognised by CASA, may continue to be utilised for this maintenance task and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Metal Spraying Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for metal spraying if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing metal spraying.

Tyre Retreading

Background

Within a Part 145 AMO, aircraft tyre retreading has been classified as specialist maintenance. Personnel performing aircraft tyre retreading must be appropriately qualified and competent to carry out these specialist maintenance tasks and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for aircraft tyre retreading under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Aircraft tyre retreading maintenance would normally be renewed without re-qualification for aircraft tyre retreading maintenance provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to gaining a Statement of Attainment for either or both of the AQF elective competency units for tyre retreading, an AMO would consider a person to be competent in performing this specialist maintenance task through a combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship, or employment training within the tyre industry.

AMC1 – Tyre Retreading Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for aircraft tyre retreading is to confirm that person has completed the following AQF competency units that make up the Skill Sets for tyre retreading from the Aeroskills MEA11 training package.

Skill Set: Aircraft tyre retreading (basic)

PMB262B	Operate tyre curing equipment
PMB263B	Operate tyre retread curing equipment
PMB264C	Check recycle wash process
PMB265C	Operate portable vulcanising equipment
PMB266B	Prepare tyre casing for retreading

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals in aircraft tyre retreading, including preparation of tyres and operation of retreading equipment.

Skill Set: Aircraft tyre retreading (advanced)

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
PMB324B	Inspect tyres for retreading
PMB325B	Lay on tyre retreads
PMB326B	Inspect tyres

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of trade qualified individuals in aircraft tyre inspection before and after retreading, and in setting up retreading equipment.

AMC2 – Aircraft Tyre Retreading Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out aircraft tyre retreading, and whose authorisation is recognised by CASA, may continue to be utilised for this maintenance task and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Aircraft Tyre Retreading Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for aircraft tyre retreading if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing aircraft tyre retreading.

Metal Machining**Background**

Within a Part 145 AMO, metal machining has been classified as specialist maintenance. Personnel performing metal machining must be appropriately qualified and competent to carry out these specialist maintenance tasks and be authorised by the Part 145 AMO as a specialist maintenance certifying employee.

Authorisation

An AMO may authorise an employee as a specialist maintainer for metal machining under section 145.A.35 of the Part 145 MOS. The certification authorisation remains in force for a maximum period of two years and only while the employee's underlying qualification remains valid.

Renewal

An AMO must assess all certifying employees for their continued competence in accordance with a procedure specified in its exposition prior to the reissue of a certification authorisation by the AMO. Metal machining maintenance would normally be renewed without re-qualification for metal machining provided the holder produces acceptable evidence that he or she has maintained proficiency and familiarity with the specialist maintenance.

Competency

In addition to gaining a Statement of Attainment for the AQF elective competency units for the various metal machining processes, an AMO would consider a person to be competent in performing these specialist maintenance tasks through a combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship, which resulted in a Certificate III or Certificate IV qualification in an allied trade.

AMC1 – Metal Machining Specialist Maintainer (AQF qualification)

An AMC for an AMO to authorise a person as a specialist maintainer to carry out and certify for metal machining is to confirm that person has completed the following AQF competency units that make up the Skill Sets for the various machining processes from the Aeroskills MEA11 training package. These qualifications cover the skills and knowledge required for various metal machining processes that would be applicable for the machining of aircraft and/or aeronautical components.

Skill Set: Machine aeronautical product component parts (general)

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07002B	Perform precision shaping/planning/slotting operations
MEM07005C	Perform general machining
MEM07006C	Perform lathe operations
MEM07007C	Perform milling operations
MEM07021B	Perform complex lathe operations
MEM09002B	Interpret technical drawing
MEM12003B	Perform precision mechanical measurement
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on general machining of aeronautical product component parts.

Skill Set: Grind aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07005C	Perform general machining
MEM07008D	Perform grinding operations
MEM07010B	Perform tool and cutter grinding operations
MEM07012B	Perform complex grinding operations
MEM09002B	Interpret technical drawing
MEM12003B	Perform precision mechanical measurement
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on grinding of aeronautical product component parts.

Skill Set: Precision jig boring of aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07005C	Perform general machining
MEM07007C	Perform milling operations
MEM07009D	Perform precision jig boring operations
MEM09002B	Interpret technical drawing
MEM12003B	Perform precision mechanical measurement
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on general machining of aeronautical product component parts.

Skill Set: Complex milling of aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07005C	Perform general machining
MEM07007C	Perform milling operations
MEM07011B	Perform complex milling operations
MEM09002B	Interpret technical drawing
MEM12003B	Perform precision mechanical measurement
MEM12023A	Perform engineering measurement
MEM12024A	Perform computations
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on complex milling of aeronautical product component parts.

Skill Set: Machine aeronautical product component parts using horizontal and/or vertical boring machines

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07005C	Perform general machining
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines
MEM09002B	Interpret technical drawing

MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on machining of aeronautical product component parts using horizontal and/or vertical boring machines.

Skill Set: Machine aeronautical product component parts using NC/CNC machines

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07015B	Set computer controlled machines/processes
MEM07016C	Set and edit computer controlled machines/processes
MEM07018C	Write basic NC/CNC programs
MEM07022C	Program CNC wire cut machine
MEM07024B	Operate and monitor machine processes
MEM07028B	Operate computer controlled machine processes
MEM09002B	Interpret technical drawing
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on machining of aeronautical product component parts using NC/CNC machines.

Skill Set: Machine aeronautical product component parts using NC/CNC machining centres

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07015B	Set computer controlled machines/processes
MEM07016C	Set and edit computer controlled machines/processes
MEM07018C	Write basic NC/CNC programs
MEM07019C	Program NC/CNC machine centre
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre
MEM07024B	Operate and monitor machine processes
MEM07028B	Operate computer controlled machine processes
MEM09002B	Interpret technical drawing
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on machining of aeronautical product component parts using NC/CNC machines.

Skill Set: Machine plastic aeronautical product component parts

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEM07001B	Perform operational maintenance of machines equipment
MEM07024B	Operate and monitor machine processes
MEM09002B	Interpret technical drawing
MEM12023A	Perform engineering measurement
MEM6006A	Organise and communicate information
MEM18001C	Use hand tools

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on machining of plastic (including composite) aeronautical product component parts.

Skill Set: Aeronautical product component parts – metal spinning lathe operations

MEA108B	Complete aviation maintenance industry documentation
MEA145A	Conversion from allied trades for employment in aviation maintenance workshops
MEA7030C	Perform metal spinning lathe operations (basic)
MEA7031C	Perform metal spinning lathe operations (complex)
MEA7032B	Use workshop machines for basic operations
MEM09002B	Interpret technical drawing
MEM12023A	Perform engineering measurement
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations

These competencies from the Aeroskills Training Package MEA11 meet the requirements for employment of individuals with Certificate III or Certificate IV qualifications in an allied trade in aircraft component maintenance workshops on metal spinning lathe operations on aeronautical product component parts.

AMC2 – Metal Machining Specialist Maintainer (foreign employer authorisation)

A person who previously held an authorisation from a foreign employer to carry out metal machining to aircraft and/or aeronautical components, and whose authorisation is recognised by CASA, may continue to be utilised for these maintenance tasks and be authorised by an AMO as a specialist maintainer. The original foreign authorisation can be taken to be the underlying qualification.

AMC3 – Metal Machining Specialist Maintainer (other CASA recognised qualification)

An AMO may authorise a person as a specialist maintainer to carry out and certify for metal machining if that person holds another qualification approved in writing by CASA as an appropriate qualification for performing metal machining tasks.

APPENDIX G

**CASA WELDING SYLLABUS PUBLICATION
AIRCRAFT WELDING EXAMINATIONS****CONTENTS**

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Types of manual welding

Satisfactory completion of aircraft welding examinations, made under one of the following types of manual welding processes, qualifies the welder with respect to that type of welding:

- Difficulty rating:
 - Type 1 - Gas welding.
 - Type 2 - Braze welding. [Note limitations apply].
 - Type 3 - Manual Metal Arc Welding.
 - Type 4 - Gas Tungsten Arc Welding (GTAW - TIG).
 - Type 5 - Gas Metal Arc Welding (GMAW - MIG).
 - Type 6 - Plasma Arc Welding (PAW).

Parent metal groups

- The parent metal groups for which qualifications may be obtained are:
 - Group 1 - Aluminium Alloys.
 - Group 2 - Magnesium Alloys.
 - Group 3 - Carbon Steels and Low Alloy Steels.
 - Group 4 - Corrosion and Heat Resisting Steels.
 - Group 5 - Nickel Alloys.
 - Group 6 - Copper based Alloys.
 - Group 7 - Titanium Alloys.

Definitions

- All terms and definitions used in this publication are in accordance with Australian Standard (AS) AS 2812–2005 — “Welding, brazing and cutting of welds — Glossary of terms”.
- ‘Tubular part’, means a part of a primary structure not exceeding approximately 50 mm in diameter.

PART 1 – AIRCRAFT WELDING EXAMINATIONS

Types of aircraft welding examinations

Dependent on the welding qualification sought, the aircraft welding examinations required to obtain qualifications are to be prepared as follows:

- Joint No. 1 - Sheet to sheet butt weld as specified in Diagram 1.
- Joint No. 2 - Tube to sheet fillet weld as specified in Diagram 2.
- Joint No. 3 - Sheet to sheet fillet weld as specified in Diagram 3.
- Joint No. 4 - Tube to tube test weld as specified in Diagram 4.
- Joint No. 5 - An aircraft part typical of the most difficult to be welded in production/repair by the applicant, e.g. repair/rebuild of engine nozzle guide vane; repair of gas turbine engine flame tube or repairs to component castings etc.

Note: A welding test joint which simulates the Joint No. 5 part may be prepared by the applicant at the discretion of the person conducting the aircraft welding examination. Where a simulated joint is prepared, the applicant must use the same materials, equipment, process, joint configuration, welding technique and maintenance data/specifications as that used for the production or repair part.

Examinations required for initial issue of a Part 145 AMO aircraft welding authorisation

For the purposes of a Part 145 AMO welding authorisation, an applicant must satisfactorily complete at least one of the aircraft welding examinations set out in this publication. The aircraft welding examination must be completed in each of the types of manual welding and parent metal groups to which the application relates and is relevant to the conditions of the authorisation sought.

Applicants for a braze welding type of manual welding qualification must satisfactorily complete at least the aircraft welding examination Joint No. 2 in the parent metal group to which the application relates.

Braze welding is restricted to tube-to-sheet Joint No. 2 and the type of weld joint prepared as Joint No. 5. There is no 'unrestricted' qualification or 'restricted to exclude tubular parts' qualification permitted for braze welding.

Examinations required for reauthorisation of an Part 145 AMO aircraft welding authorisation

For the purposes of the Part 145 AMO specialist maintenance authorisation the holder of an aircraft welding authorisation seeking reauthorisation must satisfactorily complete aircraft welding examinations, as set out in this publication.

Part 145 AMO welding authorisation - reauthorisation and additional general information

Most technically difficult welding type and metal group

Unless previously determined in respect of a particular employee, determination of the most technically difficult welding type and metal group for the purpose of these tests must be made by a person holding the necessary metallurgical or engineering qualifications.

Reauthorisation requirements for holders of a Part 145 AMO aircraft welding authorisation endorsed with Braze Welding

All holders of Part 145 AMO aircraft welding authorisations endorsed with Type 2 — Braze Welding qualifications must, within the 3 month application period, satisfactorily complete a welding examination.

Addition of a type of manual welding

If the authorisation holder is seeking to have a type of manual welding (other than Type 2 — Braze Welding) added to the authorisation, the holder must satisfactorily complete at least one of the aircraft welding examinations, set out in this publication, in the type of manual welding to which the application relates in any parent metal group.

Addition of a parent metal group

If the authorisation holder is seeking to have a parent metal group added to the authorisation, the holder must satisfactorily complete at least one of the aircraft welding examinations, set out in this publication, in the parent metal group to which the application relates in any type of manual welding.

Addition of Braze Welding

If the authorisation holder is seeking to have Type 2 — Braze Welding added to the authorisation, the holder must satisfactorily complete a braze welding test in accordance with a standard acceptable to CASA.

Examination failure

If an employee fails a welding examination for the initial issue, reauthorisation or additional qualifications of a welding authorisation, the applicant may submit a further welding examination sample for assessment.

If the applicant then fails the re-examination, CASA recommends that the applicant completes some form of remedial practical and theoretical training on the type of manual welding and parent metal group and demonstrate welding practice to the person conducting the welding examination prior to further examination.

Documentary evidence may be required by the person conducting the re-examination in support of any remedial welding training completed.

Parent metal thickness limitation/conditions

The welding examinations — Joints No. 1, No. 2, No. 3 and No. 4 specify that the weld must be carried out on a pre-determined representative parent metal thickness for the particular welding process (gas) or (arc).

Welders complying with the examination metal thickness specifications are qualified to carry out manual welding (using the particular process) on parent metals of any thickness. There will be no parent metal thickness limitation or condition endorsement made on the welding authorisation.

Welders who carry out welding examinations using parent metals of a greater thickness than that specified for the welding examination will be qualified to carry out welds on the parent metal of that thickness or greater. The welding authorisation will be endorsed with a parent metal thickness condition e.g., if the welding examination specifies that the sheets to be arc welded must be 1.2 mm thick and the welder uses sheets of 1.5 mm thick, then the parent metal thickness condition endorsed on the welding authorisation will limit the welder to only carrying out welds on metals of 1.5 mm thickness or greater.

Welding identification and welding position code

On completion of the welding examination, the person conducting the examination must stamp, etch or permanently mark each welding examination sample with the appropriate welding position code letter, as follows:

- F – Flat (fillet or butt), where the face of the weld is approximately horizontal;
- H – Horizontal (fillet or butt), where the line of weld root is approximately horizontal;
- OH – Overhead (fillet or butt), where the weld is performed from the under-side of the joint;
- HV – Multiple Position (fillet only), where the axis of the tube is approximately horizontal and the tube is not rotated during welding; or
- V – Vertical (fillet or butt), where the line of the weld root is approximately vertical.

Examples of examination combinations and conditions

An aircraft welding authorisation will be issued by the Part 145 AMO subject to the qualification conditions or restrictions determined by the type and number of welding examination combinations selected and satisfactorily completed by the welder.

Examples of the conditions the AMO may impose when particular aircraft welding examination combinations have been successfully completed are given below and apply to both the initial issue and additional qualification requirements for the aircraft welding authorisation:

Example #1

Welding Examination Carried Out
Joint No. 1
Condition Entered on the Part 145 AMO Welding Authorisation — for each type of manual welding and parent metal group
“Restricted to Butt welds of ‘X’ mm thick sheets”

This example is intended to show the flexibility of welding examination selection for the issue of a welding authorisation whereby an applicant only requires one welding examination qualification. The satisfactory completion of Joint No. 1 will qualify the welder to carry out manual welding ‘butt welds’ (using a particular process) on sheets of a specified thickness (for a particular parent metal). Similarly, if, for example, a Joint No. 3 is selected and satisfactorily completed, the form of condition entered on the authorisation may read “Restricted to fillet welds of sheets ‘x’ mm thickness” (for the particular process/metal group).

Example #2

Welding Examinations Carried Out	
Joint No. 2	Joint No. 5
Condition Entered on the Part 145 AMO Welding Authorisation — for each parent metal group	
“Braze Welding only - Restricted to particular parts or types of parts” (statement may include description of part(s) or approved procedures reference)	

With respect to issue of the Braze welding authorisation, the braze welding qualification is restricted for tube to sheet Joint No. 2 and the type of the weld prepared as Joint No. 5. There is no “Unrestricted” qualification or “Restricted to exclude tubular parts” qualification permitted for braze welding.

Example #3

Welding Examinations Carried Out	
Joint No. 1	Joint No. 5
Condition entered on the Part 145 AMO Welding Authorisation — for each type of manual welding and parent metal group	
“Restricted to the particular parts or types of parts” (Statement may include description of part or approved welding procedures reference)	

The annotation “Restricted to particular parts or type of parts”, requiring Joints No. 1 and 5, applies where the only welds to be carried out are restricted to a particular joint configuration on a specific part or types of parts, e.g., repair/rebuild of engine nozzle guide vanes, or repair of gas turbine engine flame tube or repairs to component castings, etc. This may also apply where welds are carried out repetitively on a production line basis in accordance with particular procedural data.

The holder of the welding authorisation is only authorised to carry out manual welding of the particular part or type of parts described in the welding authorisation (e.g., butt joints in flame tubes of (type) engines, or edge welds on nozzle guide vane support Part No. ..., etc.).

The welding carried out must be as specified in the approved maintenance data for the parent metal group and type of manual welding for which the “Restricted to part” annotation is granted.

Example #4

Welding Examinations Carried Out		
Joint No. 1	Joint No. 3	Joint No. 5
Condition Entered on the Part 145 AMO Welding Authorisation — for each type of manual welding and parent metal group		
“Restricted to exclude Tubular Parts”		

The annotation “Restricted to exclude tubular parts”, requiring Joints No. 1, 3 and 5 is intended to make provision for applications for metal groups other than aluminium or steel, which are generally not used in tubular form in aircraft primary structure or are not generally available in tubular form. e.g., magnesium, nickel or titanium (as a tubular part is part of a primary aircraft structure not exceeding approximately 50 millimetres in diameter, then an exhaust manifold is not considered a tubular part since it is not primary structure).

The holder is qualified to carry out manual welding of any part (e.g., flat, horizontal and overhead butt welds and fillet welds for sheet-to-sheet), except for tubular parts, where welding is specified in approved maintenance data for the parent metal group and type of manual welding for which the “Restricted” annotation is granted.

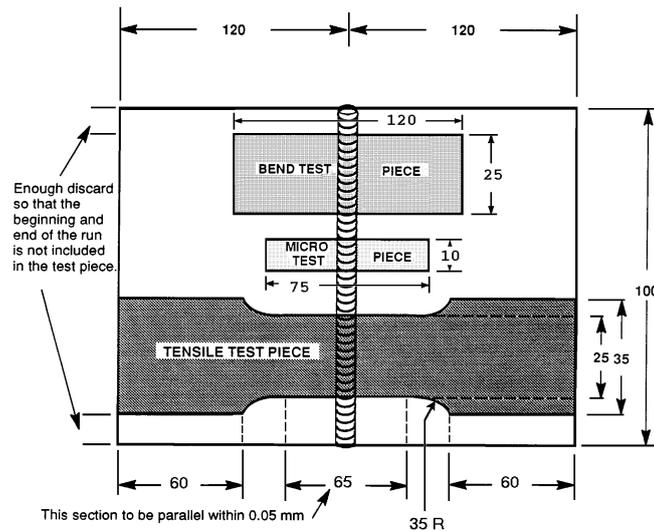
Example #5

Welding Examinations Carried Out		
Joint No. 1	Joint No. 2	Joint No. 4
Condition Entered on the Part 145 AMO Welding Authorisation — for each type of manual welding and parent metal group		
“Unrestricted” or “Nil”		

The “Unrestricted or Nil” annotation, requiring Joints No. 1, 2 and 4 is granted on the basis that the selection of joints is considered sufficiently searching of welding ability in the majority of cases (e.g., flat, horizontal, overhead, vertical and multi-position butt welds [sheet-to-sheet], fillet welds [sheet-to-sheet] [sheet-to-tube] and fillet and butt welds [tubular parts]).

It is intended to apply primarily to aluminium and steel metal groups and where structural tubing is in common use. Where more difficult welds are to be carried out to satisfy production, additional Joint No. 5 examination may be required.

The welder is qualified to carry out manual welds of any part where welding is specified in approved maintenance data, without restriction for the parent metal group and type of manual welding for which the “Unrestricted or Nil” annotation is granted.

AIRCRAFT WELDING EXAMINATION No. 1**Diagram 1 – Joint No 1 – Sheet to Sheet Butt Weld****Weld for aircraft welding examination No. 1**

- For the purposes of undertaking the aircraft welding examination No. 1, a person must carry out a Joint No. 1 - sheet to sheet butt weld in accordance with the specifications set out in diagram 1.
- All measurements are nominal and in millimetres (mm).
- The examinations must be carried out using parent metals of the same alloy type or grade procured to the applicable specifications referenced in the production procedure/maintenance data.
- For oxy-acetylene (gas), GTAW (TIG) and MTAW (MIG) welding processes, examination metal thickness of sheets is 1.6 mm thick (this will include material of 0.063 inch thickness).
- For other arc welding processes, examination metal thickness of sheets is 2.5 mm to 2.6 mm thick (this includes sheet of 0.100 inch thickness).
- If sheets of other thicknesses are used, the thicknesses of the sheets should be kept in these proportions. (Note: qualification will be subject to thickness conditions.)
- Tack welds may be made from any position but shall be incorporated into the completed weld.
- Welding position - flat.
- The weld shall be performed by welding from one side only using correct filler rod, flux or shielding gas as applicable.
- The sheets to be welded shall be supported so that they do not contact the bench or other material that will form a backing bar in the welded joint.
- Completed welds may be cleaned by wire brush, but must not be dressed, hammered or sand blasted (light tapping with a hammer to remove scale deposits, is not regarded as a dressing operation).
- Weld residue (flux, slag) shall be removed from the weld in the usual way.

- Be aware of any grain direction in the material which may compromise the bend test.

Note: The welding examination sample must be submitted to the Weld Testing Agency intact. The testing agency is responsible for the preparation of the particular test pieces.

AIRCRAFT WELDING EXAMINATION No. 2

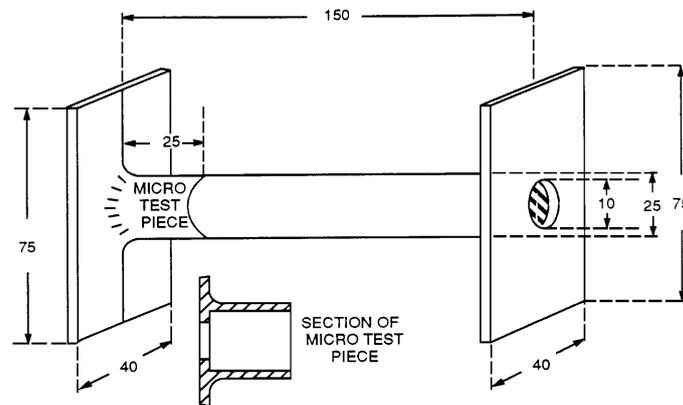


Diagram 2 – Joint No 2 Sheet to Tube Fillet Weld

Weld for aircraft welding examination No. 2

- For the purposes of undertaking the aircraft welding examination No. 2, a person must carry out a Joint No. 2 - sheet to tube fillet weld in accordance with the specifications set out in diagram No. 2.
- All measurements are nominal and in millimetres (mm).
- The examinations must be carried out using parent metals of the same alloy type or grade procured to the applicable specifications referenced in the production procedure/maintenance data.
- For oxy-acetylene (gas), GMAW (MIG) and GTAW (TIG) welding processes, examination metal thickness for tube is 0.9 mm wall thickness and end plates of 1.6 mm thick.
- For other arc welding processes, examination metal thickness for tube is 1.6 mm to 1.65 mm (this includes 0.065 inch) wall thickness and end plates of 2.5 mm to 2.6 mm thick (includes 0.100 inch sheet).
- If tubes and end plates of other thicknesses are used, the thicknesses should be kept in these proportions. (Note: qualification will be subject to thickness conditions)
- Where a greater thickness material is used there must be two nominal gauge sizes difference between the tube and end plate.
- Centre of end plates to be drilled with 10 mm diameter hole prior to welding.
- End plates may be positioned by tack welds.
- The first weld shall be completed by working around the tube with the end plate horizontal (flat) on the work surface and the tube in the vertical position.

- The second weld shall be completed by working under and over the tube with the tube in the horizontal position (as depicted in diagram 2) and not moved during the process of completing the weld. (Note: the micro test piece will be taken from the second weld area).
- Completed welds may be cleaned by wire brush, but must not be dressed, hammered or sand-blasted (light tapping with a hammer to remove scale deposits is acceptable and is not regarded as a dressing operation).
- Weld residue (flux, slag) shall be removed from the weld in the usual way.

Note: The welding examination sample must be submitted to the Weld Testing Agency intact. The testing agency is responsible for the preparation of the particular test pieces.

AIRCRAFT WELDING EXAMINATION No. 3

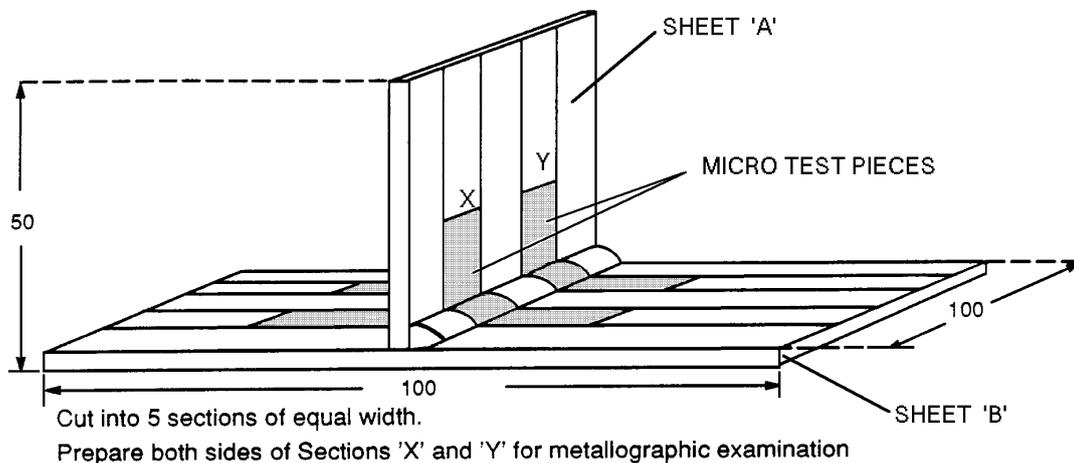


Diagram 3 – Joint No 3 – Sheet to Sheet Fillet Weld

Weld for aircraft welding examination No. 3

- For the purpose of undertaking the aircraft welding examination No. 3, a person must carry out two Joint No. 3 - sheet to sheet fillet welds in accordance with the specifications set out in diagram 3.
- All measurements are nominal and in millimetres (mm).
- The examinations must be carried out using parent metals of the same alloy type or grade procured to the applicable specifications referenced in the production procedure/maintenance data.
- Examination metal thickness for both arc and gas welding processes are: Sheet 'A' - 1.2 mm to 1.3mm (includes 0.50 inch sheet) and Sheet 'B' - 1.6 mm (includes 0.063 inch sheet).
- If sheets of other thicknesses are used, Sheet B must be two nominal gauge sizes (for the selected material) greater than Sheet A (Note: qualification will be subject to thickness conditions).

- The plates should be positioned by tack welds on the opposite side to the weld and one weld shall be welded with Sheet 'A' in the vertical (as depicted in diagram 3).
- The second weld shall be with the weld joint in the overhead position.
- Completed welds may be cleaned with a wire brush but must not be dressed, hammered or sand-blasted (light tapping with a hammer to remove scale deposits is acceptable and is not regarded as a dressing operation).
- Weld residue (flux, slag) shall be removed from the weld in the usual way.

Note: The welding examination sample must be submitted to the Weld Testing Agency intact. The testing agency is responsible for the preparation of the particular test pieces.

AIRCRAFT WELDING EXAMINATION No. 4

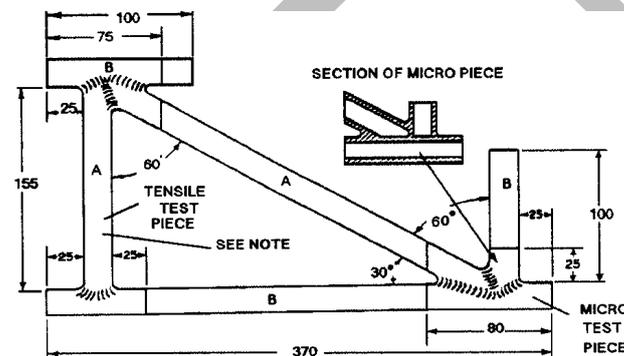


Diagram 4 – Joint No 4 – Tube To Tube Weld

Note: Vent holes should not be drilled in the tensile test piece vertical tube 'A'.

Weld for aircraft welding examination No. 4

- For the purposes of undertaking the aircraft welding examination No. 4, a person must carry out a Joint No. 4 - tube to tube weld in accordance with the specifications set out in diagram No. 4.
- All measurements are nominal and in millimetres (mm).
- The examinations must be carried out using parent metals of the same alloy type or grade procured to the applicable specifications referenced in the production procedure/maintenance data.
- Each tube has a diameter of 19 mm to 19.5 mm (includes 0.750 inch OD tube). Examination metal thicknesses for oxy-acetylene (gas), GMAW (MIG) and GTAW (TIG) welding processes are: Tubes 'A' - 0.9 mm (includes 0.35 inch) wall thickness and Tubes 'B' - 1.4 mm to 1.5 mm (includes 0.58 inch) wall thickness.
- For other arc welding processes the examination metal wall thickness is 1.6 mm to 1.65 mm (includes 0.065 inch walled tube) for Tubes "A" and 2.0 mm to 2.15 mm (includes 0.083 inch wall tube) for Tubes "B".
- If tubes of other thicknesses are used, then Tubes "B" must be two nominal gauge sizes greater (for the selected material) than Tubes "A". (Note: qualification will be subject to thickness conditions).

- The tubes shall be prepared assembled (in the manner shown in diagram No. 4) in a jig and tacked. The assembly is then to be removed from the jig and mounted in a vertical position with the longest tube horizontal and at the lowest point (as depicted in diagram 4). The assembly shall not be moved from this position during the process of completing the welds.
- The uppermost joint which is formed by the short horizontal, vertical and diagonal tubes shall be welded by the overhead technique and the remaining joints completed by working around the joints.
- Completed welds may be cleaned by wire brush, but must not be dressed, hammered or sand blasted (light tapping with a hammer to remove scale deposits is not regarded as a dressing operation)
- Weld residue (flux, slag) shall be removed from the welds in the usual way.

Note: The welding examination sample must be submitted to the Weld Testing Agency intact. The testing agency is responsible for the preparation of the particular test pieces.

JOINT No. 5 — PRODUCTION/REPAIR PART WELD

Weld for aircraft welding examination No. 5

- For the purposes of undertaking the aircraft welding examination No. 5; using the procedures, joint configuration, welding positions, equipment and consumables specified for the production or repair weld, a person must carry out a weld on:
- an aircraft part that is no longer intended for use in an aircraft or as a part of an aircraft; or
- a simulated aircraft part made of a metal of a type and grade that is the same as that metal to be used for the production or repair part.

Note: The welding examination sample must be submitted to the Weld Testing Agency intact. The testing agency is responsible for the preparation of the particular test pieces.

PART 2 – EXAMINATION ASSESSMENT CONSIDERATIONS

Assessment standard

Under the provisions of paragraph 145.A.30 (f) of the Part 145 MOS a specialist maintenance authorisation for aircraft welding may be issued by the AMO if CASA has approved the method of qualification included in the AMO's exposition.

To ensure that standardisation is maintained nationally, assessments of the aircraft welding examinations are to be conducted by an organisation accredited by the NATA Australia as a Weld Testing Agency, to test metal welds.

NATA accreditation provides a means of determining, formally recognising and promoting the competence of these facilities to perform specific types of testing and inspection, and other related activities.

To maintain accreditation, a Weld Testing Agency must be re-assessed regularly. NATA accreditation is highly regarded both nationally and internationally as a reliable indicator of technical competence, signifying that an accredited facility has been assessed against best international practice.

Assessment of the weld is to be based on consideration of the entire test sample including visual examination, metallographic examination and mechanical tests where relevant. Where doubt exists as to the acceptability of a sample, or if it is thought that a defect may be of a local nature, further sections should be examined and the assessment of the sample will be based on all the sections examined. Where a joint sample does not meet the stated criteria in one assessment area, then the complete joint must be repeated and re-assessed.

An employee has passed the aircraft welding examinations considered necessary in the interest of the safety of air navigation if that employee has completed the required sample welds to the standard required by CASA. Fundamental to passing an aircraft welding examination is the satisfactory assessment of the completed weld and welded joint(s).

Braze welding assessment

Braze welds must be inspected and tested in accordance with procedures, standards and limitations as set out in an industry standard acceptable to CASA Refer to Part 1 of this Annex for acceptable standards

Fusion welding assessment

The assessments required for each aircraft welding examination joint sample are as follows:

- Joint No. 1 – Sheet to Sheet Butt Weld: Visual Examination; Bend Test (AS 2205.3.1); Tensile Test (AS 2205.2.1); and Metallographic Test (AS 2205.5.1).
- Joint No. 2 – Tube to Sheet Fillet Weld: Visual Examination and Metallographic Test (AS 2205.5.1).
- Joint No. 3 – Sheet to Sheet Fillet Weld: Visual Examination and Metallographic Test (AS 2205.5.1).
- Joint No. 4 – Tube to Tube Weld: Visual Examination; Tensile Test (AS 2205.2.1) and Metallographic Test (AS 2205.5.1).
- Joint No. 5 – Aircraft Part or Part Typical of Production Weld: Visual Examination and Metallographic Test (AS 2205.5.1).

Visual examination

The entire weld is to be examined. Inspection should be performed at magnification of up to 3 times for welds in parent metal up to 1.6 mm and without magnification for thicker metals.

Features to be Examined

The contour and weld dimensions should be examined for the following features:

- The transition from the surface of the parent metal to the weld face is to have a reasonably smooth blended contour, free from excessive undercut or an abrupt edge to the reinforcement at the toe of the weld. Some undercut in parent metal thicknesses of 1.6 mm and above is acceptable where it does not exceed the following amounts, 0.05T or 0.08 mm whichever is the lesser for butt welds and 0.1T or 1.6 mm whichever is the lesser for fillet welds.
- The weld face should be reasonably smooth, free from cavities and other surface defects. The ripple pattern should be regular, and the depth 'B' (Figure 2) of occasional depressions is not to exceed 0.15T, where 'T' is the thickness of the thinner parent metal. The weld and adjacent parent metal should be free from excessive weld spatter.
- The weld width 'W' (Figures 1 and 2), should be reasonably uniform, and for butt welds the weld width is to be the minimum necessary for the weld metal to penetrate the joint as specified below.
- For butt welds the joint should have complete penetration evidenced by a penetration bead (Figure 1), or the absence of an unfused joint line at the root of the weld (Figure 3).
- Butt weld reinforcement 'R' (Figure 1) is to be present and should preferably be approximately 0.3T, but should not exceed 0.5T.
- For external corner welds, the actual throat thickness 'A' (Figure 10) is to be not less than 'T', weld width 'W' and reinforcement 'R' should be the minimum necessary to obtain complete penetration of the joint as evidenced by a penetration bead or the absence of an unfused joint line at the inside corner.
- The presence and extent of warping or misalignment.
- The presence of hard spots or cracking caused by stray arc strikes adjacent to, or on the weld.

Unacceptable Welds

Welds which exhibit any type of crack, incomplete joint penetration, underfill or overlap and stray arc strikes made on the parent metal in a position adjacent to or other than the weld preparation are unacceptable.

Tensile tests

Method of Test

The tensile test pieces shown in Joints No. 1 and No. 4, (Diagrams 1 and 4 of Part 1) are to be cut from the sample. Test the piece to destruction in accordance with the procedure specified in AS 2205.2.1 - Transverse Butt Tensile Test. Note that for the Joint No. 4 tensile test piece, the intent of the AS 2205.2.1 procedure should be used. Light filing of the internal surface is permitted to obtain a neat fit for this test. The ultimate tensile stress (calculated on the minimum cross-sectional area of the sample neglecting the weld) and the position of the failure should be recorded.

Tensile Test Assessment

For the Joint No. 1 tensile test, the weld is satisfactory if the test piece fails in the parent metal outside of the heat affected zone (HAZ) as determined by the micro test piece. If failure occurs at the toe of the weld or in the weld metal, the weld is satisfactory only if the fracture surfaces are free of defects (such as cracking, large pores, lack of fusion, excessive porosity or inclusions etc.), and the weld conforms to all other requirements and the ultimate tensile strength (UTS) is at least 90% of the strength of the parent metal. If any doubt exists as to the value of the UTS, it is recommended that a hardness test be conducted to accurately determine the UTS. This may be necessary if the failure in the parent metal occurs at less than 90% of the published UTS value for a given material. The UTS for a given material will have a range of values, if the material falls into the lower range of values, the UTS will also be lower. For the Joint No. 4 tensile test, the test piece must fail in the parent metal, outside of the HAZ as determined by the micro test piece. Failure in any other area is cause for rejection.

Bend test

Method of Test

The bend test piece (Diagram 1 of Part 1) is to be cut from the sample and tested with the weld lying along the centre line of the bend with the weld face (the side from which the welding was performed) on the outside of the bend in accordance with the procedure specified in AS 2205.3.1 - Transverse Guided Bend Test Method. The test piece is to be dressed on both sides e.g., by filing or grinding, so that the weld metal is flush with parent metal. The edges of the test piece should be given a reasonable radius. Bending is to be carried out by the application of continuous pressure.

Extent of Bend Tests

The test sample is to withstand bending through an angle of 180° over a radius of twice the nominal thickness, 'T', of the test sample without breaking or developing a crack visible to the unaided eye, except for the material listed in the following table and where the material specification for the parent metal specifies a less severe bend.

Material	Angle of Bend (degrees)	Radius of Bend
Magnesium Alloys	180	10T
Aluminium Alloys containing more than 6% Mg	180	5T
Aluminium Alloys of the 6061-6063 Type	180	8T
Cr-Mo Steels of the 4130 Type*	90	4T

Material	Angle of Bend (degrees)	Radius of Bend
Titanium Alloys		
Tensile Strength Less than:		
516 Mpa	180	3T
516-827 Mpa	180	5T
827-965 Mpa	180	8T
965-1069 Mpa	180	10T
1069-1171 Mpa	180	14T
Martensitic and PH Stainless	Not applicable	
Steels and PH Nickel Alloys		
* After any pre or post-weld heat treatments similar to production welds represented by the test samples.		

Metallographic examination

Method of Test

The metallographic (macro) tests are to be carried out in accordance with the procedure specified in AS 2205.5.1 - Macro Test - Cross Section Examination Method. Sections are to be taken from each test sample at the following locations and prepared for metallographic examination as follows:

- Joints No. 1 to 4: At the approximate locations shown in the relevant joint sketches (Diagrams 1 to 4 of Part 1).
- Joint No. 5: At appropriate locations to cover each type of joint in the weldment.

An additional sample should be prepared and examined if doubt exists as to the acceptability of the sample. The sections are to be taken transverse to the direction of welding at locations where the weld quality appears poorest, except that the start and finish sections of the sheet samples should be avoided.

Weld Assessment Criteria

The sections should be examined unetched and etched at magnification of up to 5 times and where appropriate, reported in accordance with the following requirements:

- The depth of fusion of fillet welds 'F' (Figures 4 to 7) shall be at least 0.15T, where 'T' is the thickness of the thinner parent metal.

- The size of fillet welds 'S' (Figures 4 and 5) are to be not less than the following values, where 'T' is the thickness of the thinner parent metal:

Parent Metal Thickness (mm)	Minimum Weld Size
0.254 - 0.635	2.4T
0.660 - 1.270	1.6T
1.295 - 2.285	1.3T
2.310 - 3.175	1.1T
3.200 and over	T

- The design throat thickness of fillet welds 'D' (Figure 4) should not be less than 0.7 x the minimum weld size 'S' as specified above.
- In fillet welds some lack of complete root fusion is acceptable where the following conditions exist. In all other cases complete root fusion is required.
- For welds of approximately 45° included angle, the unfused distance 'X' (Figure 6) should not be greater than 1/3 of the distance 'Y'.
- For welds of approximately 30° included angle, the presence of a cavity and an unfused section is permissible provided that the throat thickness 'D' is not less than the minimum weld size 'S' specified above (Figure 7).
- For welds of 90° in sheets or tubes where the base metal thickness is equal to or less than 1.6 mm incomplete root fusion of either weld leg for a distance 'X' of not more than 0.3 times actual throat size 'D' is acceptable (Figure 8) provided that the actual throat thickness is not less than the minimum weld size 'S' specified above.
- For lap welds the actual throat thickness 'A' (Figure 9) and the weld size 'S' should be not less than 'T'; depth of fusion 'F' should be not less than 0.15T.

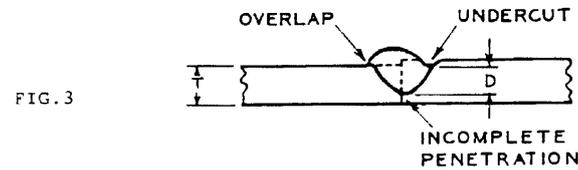
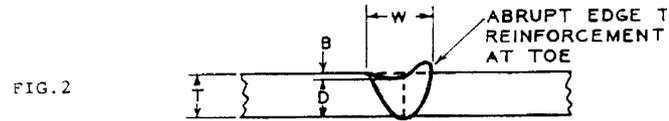
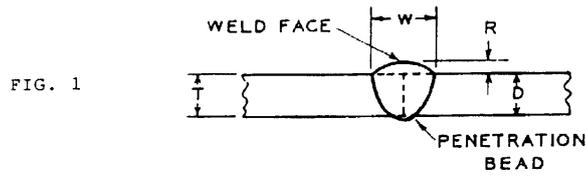
Unacceptable Weld Features

Welds which exhibit any of the following defects are unacceptable.

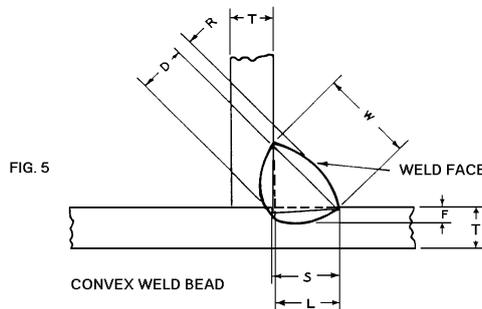
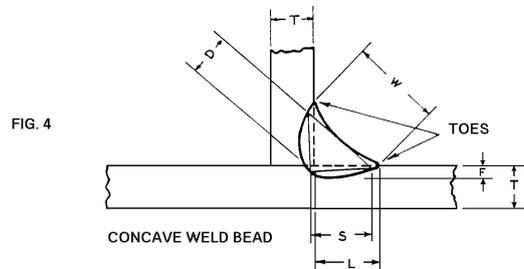
- Cracks.
- Incomplete fusion at the weld face except for the cases stated above.
- Undercut in excess of the amounts stated in the visual examination.
- Overlap.
- In fillet welds a ratio of the leg of the larger size to the leg of the smaller size of greater than 1.5 at any cross section.
- A leg length more than 6T or T + 4.5 mm whichever is the lesser for fillet welds in parent metal thicknesses equal to or less than 1.6 mm (where members differ in thickness 'T' are to be based on the thinner member).
- In convex fillet welds a convexity in excess of 0.1 times the average weld leg length at any location.
- In concave fillet welds, an actual throat size of less than 0.5T at any cross section. Where members differ in thickness 'T' are to be based on the thinner member.

- Excess penetration at the tube or sheet face opposite the weld bead in fillet welds of more than 1.6 mm thickness. In thickness up to and including 1.6 mm, excess penetration may extend for a distance of not more than the tube or sheet thickness 'T' beyond the tube or sheet wall.
- An individual pore size of 0.4T or 2.5 mm whichever is the lesser (where members differ in thickness 'T' is to be the thickness of the thinner member).
- Excessive porosity. Inclusions such as Tungsten shall be counted as porosity. All defects less than 0.05 mm size in parent metal thicknesses, up to 1.6 mm and less than 0.12 mm or 0.03T size, whichever is the lesser in parent metal thicknesses above 1.6 mm, are to be disregarded. Where porosity or the maximum pore size appears excessive, the weld is to be sectioned at other locations or broken open (nick-break) and a length of the weld examined. The assessment is to be based on the weld length of all metallographic sections.
- Any other defects which are attributable to unsatisfactory welding techniques or any unsatisfactory knowledge of welding consumables or the parent metals used.

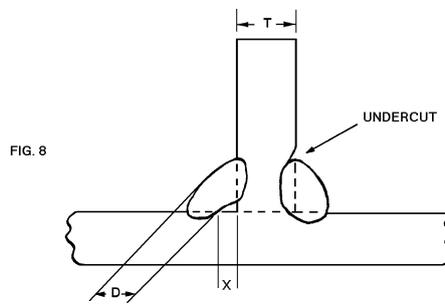
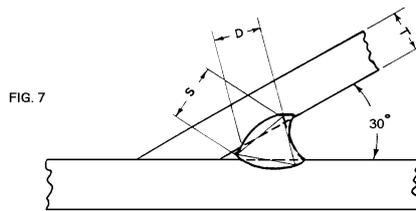
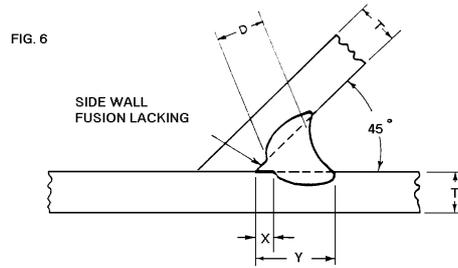
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B = DEPRESSION DEPTH
 D = DESIGN THROAT THICKNESS
 R = REINFORCEMENT
 T = THICKNESS OF THE THINNER PARENT METAL
 W = WELD WIDTH

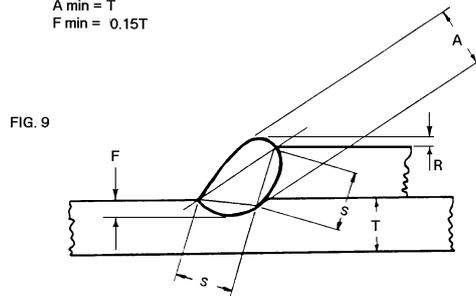


D = DESIGN THROAT THICKNESS
 F = FUSION DEPTH - MAXIMUM
 L = LEG LENGTH
 R = REINFORCEMENT
 S = SIZE OF WELD
 T = THICKNESS OF THE THINNER PARENT METAL
 W = WELD WIDTH

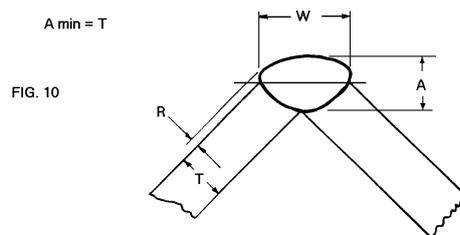


D = DESIGN THROAT THICKNESS
 T = THICKNESS OF THE THINNER PARENT METAL
 S = SIZE OF WELD

$S_{min} = T$
 $A_{min} = T$
 $F_{min} = 0.15T$



$A_{min} = T$



A = ACTUAL THROAT THICKNESS
 F = DEPTH OF FUSION - MAXIMUM
 R = REINFORCEMENT
 S = SIZE OF WELD
 W = WELD WIDTH