



ADVISORY CIRCULAR

AC 21-27 v2.1



Manufacturing approval - overview

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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.

Advisory Circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- Australian aviation manufacturing industry
- Civil Aviation Safety Authority (CASA) authorised persons contracted by the Australian aviation manufacturing industry.

Purpose

This AC is one of several that provide assistance and advice concerning Part 21 manufacturing authorisations of aircraft, aircraft engines, propellers, articles and aeronautical products. Other related AC include AC 21-14, AC 21-16, AC 21-20, AC 21-54.

This AC does not cover approvals granted under the continuing airworthiness regulations for maintenance organisations to manufacture/fabricate parts in the course of maintenance.

For further information

For further information on this AC, contact CASA's Airworthiness and Engineering Branch (airworthiness@casa.gov.au or telephone 131 757).

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Status

This version of the AC is approved by the Branch Manager, Airworthiness and Engineering.

Note: Changes made in the current version are annotated with change bars.

Version	Date	Details
v2.1	August 2020	General update. Reference to AC 21-20 added and previous references to AC 21-601 changed to new document number AC 21-54.
v2.0	August 2016	Version numbering updated. Inclusion of overseas manufacturing and composite manufacturing policy. Addition of Appendix B and C.
(0)	September 1999	Initial AC

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1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	Advisory Circular
AD	Airworthiness Directive
APMA	Australian Parts Manufacturer Approval
ATSO	Australian Technical Standard Order
ASTOA	Australian Technical Standard Order Authorisation
CAR	<i>Civil Aviation Regulations 1988</i>
CASA	Civil Aviation Safety Authority
CASR	<i>Civil Aviation Safety Regulations 1998</i>
CofA	Certificate of Airworthiness
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration (of the United States of America)
FIS	Fabrication Inspection System
MRB	Material Review Board
NAA	National Aviation Authority (for a country other than Australia)
NDI	Non-Destructive Inspection
NDT	Non-Destructive Testing
PAH	Production Authorisation Holder
PC	Production Certificate
PIS	Production Inspection System
PLR	Production Limitation Record.
QMS	Quality Management System
STC	Supplemental Type Certificate
TC	Type Certificate
TSO	Technical Standard Order

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below.

Term	Definition
Aeronautical product	Any part or material that is, or is intended by its manufacturer to be, a part of or used in an aircraft, unless excluded by the regulations.
AS9100	An aerospace standard based on the International Organization for Standardization (ISO 9000) quality system requirements.
Class I product	A complete aircraft, aircraft engine, or propeller, that: <ul style="list-style-type: none"> has been type certificated in accordance with CASA regulations and for which civil specifications or type certificate data sheets have been issued; or is identical to a type certificated product specified above in all respects except as is otherwise acceptable to the National Aviation Authority (NAA) of the importing state.
Class II product	A major component of a Class I product (for example, wings, fuselages, empennage assemblies, landing gears, power transmissions and control surfaces), the failure of which would jeopardise the safety of a Class I product; or any part, material, or appliance, approved and manufactured under an ATSO in the 'C' series.
Class III product	Any part or component which is not a Class I or Class II product.
Manufacturer	A production authorisation holder (PAH) who produces products in accordance with Subparts 21.F, 21.G, 21.K or 21.O.
Supplier	Any person who furnishes aeronautical products, articles or services related to the manufacture of type certificated products.

1.3 References

Regulations

Regulations are available on the Federal Register of Legislation website <https://www.legislation.gov.au/>

Document	Title
Part 21	Certification and airworthiness requirements for aircraft and parts
Part 202	Transitional

Advisory material

CASA's advisory circulars are available at <http://www.casa.gov.au/AC>

CASA's Civil Aviation Advisory Publications are available at <http://www.casa.gov.au/CAAP>

Document	Title
AC 21-08	Approval of Modification and Repair Designs under Subpart 21.M
AC 21-14	Production Certificates

Document	Title
AC 21-16	Australian Parts Manufacturer Approval
AC 21-20	Production Under Type Certificate Only
AC 20-07	Calibration - Inspection and Test Equipment (formerly AC 21-35)
AC 21-54	Australian Technical Standard Order Authorisation
Federal Aviation Administration (FAA) AC 21-26A	Quality System for the Manufacture of Composite Structures
DOT/FAA/AR-02/110	Guidelines for the Development of Process Specifications, Instructions and Controls for Fabrication of Fibre-Reinforced Polymer Composites

1.4 Forms

CASA's forms are available at <http://www.casa.gov.au/forms>

Document	Title
Form 1	Authorised Release Certificate
Form 849	Production Approval - Application

2 Part 21 Manufacturing Approvals

2.1 Purpose of a Part 21 manufacturing approval

- 2.1.1 A type certificated aircraft is airworthy when it conforms to its approved design and is in a condition for safe operation.
- 2.1.2 The purpose of a Part 21 manufacturing approval is to provide the requisite level of safety assurance that each finished aircraft or aeronautical product manufactured under that approval conforms to the approved design and is in a condition for safe operation.
- 2.1.3 In particular, a production approval holder must have the personnel, procedures, quality systems, data, equipment and facilities that are necessary for the particular product(s) and the kind of approval.

2.2 Types of approval

- 2.2.1 There are currently two methods under which approval for the manufacture of type certificated aircraft, aircraft engines and propellers (classified as Class I products) can be achieved. They are:
- production under a Type Certificate (TC) only ¹
 - manufacture under a Production Certificate (PC).²
- 2.2.2 Part 21 approvals to manufacture parts for type certificated aircraft are generally one of the following:
- A PC³
 - an Australian Parts Manufacturer Approval (APMA)⁴
 - an Australian Technical Standard Order Authorisation (ATSOA).^{5 6}

Note: This AC does not cover approvals granted under the continuing airworthiness regulations for maintenance organisations to manufacture/fabricate parts in the course of maintenance.

¹ Refer to regulations 21.121 to 21.130A of Subpart 21.F.

² Refer to regulations 21.131 to 21.166 of Subpart 21.G.

³ Refer to regulation 21.133 of Subpart 21.G.

⁴ Refer to Subpart 21.K.

⁵ Refer to Subpart 21.O.

⁶ The identical nature of a part would be difficult to prove without a licensing agreement with the TC or STC holder.

3 Production types

3.1 Production under a Type Certificate

- 3.1.1 Production under a TC is a means by which the holder of a TC, or a licence agreement to manufacture a type-certificated product, may be approved to manufacture. It is generally issued as an interim approval while the manufacturer develops their production inspection system (PIS) in preparation for a PC. Approval to manufacture under a TC requires a higher level of involvement of CASA in the production process than a PC.
- 3.1.2 A manufacturer who does not hold a PC, but who has been issued with a TC or has a licence agreement to manufacture a type-certificated product, who wishes to commence manufacturing must, within six months from the date of issue of the TC, establish and have approved by CASA a production inspection system (PIS) in accordance with paragraph 21.123 (1) (c). This is to ensure that each example of the product conforms to the type design and is in a condition for safe operation.
- 3.1.3 A manufacturer of an aircraft, aircraft engine or propeller being manufactured only under a TC must make each aircraft, aircraft engine or propeller available for inspection by CASA in accordance with regulation 21.123.
- 3.1.4 Prior to approving the PIS, CASA will inspect and confirm the following criteria of each product:
- technical data
 - processes and procedures
 - conformity with type design
 - suitability for issue of a Certificate of Airworthiness (CofA) for each example of the product manufactured.
- Note:** CASA will also progressively review and approve the development of the PIS during this time.
- 3.1.5 In the event that a manufacturer does not establish and implement an approved PIS within the required 6 month period, CASA will discontinue its inspections and production will cease (unless otherwise specifically authorised by CASA). However, a manufacturer may apply for an extension of time when there are unusual or extenuating circumstances that precluded, or would preclude, the establishment of such a system within the allowed timeframe.
- 3.1.6 Once the manufacturer is operating with the full approved PIS, development of the additional criteria required for a PC should be progressed.
- 3.1.7 Additional guidance on the subject of production under a TC is contained in AC 21.20.

3.2 Production under a Production Certificate

- 3.2.1 A PC is the standard international civil aviation manufacturing approval for type certificated aircraft and parts.
- 3.2.2 In order to be eligible for the issue of a PC, the applicant must be the holder of, or have manufacturing rights to, a TC or STC and satisfy the requirements for a quality system

as specified in regulations 21.139 and 21.143. The existence of an International Organization for Standardization (ISO 9000) or AS9100 series quality system will not, in itself, show compliance with this requirement - the system must address all the requirements of the Australian regulations.

- 3.2.3 A one-off PC permits the manufacture of aircraft parts for supply to a maintenance organisation or an aircraft owner or operator. This kind of approval is intended for support of in-service aircraft and may therefore be approved with more flexible arrangements than a normal PC to accommodate in-service scenarios. Flexible arrangements may not be appropriate for parts that have significant safety effects, so the scope of the production limitation record (PLR) is described accordingly.
- 3.2.4 Additional guidance on manufacturing under a PC is contained in AC 21-14.

3.3 Australian parts manufacturer approval

- 3.3.1 An APMA is a means for approval and manufacture of replacement and modification parts for type certificated aircraft. The intent is that replacement or modification parts for installation on a type certificated product meet substantially the same requirements as required for type certification, but through a dedicated, and therefore simpler, process.
- 3.3.2 An APMA is required for manufacture of aircraft parts to be sold for installation on type certificated aircraft or aeronautical products, other than:
- parts produced by the holder of a TC or PC
 - 'standard parts' as per regulation 21.306
 - parts approved and manufactured under an Australian Technical Standard Order (ATSO)
 - parts manufactured in the course of maintenance by an approved maintenance organisation
 - parts manufactured under a one-off PC for supply to either of the:
 - o holder of a Certificate of Approval engaged in the maintenance of an aircraft for installation in or on the aircraft
 - o operator of an aircraft or the owner of an aircraft, aircraft engine or propeller for installation in or on the aircraft, aircraft engine or propeller.
 - parts manufactured by an owner or operator for maintaining or altering an aircraft, an aircraft engine, or propeller that has been manufactured by the owner or operator.
- 3.3.3 The approval granted under Subpart 21.K is an engineering approval of the design data, combined with a manufacturing approval. CASA will ensure that the manufacturer has sufficient manufacturing capability to carry out the fabrication in accordance with the design data. CASA will also check that the manufacturer has a fabrication inspection system (FIS) in place ensuring that the product conforms to that data and is safe for installation in a type-certificated product.
- 3.3.4 The circumstances that may involve an APMA include a parts manufacturer producing any of the following:

- a part that is a replacement part to one manufactured by a TC or STC holder, and which is identical to the TC or STC part⁸
 - a part that can be used in lieu of a TC or STC holder's part, but is not identical—in this case, full substantiation of design must be shown with the applicable airworthiness requirements of the CASR (i.e. a replacement part that is, in effect, a modification), noting that:
 - o a replacement part is a direct substitute for a product approved under a TC
 - o a modification product is new to the aircraft, engine or propeller and approved under a major or minor change to the type design
 - a part under licence to a TC or STC holder but not using the TC holder's inspection or quality system⁹
 - a parts manufacturer producing a part that is approved for installation on an aircraft under design approvals given under an STC or Subpart 21.M (regulations 21.435 or 21.437).
- 3.3.5 The applicant must show that the design meets the applicable airworthiness requirements. CASA may approve an APMA on the basis of any of the following:
- an examination of the design
 - the technical data for the design approved under regulation 21.009
 - a certification activity from an approved design organisation.
- 3.3.6 However, technical data for an APMA may only be approved by CASA or a person who has been authorised to approve technical data for an APMA (i.e. whose scope of approval includes paragraph 21.009 (1) (g)). Technical data approved for the purpose of a modification/repair design approval under regulations 21.435 or 21.437 may be used as a basis for approval of an APMA, but may need to be supplemented to cover the manufacturing requirements associated with an APMA if there is insufficient manufacturing information in the technical data.
- 3.3.7 Additional guidance on APMAs is contained in AC 21-16.

3.4 Australian Technical Standard Order Authorisation

- 3.4.1 An ATSO is a minimum performance standard issued by CASA for specified materials, parts, processes, or appliances (i.e. articles) used on civil aircraft. Each ATSO covers a specific type of article.
- 3.4.2 An ATSOA is a design and production approval issued by CASA to the manufacturer of an article that has been found to meet a specific ATSO, FAA Technical Standard Order (TSO) or European Technical Standard Order (ETSO). The manufacturer must also have a quality system that meets the requirements of the regulations.
- 3.4.3 During the application for an ATSOA, the manufacturer certifies, after suitable evaluation and testing, that an article complies with minimum performance standards set forth by a specified ATSO, TSO or ETSO. CASA would then find compliance against

⁸ The identical nature of a part would be difficult to prove without a licensing agreement with the TC or STC holder.

⁹ Approval of parts manufactured under this provision that have been installed on foreign state of design aircraft exported from Australia will not necessarily be recognised by foreign NAAs, including the NAA that issued the original TC.

Part 21, assess the applicant's quality system and authorise the production of the article under the ATSOA system.

- 3.4.4 An ATSOA does not confer installation authority. The installation of an article manufactured under an ATSOA must be approved separately in a manner identified in Part 21, such as type certification, an STC or a Subpart 21.M modification/repair design.
- 3.4.5 Further guidance on ATSOAs is provided in AC 21-54.
- 3.4.6 It is possible for CASA to issue a letter of ATSO design approval for an imported appliance. Refer to Section 6 of AC 21-54 for further details.

4 Quality systems for manufacture (PC, APMA, ATSOA)

4.1 Introduction

- 4.1.1 All the Part 21 manufacturing approvals outlined in this AC require the applicant to have a quality system (or FIS for an APMA) that ensures each product and article conforms to its approved design and is in a condition for safe operation. Quality system requirements are scalable, depending on the size and complexity of the PAH and of the product or article produced.
- 4.1.2 This section provides an overview of the assessment process for a Part 21 manufacturing quality system.

4.2 Overview of stages

- 4.2.1 Assessment of any quality system is normally a three-stage process as described below:

Stage 1 – Desktop review

- 4.2.2 CASA conducts a 'desktop review' of the applicant's system to ensure that all the required procedures have been included and adequately address the regulatory requirements.

Stage 2 – Quality system evaluation

- 4.2.3 CASA evaluates the system at the manufacturing location(s) to ensure that:
- the applicant's procedures have been implemented
 - all procedures have been documented
 - the manufacturer effectively controls the work to be undertaken.

Stage 3 – Manufacturer's corrective action

- 4.2.4 If required, the manufacturer initiates corrective action to amend documented procedures and to address any noted deficiencies or discrepancies in the quality system.
- 4.2.5 Quality systems for PCs and ATSOAs must comply with regulations 21.143 and 21.144. The quality system must be documented in a manual and must describe the following functions (as applicable):
- organisation structure and appointed persons
 - technical data control
 - manufacturing processes
 - special processes
 - non-destructive testing (NDT)
 - tool and gauge control
 - supplier control and receiving inspection
 - inspection and testing

- material review or rejection procedure
- stores control procedure
- certification and release of completed parts/products
- service difficulties and product support
- internal audits
- maintenance of a quality system.

4.2.6 CASA recommends that the additional information listed below is included in the quality system manual in order to allow for its effective revision and configuration management.

- first page:
 - o name of the manual
 - o name and address of the organisation
 - o production approval number
 - o approval date
- each page:
 - o name of organisation
 - o manual identification
 - o amendment/revision number of the manual
- general chapters:
 - o Table of contents
 - o List of effective pages
 - o Amendment list
 - o Distribution list
 - o Terms and abbreviations
 - o Introduction/Description of the organisation
 - o Policy statement signed by the Accountable Manager

4.2.7 Further information of these topics is provided in Appendix A. Not all elements specified in Appendix A would necessarily be applicable to every manufacturing activity. However, it is essential that all aspects of the intended manufacturing activity are clearly and adequately specified in the applicant's quality system manual.

4.2.8 The requirements of the APMA FIS are detailed in subregulation 21.303 (11). Whilst the FIS for the APMA does not contain a requirement for the applicant's organisational structure, CASA suggests that it is good practice to address the requirements of Appendix sections A.1 and paragraph A.1.2.

4.3 Stage 1 – Desktop review

4.3.1 This phase of the evaluation is a thorough analysis of a manufacturer's data (including any referenced procedures, policies, standards, instructions, processes) which describe the quality system required for the particular production approval.

4.3.2 Data analysis method

4.3.2.1 CASA will critically analyse the submitted data to ensure that:

- the described quality system will adequately provide for the consistent acceptance of only those products/parts that conform with the approved design data

- the manufactured products/parts are in a condition for safe operation/installation.
- 4.3.2.2 A quality system must be adequately described. The prime objective in analysing the data is to ensure that the quality system meets the intent of the pertinent rules and that such a system can be realistically implemented.
- 4.3.2.3 All data should be positively identified by title, revision, and date. It should also be approved for use by an authorised management representative.
- 4.3.2.4 The initial analysis of a manufacturer's quality system data will be thorough and comprehensive. Subsequent analysis of a particular manufacturer's data may consist of:
- a cursory review of previously submitted data to determine whether or not the data has remained adequate
 - a thorough review of any data which has been revised since the last evaluation
 - a thorough review of any new data which has been developed and implemented since the last analysis. For example, review of the quality assurance provisions of a new bonding process introduced subsequent to the last analysis.

4.3.3 Quality system functions

- 4.3.3.1 Notwithstanding the type of production authorisation held, the product or article must be produced in conformity with the approved design data and be in a condition for safe operation.¹²
- 4.3.3.2 The major system functions suggested in Appendix A are common to all production authorisations, although the level of detail required to ensure control of any particular function may vary between the different types of approvals. The applicant's system should adequately address each function, and that the function procedures are satisfactory to ensure the product/part conforms to the approved design. These functions include the essential elements and the analysis criteria that CASA will apply when assessing the applicant's system.

4.4 Stage 2 – Quality system evaluation

- 4.4.1 This phase of the assessment consists of an analysis of the quality system at the manufacturer's production facilities and all applicable major system functions to determine if the manufacturer has satisfactorily implemented and is maintaining the required inspection system.

4.4.2 System assessment

- 4.4.2.1 CASA will ensure that the manufacturer practices rigorous system discipline; however, CASA does not dictate to a manufacturer the specific manner in which a product will be produced. Once a manufacturer commits to a specific system that is acceptable to CASA, the manufacturer is obligated to adhere to every facet of the system without deviation, unless otherwise approved by CASA to do so.

¹² Refer to regulations 21.165 and subregulation 21.303 (14).

- 4.4.2.2 Whenever a change to the system is necessary, the manufacturer must make the change in accordance with the provisions of the approved system prior to implementation.

4.5 Stage 3 – Manufacturer's corrective action

- 4.5.1 The manufacturer may be required to initiate corrective action to address any noted deficiencies or discrepancies arising from assessment of an initial application or change to an existing system, as identified by CASA.
- 4.5.2 After the production authorisation has been issued, any requests for a change to the production authorisation should be submitted to the CASA Permissions Application Centre (PAC) via CASA Form 849.

Appendix A

Quality system functions – additional information

The applicant should consider the following criteria before making an assessment application to CASA. Not all elements specified in this appendix are applicable to every manufacturing activity. Requirements are scalable, depending on the size and complexity of the PAH and of the product or article produced.

A.1 Organisation structure and appointed persons

A.1.1 Considerations

A.1.1.1 The manufacturer should have:

- management responsibility for the quality system described in the quality data
- clearly defined responsibilities for control of management, production and quality functions, including internal audit responsibilities
- management responsibility for training of personnel
- personnel performing critical operations, inspections, special processes etc. or certifying for inspections and/or stages of work are adequately trained and approved.

A.1.2 Analysis criteria

A.1.2.1 The manufacturer should consider the following analysis criteria when compiling an application to submit to CASA:

- a clear, concise statement that describes the assigned responsibilities and delegated authority of the quality function
- a table of organisation that describes the functional relationship of the quality function to management and to the other organisational components
- a table of organisation that describes the chain of authority and responsibilities within the quality function
- a list of company authorised personnel for the purposes of conducting conformity inspections and issue of CASA Form 1.
- procedures describing the duties and responsibilities of the Accountable Manager, Production Manager and Quality Manager or managers with equivalent functions and responsibilities
- procedures for incorporating changes to the quality system and outlining the authority of those who are authorised to make such changes
- procedures to ensure that any change to the quality system which may affect inspection, conformity, or airworthiness of the product are forwarded to CASA in writing
- procedures for establishing and maintaining a system for all controlled documents identified in the quality system
- procedures that provide for an adequate method of self-audit by the manufacturer of the entire quality system, including supplier facilities.

Note: The prime objective of the self-audit is for the manufacturer to determine compliance with their own procedures and to ensure that management is aware of any existing system deficiencies.

A.2 Technical data control

A.2.1 Considerations

A.2.1.1 The following criteria should be considered when submitting technical data control for assessment:

- technical data (drawings, specifications, and changes thereto) should be approved only by personnel authorised to approve such documents
- technical data should be approved prior to release, and should contain the signature (including electronic signature of the person authorised to release the data)
- distribution of technical data should be controlled to ensure they are current and readily available to production and inspection personnel
- inapplicable, inappropriate or obsolete technical data should be removed from use
- only acceptable approved technical data should be used for inspection acceptance
- drawings and specifications bearing unauthorised changes or unauthorised notations should not be used for inspection acceptance purposes
- ensuring procedures adequately provide for immediate incorporation of design changes resulting from Airworthiness Directives (ADs) have been properly implemented.

Note: Technical data should be stored and retained in such a way that it is available to production staff and CASA when required.

A.2.2 Analysis criteria

A.2.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- for drawing and engineering change control
- for informing company inspectors of current approved changes in engineering data, specifications, and quality procedures
- for the use of electronic signatures addressing elements such as control, traceability and security. The electronic signature procedures should include a description of the electronic system and a process by which alterations to the electronic signature procedures are submitted to CASA's engineering and manufacturing branch for evaluation and approval
- to ensure that major changes to the design data are approved by CASA, or an appropriately Authorised Person or an Approved Design Organisation prior to being incorporated in the product/part
- to ensure that design changes generated as a result of ADs are incorporated in the design data as per the AD requirements, to ensure that the design change is incorporated on production products prior to final acceptance
- for the control, protection and back up of the information management system and electronic data storage.

A.3 Manufacturing processes

A.3.1 Considerations

A.3.1.1 The manufacturer should have the following processes in place:

- production facilities should be arranged to preclude contamination of products/parts (e.g. isolation of grinding, painting or sanding areas from a critical assembly area)
- products/parts must be properly handled and stored to prevent corrosion, damage or contamination
- shop travellers, checklists, or similar media should be used to ensure the proper movement, handling, and storage of products/parts from one station to another through all phases of the manufacturing process
- inspection records should be maintained and used as required
- the degree of protection afforded by any sampling plan used should be known and the associated conditions for its satisfactory use enforced by the manufacturer
- technical data should be appropriately authorised and should reflect the proper revision for the particular manufacturing process
- inspection stations should be located at points in the manufacturing process where accurate quality determinations can be made
- inspection equipment being used should be adequately controlled for accuracy
- the facilities and equipment should be adequate for the manufacture and inspection of the products/parts in production
- planning methods should ensure the complete inspection of the production product/part
- inspection sequences should be established and inspections accomplished at intervals where accurate quality determinations can be made
- non-conforming products/parts should be segregated and identified to preclude incorporation into the end product/part
- an operator verification program (production personnel performing in-process checks) if used, should have adequate controls so that final acceptance responsibility remains with the quality function
- the degree and timeliness of training that production personnel receive should be commensurate with the skill level necessary to perform the assigned duties.

A.3.2 Analysis criteria

A.3.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- for generating and approving manufacturing and inspection function recording sheets. These should list the approved data to be used, together with methods of inspection by tooling, characteristics, and sampling quantities. They should also identify the persons performing the manufacturing work, and those conducting the inspection and certification
- for suitable identification and inspection marking of products/parts throughout the manufacturing cycle, i.e. part number, serial number, acceptance, rejection, NDT, process and material identification

- outlining actions required or a flow chart for processing all products/parts through the manufacturing cycle
- that will provide for the selection of appropriate inspection methods, including calibration procedures for equipment, and plans for each product/part to ensure that all priority parts will be inspected as required to eliminate discrepancies and to ensure that the end item will be in conformity to the approved design data
- for establishing and maintaining the qualifications of personnel as may be appropriate for the various processes, tests and inspection functions
- to control material lot splitting while in the manufacturing process to ensure complete accountability (i.e. action to be taken when a lot or batch contains more or less pieces than recorded on the shop traveller or check sheet)
- to control the movement of products/parts throughout the manufacturing process showing production and inspection status at all times
- for composites manufacturers detailing where the requirements of FAA AC 21-26A have been met
- for the control and management of software used to control critical manufacturing processes.

A.4 Special processes

A.4.1 Considerations

A.4.1.1 The manufacturer should consider the following:

- all processes should be covered by appropriate and approved specifications
- process specifications should contain inspection/quality assurance criteria, which will ensure that all products/parts that are processed and accepted conform to the particular specification
- current specifications should be readily available and be used by operators and inspection personnel
- any equipment such as tools, gauges, instruments, timers, ammeters and voltmeters should be readily available and maintained for accuracy
- processes, equipment, and operators should be qualified, approved and reassessed at appropriate intervals by the manufacturer in accordance with the specification/manufacturer's procedures
- products/parts should be properly handled throughout the area to prevent such things as damage, contamination and rust
- records should be maintained to accurately reflect compliance with the specification requirements
- the degree and timeliness of training that production personnel received is commensurate with the skill level necessary to perform the assigned duties.

A.4.2 Analysis criteria

A.4.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- for the control of process characteristics that affect safety

- that require all process changes to be submitted to CASA's engineering and manufacturing branch for evaluation and approval
- to address the necessary controls for special purposes as related to personnel qualifications, equipment and testing methods
- for the inspection and quality assurance provisions of the process specification should be approved as part of the quality data, when applicable
- for the qualification of special processes (if applicable).

A.5 Non-destructive inspection

A.5.1 Considerations

A.5.1.1 The manufacturer should consider the following:

- operators should be qualified, and approved by CASA or by the manufacturer when authorised by CASA
- operators' qualifications should be kept current
- operators should always work to the current, applicable process specifications
- equipment should be inspected and calibrated periodically to ensure accuracy
- realistic acceptance criteria should be established
- inspection acceptance/rejection criteria should be established to conform with the current design data
- records should be maintained to accurately reflect compliance with the specification requirements.

A.5.2 Analysis criteria

A.5.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- for training, qualification and periodic re-qualification of personnel
- for periodic testing and calibration of equipment, processes and materials
- for performance of each NDT method utilised, including use of approved data, and certification of completed NDT inspection together with results.

A.6 Tool and gauge control

A.6.1 Considerations

A.6.1.1 The manufacturer should consider the following:

- all equipment used for inspection purposes should have the degree of accuracy necessary to determine conformity of the characteristic being inspected
- tool and gauge controls should include procedures for protecting, maintaining and updating this equipment as required to ensure conformity to approved design data
- the quality system should require inspection acceptance and periodic reinspection of all inspection equipment
- the control of inaccurate items such as inspection tools, gauges, instruments and jigs should ensure their identification and removal from use until repair, rework or recalibration has been accomplished

- adequate records should be maintained of all equipment used for inspection purposes. These records should contain the nomenclature, serial number, location, details of all repair or rework accomplished and date next inspection is due.

A.6.2 Analysis criteria

A.6.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:¹³

- to ensure that calibration is traceable to national standards or equivalent foreign national body
- that provide adequate instructions for the operation, inspection and testing of all equipment and tooling used for the acceptance of dimensional characteristics
- to ensure adequate control of tools and gauges, including initial approval and periodic inspections. The procedures should define acceptable methods of tool and gauge rework and reinspection.

A.7 Supplier control and receiving inspection

A.7.1 Considerations

A.7.1.1 The manufacturer should consider the following:

- any holder of a production approval who has delegated inspection duties or relies on suppliers for controlling conformity should ensure, by evaluation and/or surveillance, that those suppliers are continuously in compliance with the approved quality system
- each manufacturer should make information available to CASA regarding all delegation of authority to suppliers to make conformity inspections of any products/parts
- the manufacturer should advise CASA in writing of any authority granted to the supplier to ship directly to the user
- the supplier control function should ensure that all material review actions and design changes taken on supplier-furnished parts and services are approved by the manufacturer prior to their use
- the manufacturer's receiving inspection function must ensure that all supplier furnished parts/services conform to the approved design and are, in fact, in a safe condition for operation
- the manufacturer's purchase order, or equivalent, should reflect the current design data and the pertinent quality requirements
- parts which are found to have transit damage or parts that are awaiting certification should be properly segregated until dispositioned.

A.7.1.2 The manufacturer's receiving inspection function should ensure that all incoming material is properly identified by batch, specification and verification test results. Material received under cover of an Authorised Release Certificate (CASA Form 1) or equivalent document from a recognised authority would be acceptable in lieu of providing the verification test results. If verification test results (Form 1 or equivalent)

¹³ CASA AC 20-07 provides further advice and guidance on calibration.

are not provided with the material, the manufacturer will normally undertake verification testing of the material to the specifications.

A.7.2 Analysis criteria

A.7.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- related to the manufacturer's evaluation, surveillance, and control of supplier-produced raw materials, purchased items, parts and assemblies and parts subjected to special processes
- that detail any delegation of authority to suppliers to make inspections or conduct tests of products/parts for the manufacturer
- for advising CASA of any supplier's performing inspections of products/parts that cannot or will not be completely inspected by the manufacturer
- outlining inspection acceptance of raw materials, purchased items and parts and assemblies including independent analysis of material for critical items to the specification
- to ensure that suppliers submit all design changes for approval and/or are provided with the latest applicable revisions to the approved design data, as appropriate
- to ensure that verification testing is carried out for all incoming material not supplied with appropriate documentation
- for ensuring inspection acceptance, identification, proper segregation, protection and issuance of product/parts in storage areas, including controls for incorporation of applicable design changes
- detailing the Material Review Board (MRB) delegations for when the manufacturer relies on or delegates such MRB duties to supplier facilities.

A.8 Inspection and testing

A.8.1 Considerations

A.8.1.1 The manufacturer should consider the following:

- the manufacturer should establish and comply with test procedures applicable to the products/parts
- in the case of aircraft, the manufacturer should establish and comply with approved flight test procedures and flight test check-off form
- test equipment should be controlled and calibrated to ensure accuracy
- products/parts subjected to adjustment or rework after inspection acceptance should be retested to approved test procedures
- where sampling inspection tests are utilised, other inspections and tests should be implemented, as required, to ensure the acceptance of only those products/parts which conform to the design data and are safe for operation
- records of all tests conducted should be maintained in accordance with the manufacturer's procedures.

A.8.2 Analysis criteria

A.8.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- to ensure that the inspection of products/parts will be performed and properly recorded at points in production where accurate quality determinations can be made
- to properly perform, control, record and identify all inspection processes
- to ensure that the use of any statistical sampling inspection plan will not result in an unsafe condition in an end product/part
- that provide adequate instructions for recording information in inspection records (i.e. acceptance, rejection, serial numbers, heat code)
- for the control, issuance and use of all inspection stamps, punches, etc.

A.9 Material review and rejection procedure

A.9.1 Considerations

A.9.1.1 The manufacturer should consider the following:

- an MRB should be established and should include representatives from the quality and engineering departments
- the MRB procedures should include requirements for obtaining CASA engineering approval on any non-conformities of the product/part which constitute a major change to the approved design data, prior to final acceptance of the product/part
- the MRB procedures should provide controls for identification and segregation of non-conforming products/parts, and actions to be taken
- the manufacturer should maintain a list of approved MRB members
- non-conforming products/parts should not be released by the MRB until the MRB has determined the actions to be taken
- the MRB area should be controlled to prevent the unauthorised removal of MRB withheld products/parts
- the MRB records should include part number, quantity, date, adequate description of defects, action taken and authorised MRB signatures
- the MRB procedures should provide a system for obtaining corrective action on redundant or chronic unsatisfactory conditions to prevent recurrence.

A.9.2 Analysis criteria

A.9.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- that require corrective action (in-plant, at suppliers and in-service) where processes or procedures result in a non-conforming product/part
- describing the MRB system, including the procedure for recording MRB decisions and disposing of nonconforming products/parts (i.e. use as is, rework or scrap)
- for the identification/segregation of products/parts submitted to MRB action
- describing MRB delegations when the manufacturer relies on or delegates such MRB duties to supplier facilities

- for the review of inspection and service records for evaluation and corrective action on repetitive discrepancies
- for appointing MRB members and a description of what minimum qualifications, training and experience are required to hold these positions
- describing the authority and scope that the MRB has for making decisions about parts that deviate from the design data and how this affects/relates to a design change.

A.10 Stores control procedure

A.10.1 Considerations

A.10.1.1 The manufacturer should consider the following. The system should ensure:

- that only accepted products/parts are placed in storage, and that they are properly identified before being stored
- that products/parts which are subject to deterioration from prolonged storage are periodically reinspected and any action to be taken is determined, as appropriate
- the protection from damage and deterioration of products/parts which are being delivered to fabrication, shipping or other areas, and while stored in those areas
- that required design changes are incorporated on products/parts in storage prior to their release for installation/shipment
- that only those products/parts which are identified as having passed company inspection are issued from stores.

A.10.2 Analysis criteria

A.10.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- for each of the items in A.10.1
- for the traceability of incoming material, parts and standard parts, including records and certification or specification documents
- to quarantine and identify parts or material awaiting MRB disposition, expired shelf life, unserviceable parts and those parts awaiting conformity inspection.

A.11 Certification and release of completed parts/products

A.11.1 Considerations

A.11.1.1 The manufacturer should consider the following:

- all engineering data used for the acceptance of the product/part must be approved in accordance with Part 21 requirements
- the product/part conforms to the approved engineering data
- all required inspections and tests necessary to ensure that the end product/part conforms to the approved design data and is in a condition for safe operation before the product/part can be certified or approved
- aircraft, engine and propeller logbooks and/or records should have inspections and operating times properly recorded, signed and dated

- each product/part should be properly identified, as required by Subparts 21.O and 21.Q
- statements of conformity should be properly documented, signed, dated and submitted to CASA as applicable
- applications for CofAs or Special Flight Permits should be properly executed, signed, and submitted to CASA or an authorised person
- personnel making certifications for completion of stages of work, final certifications and release of articles or aeronautical products on Authorised Release Certificate (CASA Form 1) are authorised to do so.

A.11.2 Analysis criteria

A.11.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- to identify completed products/parts
- to ensure that all required inspections and tests will be satisfactorily accomplished prior to final acceptance of the completed products/parts
- that ensure that end products/parts are in conformity with approved design data and are in a condition for safe operation
- to ensure that certifications for completed work are only made by authorised personnel
- to ensure that the final certification for completion of the manufacture of the product/part is made
- to ensure that CASA Form 1, or other acceptable document is signed and issued by authorised personnel, and that this document provides traceability for the applicable part, and complies with the requirements section (i) of CASA Form 1.
- to ensure that completion of CASA Form 1 includes in Block 12 the aircraft eligibility for APMA parts, the approved design data and revision status used for manufacture and the aircraft registration details for one-off PC parts
- to ensure that completed aircraft, engines and propellers are released with appropriate log books, compiled by authorised personnel
- for airworthiness certification or approval of products/parts to be exported including personnel authorised to make such certifications.

A.12 Service difficulty and product support

A.12.1 Considerations

A.12.1.1 The manufacturer should consider the following:

- the system should ensure that service problems are investigated and appropriate corrective actions are taken by the manufacturer
- the system should have a means for keeping users of the product/part informed of service difficulties and resultant changes to the type design approved by CASA
- the system should provide for receiving feedback on service problems from users of the product/part.

A.12.2 Analysis criteria

A.12.2.1 When compiling an application to submit to CASA, the manufacturer should include procedures:

- that define the manufacturer's responsibilities and corrective actions relative to service difficulties involving products/parts in-plant or in-service, including spares in storage or shipped to a user
- to ensure reporting to CASA failures, defects and malfunctions as required by regulation 21.003
- to define the manufacturer's responsibilities in relation to dealing with article/aeronautical product recall and quality escapes.

Appendix B

Approval of manufacturing capability outside of Australia

B.1 Considerations for the use of overseas manufacturing locations and overseas suppliers

B.1.1 CASA and the applicant should consider if the use of an overseas supplier or overseas manufacturing location imposes any undue burden on CASA as per regulation 21.137, and subregulations 21.303 (10) and 21.601 (4). The applicant will be notified during the earliest possible stage of the application process that use of overseas suppliers or addition of an overseas manufacturing location may require audits of the overseas facility to be conducted by CASA.

Note: This early stage notification will normally take place during a meeting of the Production Control Board.

B.1.2 An existing production authorisation holder (PAH) who plans to add/use a supplier in another country should notify CASA about this intention before the supplier is added to the approved suppliers list. This notification is to allow CASA to determine if CASA will need to perform any assessment and surveillance of this supplier and if this activity would impose any undue burden on CASA. A decision about a need to perform any assessment or surveillance of a supplier in another country will be made on the basis of CASA's assessment of the complexity of the product and its impact on the airworthiness of the higher assembly and/or aircraft it is intended to be installed on.

B.1.3 The cost of funding initial supplier assessment and ongoing surveillance will normally be the responsibility of the PAH to ensure that no undue burden is imposed on CASA.

B.1.4 Some of these audits may be able to be conducted by other NAAs if Australia has the appropriate agreements in place. The feasibility of this approach will need to be assessed by CASA on a case-by-case basis. The initial assessment and ongoing surveillance of all overseas manufacturing locations that will be added to the production approval will be cost recoverable as per the initial application or variation process using CASA Form 849.

B.1.5 The scope of work that can be conducted by overseas suppliers to a PAH should be categorised using the following considerations listed in B.1.6 to B.1.9.

B.1.6 An initial onsite assessment and ongoing surveillance conducted by CASA of overseas suppliers should be conducted when:

- suppliers are providing Class 1 and Class 2 products to the PAH
- suppliers are providing Class 3 products that cannot be completely inspected during receipt by the PAH. For example:
 - o a seat assembly that has sections that have been closed up during manufacture
 - o a metal assembly that has been riveted together that cannot be inspected internally without destruction of the part
 - o parts that have been subjected to critical special manufacturing processes such as welding or NDT or composite manufacturing.

B.1.7 In addition to CASA oversight, the PAH approved Quality System/PIS/FIS should detail the following:

- a rigorous supplier control program implemented by the PAH, including an initial supplier onsite assessment and ongoing audit program.

- all products received by the PAH are to be accompanied by documentation to support control over the manufacturing process. For example:
 - o job travellers or worksheets
 - o material certificates
 - o testing results
 - o certification for special processes
- details of any contractual obligations or supplier arrangements
- a list of all the parts that are produced overseas and which supplier is manufacturing them.

B.1.8 Some Class 3 products manufactured by overseas suppliers may be authorised without the need for CASA to conduct an onsite assessment or ongoing surveillance using the following guidelines, which should be contained within the approved Quality System/PIS/FIS:

- a rigorous supplier control program implemented by the PAH, including an initial supplier onsite assessment and ongoing audit program
- a rigorous design data control system or configuration management system to ensure that the supplier holds the current design data and manufactures/certifies the manufactured parts to the current design data
- details that all products received by the PAH are to be accompanied by documentation to support control over the manufacturing process. For example:
 - o job travellers or worksheets
 - o material certificates
 - o flammability testing results
- details of any contractual obligations or supplier arrangements
- a list of all of the parts that are produced overseas and which supplier is approved to manufacture those parts.

B.1.9 Some examples of products that may be considered as Class 3 products under this categorisation include:

- curtains, carpets and seat covers
- sheet metal parts that are able to be completely conformed when received by the PAH. This includes parts that have been subjected to special process requirements (i.e. alodine or painting). Products that are subject to complex or critical special processes should not be considered under this category.

Appendix C

Manufacture of composite aeronautical products under a one-off production certificate

C.1 Composite primary structure

C.1.1 One-off PCs are primarily intended for support of in-service aircraft and accordingly are issued with more flexible arrangements and scope. Such arrangements are generally unsuitable for manufacture of composite primary structure. CASA therefore encourages the manufacture of composite primary structure under an APMA or PC.

C.2 Production limitation record

C.2.1 The production limitation record (PLR) will be broken down in accordance with regulation 21.151, setting out each product authorised to be manufactured. Some examples of what should be taken into consideration into the PLR are listed below. Products/capability/scope will be added or removed accordingly to the PAH's ability to support the application:

- secondary/non-load bearing structure - fibreglass composite products
- secondary/non-load bearing structure - carbon fibre wet lay-up composite products:
 - o kevlar (aramid)
 - o carbon/graphite
 - o boron
 - o ceramic fibres
 - o sandwich construction
- secondary/non-load bearing structure - pre-impregnated fibreglass and carbon fibre composite products.

C.3 Quality management system/production inspection system

C.3.1 The difficulty of approving a quality system that includes composites to be manufactured under a one-off PC is that the design data that will be used may be unknown at the time of application. Typically the design data approved for composite manufacture will include process specifications and material specifications.

C.3.2 The approved process and material specifications normally drive specific quality requirements, depending on several factors including but not limited to:¹⁴

- the type of composite product
- complexity of the part
- criticality and specific airworthiness requirements.

C.3.3 Ideally, the applicant's quality management system (QMS) and PIS will meet the requirements of FAA AC 21-26A (or later approved revision). FAA AC 21-26A is the benchmark for production of all composite structures up to and including complete aircraft. Accordingly, the QMS/PIS provided should be tailored in such a way to address all of the FAA AC 21-26A requirements that are applicable to the scope of the application. Some examples that may be used by the CASA Project Officer to aid in their assessment include:

¹⁴ Further information on the development of process specifications can be found in DOT/FAA/AR-02/110.

- an applicant that has been limited to secondary/non-load bearing structure - fibreglass composite products may not need to meet the requirements of aspects such as chemical analysis of the resin matrix system
- an applicant that is restricted to pre-impregnated composite products would not need to meet the requirements of the resin matrix system (as the resin is already impregnated into the fibre) but should provide reference to testing of pre-impregnated chemical, physical and mechanical fibre matrix
- an applicant with secondary/non-load bearing structure - carbon fibre wet lay-up approval may not know what non-destructive inspection (NDI) method will be required at the time of application. Details on how the applicant is able to satisfy each NDI type are available in FAA AC 21-26A. These should be detailed in the QMS/PIS. Some of these capabilities may be outsourced and the appropriate supplier control processes should be in place.

C.3.4 CASA expects that different design data will include specific process/material specifications and may require changes to the QMS/PIS to accommodate individual jobs. A procedure should be documented in the QMS/PIS to assess each approved design against the suitability of the approved QMS/PIS to support manufacture. This procedure should address update to the QMS/PIS and, if required, notification to CASA prior to the commencement of production of that part.