CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

# Advisory Circular
# AC 148-1

**Revision 4**

## Aircraft manufacturing organisations

~~**24 July 2007**~~

**26 August 2022**

### General

Civil Aviation Authority (CAA) Advisory Circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

### Purpose

This AC describes an acceptable means of compliance with the aircraft manufacturing organisation requirements under Civil Aviation Rule Part 148 (Part 148).

### Focus

This AC is intended to assist organisations in gaining certification to carry out aeronautical manufacturing activities in New Zealand.

### Related Rules

This AC relates specifically to ~~Civil Aviation Rule~~ Part 148, Aircraft Manufacturing Organisations Certification.

### Change Notice

Revision 4 provides updated guidance to reflect the transition from a Quality Management System (QMS) to a system of safety management (Safety Management System or SMS) focus, as reflected in rule 148.65.

Throughout, we have substituted guidance on quality management with reference to AC100-1, as participants are advised to follow this AC when designing their SMS. We have also made minor stylistic changes, including punctuation and general formatting fixes. Lastly, we have taken the opportunity to add a Version History.

***Note:*** *The rules related to Quality Assurance and QMS expired in February 2021 and were replaced with SMS requirements in rule 148.65.*

~~Revision 3 corrects various references to other ACs which have now been re-numbered.~~

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**Cancellation Notice**

This AC cancels AC148-1, dated 24 July 2007.

**Version History**

History Log

| Revision No. | Effective Date | Summary of Changes |
|---|---|---|
| 0 | 23 March 1997 | Initial issue of this AC |
| 1 | 25 December 1997 | Renumbered as AC148-A |
| 2 | 27 April 2007 | Renumbered as AC148-1, as part of a project to standardise the numbering of ACs |
| 3 | 24 July 2007 | Corrected various references to other ACs which have now been re-numbered. |
| 4 | 26 August 2022 | Provides updated guidance to reflect the transition from a Quality Management System (QMS) to a system of safety management (Safety Management System or SMS) focus, as reflected in rule 148.65.<br><br>Makes minor stylistic changes, including punctuation and general formatting fixes.<br><br>Adds a Version History. |

## Introduction

The objective of Part 148 is to provide for the certification of organisations in New Zealand to manufacture or carry out limited manufacturing tasks in the production of aircraft components. A limited manufacturing task includes any such task that contributes to the production of an aircraft component: for example, the heat treatment of parts for an aircraft being manufactured by an organisation certificated under Part 148.

Part 21 and Part 43 require certain types of parts and materials to be used on type-certificated aircraft. In New Zealand these parts and materials must be sourced overseas or manufactured locally. The holder of a manufacturing certificate has the primary responsibility for controlling the manufacture of their products and parts. These products and parts must conform with the holder's type design requirements, their quality control data, and any applicable standards and procedures.

Part 148 provides for the recognition of the organisations that produce these parts and their ability to certify the conformity of these items for use.

# Table of Contents

# Subpart A — General

*To assist readers with cross referencing, the numbering of the paragraphs contained within this AC corresponds ~~generally with the numbering of Part 148.~~ with specific rules in Part 148.*

## 148.1 Applicability

~~The Civil Aviation Regulations 1953 required firms to be approved to carry out construction, maintenance, design, processing, and supply. The organisational rules in the current Civil Aviation Rules system have replaced most of these regulations. Part 148 replaces the requirement for a construction firm to be approved with a requirement for them to be certificated as a manufacturing organisation.~~

Part 148 applies to organisations seeking certification as aircraft manufacturing organisations. An aircraft manufacturing organisation may carry out manufacturing activities covering all aspects of aviation, and this is controlled by the certification and continued compliance requirements of Part 148.

## 148.3 Definitions

The following terms are used in these AC. Additional definitions may be found in Part 1.

**Appliance** means any instrument, mechanism, equipment, component, or accessory that is used or intended to be used in operating or controlling an aircraft in flight, or is installed in or attached to the aircraft, and is not part of the airframe, engine, or propeller~~:~~

**Product** means an aircraft, aircraft engine, propeller, or their components, or a material, part, or appliance approved under an NZTSO authorisation~~:~~

**NZTSO** means New Zealand Technical Standard Order~~:~~

**Technical data** are drawings, instructions, or other data required to be used for product certification, approvals, and authorisations under Part 21 or for the modification or repair of products and appliances under Part 43~~.~~

## 148.5 Requirement for certificate

The Civil Aviation Rules require products to be approved before use. The approval of these products requires production, inspection, and testing to be carried out in a controlled environment. The control of the manufacturing environment is provided by the certification of an organisation for aircraft manufacturing activities under Part 148.

The certificate details the privileges a certificated organisation has by listing appropriate ratings as detailed in rule 148.11.

## 148.7 Application for certificate

This rule prescribes the form of the application to be submitted and allows an applicant to apply without providing any further detailed information. The application can then be registered with CAA and assistance in developing the organisation can be provided against this application.

The applicant should provide the information required by form CAA 24148/01. The form can be ~~obtained from the Operator Certification Unit of the CAA or~~ downloaded from the CAA website at: **http:\\www.caa.govt.nz**

~~*148.7(2) refers to the exposition required by 148.71. This is an error and the exposition is required by 148.67. The rule will be amended in due course.*~~

### 148.9 Issue of certificate

There are several requirements to be met for the issue of the certificate. Primarily, the applicant must meet the requirements of Subpart B of the rule to be issued a certificate. A copy of the CAA's *Certification Policy - Organisations* is available on the CAA website at this link.

To be assessed as meeting the requirements of Subpart B the applicant's documentation will be checked for compliance with the rule and suitability for the type of manufacturing tasks the applicant is proposing to carry out.

After the documentation is accepted as satisfactory, ~~an inspection of the applicant's facilities and resources will be made and may include interviews with key staff members.~~ CAA will carry out an inspection of the applicant's facilities and resources, including interviews with nominated senior persons. This initial comprehensive inspection will ensure that the organisation can comply with their exposition and that the exposition accurately reflects the organisation's activities.

Once the Director is satisfied that all certification requirements have been completed in a satisfactory manner, ~~Once CAA is satisfied with the organisation~~ the certificate is issued. ~~A certificate may be issued for a temporary period and a compliance audit required before full certification is given. This decision will be made after assessing the type of manufacturing work proposed, the adequacy of resources, and the experience of the applicant and their staff.~~

### 148.11 Privileges of certificate holder

The holder of a manufacturing certificate may:

- obtain airworthiness certificates without further checking, except that ~~the~~ CAA may inspect products for conformity with the type design
- issue airworthiness release documents for engines and propellers which are listed in the holder's exposition
- issue airworthiness release documents for replacement parts, and
- manufacture products in accordance with the ratings on the certificate and the holder's exposition.

The manufacturing organisation should hold the type certificate or a design approval for the product, but they may choose to have a suitable arrangement with the holder of one of these.

Each manufacturing certificate may then be related to one or more type certificates, but the manufacturing certificate may not always authorise manufacture of every product listed on a type certificate.

For different type certificates ~~the~~ CAA may authorise similar products to be manufactured under a single manufacturing certificate. The authorised products and parts will be listed in the organisation's exposition with the appropriate type certificate references.

#### Certificate ratings

The certificate is issued with ratings reflecting the level of production the organisation will be considered competent to perform.

Ratings available for manufacturing organisations are:

- **M1** for the manufacture of aircraft, aircraft engines, and propellers as defined in the organisation's exposition
- **M2** for the manufacture of aircraft, aircraft engine, and propeller components as defined in the organisation's exposition
- **M3** for the manufacture of appliances as defined in the organisation's exposition
- **M4** for the manufacture of materials as defined in the organisation's exposition

~~Whilst~~ While the ratings are for general abilities, the detailed capability of an organisation should be stated in their exposition. This detailed capability will largely be dependent on the facilities the organisation has access to and the experience of the personnel the organisation employs. An applicant should not detail activities the organisation will not be able to provide.

### Additional limitations on certificate

The Director may ~~prescribe~~ place limitations and conditions on a manufacturing organisation certificate. These additional limitations placed upon the certificate may include models from a type certificate, limitations based on the applicable requirements of Part 21, or general qualifications of the manufacturing activities considered appropriate.

### Limited manufacturing tasks

A limited manufacturing task is a task that contributes to the manufacture of a product but may not produce the finished item on its own.

For example, heat treatment, hardness testing, and machining may be considered limited manufacturing tasks for issue of a manufacturing certificate. These limited manufacturing tasks may be compared with the processing certificate previously issued under New Zealand Civil Aviation Regulations 1953.

In these cases, the limited manufacturing task or tasks will be listed in the organisation's exposition.

## 148.13 Duration of certificate

~~The Swedavia – McGregor report recommended that all aviation documents issued to organisations should terminate. The report proposed a maximum validity of five years and this has been reflected in the rule.~~

The initial certificate can be issued for up to five years, but the maximum duration isn't always granted. CAA will decide the length of the initial certificate on a case-by-case basis.

Certificates that expire, are suspended, or are revoked, must be returned to CAA. Certificates should be returned to the Director at the 'Contact Us' address on the CAA website within seven days of their ceasing to be effective.

~~Where the certification of an organisation will require checking after a period of initial operation the certificate may be issued only for a temporary period. After a satisfactory compliance audit, full certification should be achieved.~~

~~The initial compliance audit should ensure that the organisation is complying with their exposition and that the exposition accurately reflects the organisation's activities. Future audits will examine similar compliance requirements and any other relevant matters.~~

### 148.15 Notification of ceasing manufacturing

If an organisation decides to cease manufacturing, CAA must be informed. ~~A letter should be sent to CAA, including the certificate, within 30 days of ceasing manufacture.~~ A certificate which has expired or has been revoked must be returned to the Director.

As well as ensuring CAA has an accurate picture of the aircraft organisations in operation in New Zealand, there are continuing airworthiness responsibilities that must be addressed when a manufacturing organisation ceases to operate.

***Note:*** *Aviation documents are not transferable, as per rule 19.11. An organisation's certificate is issued against the entity (for example the number registered with the Companies Office). Should the organisation be taken over, resulting in a change to the legal entity, the certificate cannot be transferred to the new organisation, so it expires when ownership changes. Persons or organisations engaging in the sale or purchase of such an organisation should contact CAA to understand the implications for the business.*

### 148.17 Renewal of certificate

An organisation should allow sufficient time for the renewal process to be planned and carried out. The time involved will vary according to the type of manufacturing activity the organisation is certificated for and undertakes, as well as the period the certification has been in force.

Where a certificate has been in force for the full five years, a re-entry application and ~~audit~~ compliance assessment process will be required ~~to be followed~~. This process will ensure that all facets of the organisation comply with ~~the rule~~ relevant rules. The ~~extent~~ scope of this re-entry process will depend on the organisation's conduct to date, any changed circumstances, and results of safety audit findings over the period of validity.

To determine continued compliance with the Part 148, CAA will conduct such inspections and tests as it considers necessary prior to the renewal of a manufacturing certificate.

Applications for renewals should be made ~~prior to the renewal date or at least 30 days prior to the expiry date.~~ before the current certificate expires, as early applications may prevent any issues arising from delays in the issue of the certificate. ~~The renewal of a manufacturing certificate may be delayed if the organisation's application is not forwarded by the appropriate date.~~

Organisations are encouraged to make the renewal application at least 60 days prior to the expiry date. At the very latest, applications should be made:

- at least 30 days prior to the expiry date, or
- by the date shown in the 'Limitations and Conditions' section of the Exposition Acceptance document

whichever occurs earliest.

The renewal of a manufacturing organisation's certificate may be delayed if the organisation's application is not forwarded by the appropriate date or is incomplete.

***Note 1:*** *CAA actively seeks applications for renewal well in advance of 30 days, to mitigate the risk that there will not be sufficient time to prepare for recertification tasks and effect a seamless (unbroken) transition from the old to the new certificate.*

***Note 2:*** *CAA may add a condition to an organisation's Exposition Acceptance document, requiring any application for renewal to be submitted by a specified date. This is more likely to be added in larger organisations' documents, to ensure that CAA has enough time to assess renewals.*

~~The audits and inspections conducted by CAA are to ensure that holders of manufacturing certificates continue to comply with Part 148. Inspections may also ensure that the organisation is complying with the latest revision of its exposition.~~

## Subpart B — Certification Requirements

### 148.51 Personnel requirements

One basis for certification will be an adequate staffing structure from the Chief Executive (CE) position to the production personnel

In smaller organisations the ~~Chief Executive~~ (CE) and the senior persons may be the same individual, but in all cases there should be clear definitions of the position's responsibilities. Individuals undertaking one or more functions in the organisation should have a clear understanding of the division of responsibilities and be able to demonstrate this to CAA. ~~The individual undertaking one or more functions in the organisation should have a clear understanding of the division of the responsibilities and be able to show this to CAA.~~

~~The organisation's personnel levels should ensure that a sufficient number of suitably qualified people are available~~ The organisation must be able to show that it has enough authorised personnel ~~to carry out the manufacturing task to ensure that all maintenance activities are performed in accordance with acceptable methods, techniques and practices.~~ to ensure that all manufacturing activities are performed in accordance with acceptable methods, techniques and practices.

The organisation should provide for the initial assessment and maintenance of the levels of competency of all personnel involved in planning, supervision, inspection / performing certification and safety management of any maintenance activity listed in the applicant's exposition.

The International Civil Aviation Organisation (ICAO) defines competence as a combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.

~~As part of these levels, a sufficient number of qualified inspectors is required to ensure that all parts, processes, and procedures, are inspected for conformity to technical data, specifications, and procedures specified in the type design.~~

The competence of all staff should be determined on the basis of:

- academic qualifications
- licences, certificates or approvals held
- employment records showing experience relevant to the role, and/or
- written, oral, or practical examination.

~~The organisation should provide for the assessment and maintenance of the levels of competency of all personnel.~~

### The Chief Executive (CE)

The ~~Chief Executive~~ CE must have the authority within the organisation to ensure that:

- all activities are performed in accordance with the applicable requirements
- appropriate actions are taken to address safety issues and risks, and respond to accidents and incidents, and
- the financial responsibility and resources are made available to support this.

If an organisation has several independent business units then it may be appropriate to apply for certification independently. If this is the case, the organisation will need to identify a ~~Chief Executive~~ CE ~~will be required to be identified~~ for the manufacturing unit specifically.

If, on the other hand, an organisation retains one identity the ~~Chief Executive~~ CE should be clearly shown to have an appropriate level of authority. This may occur where an organisation is certificated for other tasks such as maintenance or design and only one core exposition is used for all administrative functions.

### The senior persons

The person or persons nominated will represent the management structure of the organisation and ~~are required to~~ must be acceptable to the Director. ~~The senior persons should be suitably qualified for the positions held and should be given the responsibility for the conduct of the manufacturing activities of the organisation.~~

Titles may vary between organisations, but the requirements are for management representatives for supply, production, inspection and testing, and ~~internal quality assurance~~ the system for safety management (SMS). If a particular area is specifically excluded, or specifically included~~,~~ in the exposition the responsibilities required to be addressed may vary.

In particular, the senior person responsible to the ~~Chief Executive~~ CE for the organisation's compliance with Part 148 should be a design or production engineer.

To be found acceptable, senior persons must have adequate knowledge and experience relevant to their area of responsibility. In addition, technical managers will be expected to have appropriate experience on aircraft or equipment similar to that for which the organisation seeks certification.

Persons nominated for these positions are expected to have a broad level of experience relevant to their area of responsibility. Lesser experience may be accepted where the area of responsibility is restricted, such as in component shops, or if the nominated persons have undergone a recognised course of training relevant to the position.

Any person exercising privileges, under the authority of a document holder, is required to be a fit and proper person (FPP) according to the criteria of section 10 of the Civil Aviation Act (1990). This includes all the nominated senior persons. The persons nominated must be identified on the application form CAA 24145/01 and a completed form CAA24FPP must be submitted for each person. The person's biographical details or *curriculum vitae* should accompany these forms.

A shorter form, the *Fit and Proper Person Declaration* (24FPPDEC) may be used by applicants who:

- have been determined fit and proper previously, and:
    - within the past five years have completed an FPP questionnaire (CAA 24FPP) and have been accepted by CAA as an FPP, and

- can attest that the facts and information declared previously are unchanged.

The responsibilities of senior persons include, but are not limited to:

### Supply

Responsibility for ensuring that:

- raw materials are inspected for compliance to the required specifications
- any assemblies sourced from external suppliers meet the requirements of the manufacturing organisation, particularly if the assemblies cannot be completely checked on receipt
- internal supply procedures include the acceptance, packaging, preservation, and delivery of products
- liaison is maintained with all suppliers to ensure on-time delivery of materials and parts necessary to support the manufacturing process
- the suppliers used are aware of the manufacturing organisation's systems and requirements
- any corrective action relating to supply and stores resulting from the ~~internal quality~~ SMS ~~assurance programme~~ is quickly and effectively carried out.

### Production

Responsibility for ensuring that:

- appropriate materials are provided for the manufacturing process
- suitable arrangements for testing and inspection, including equipment and facilities, exist with providers of these services
- there are procedures for liaison with the appropriate design organisation to allow for effective production and concessions and corrections to be made during the production process
- staff are appropriately authorised
- appropriate production process control exists including provisions for supply, processing, testing, storage of completed items, and issue of those items for release
- any corrective action relating to the manufacturing process resulting from the ~~internal~~ SMS ~~quality assurance programme~~ is quickly and effectively carried out.

### Inspection and testing

Responsibility for ensuring that:

- any inspections and tests carried out are implemented and running effectively
- inspections and tests reflect the current state of the art of the aviation industry and provide the results necessary to show compliance with airworthiness requirements
- suitable arrangements with providers of testing equipment and facilities are established and reflected in the exposition

- support systems are effective in providing for the activities of the inspection personnel
- any corrective action relating to the inspection and testing resulting from the internal quality assurance programme is quickly and effectively carried out.

**~~Internal quality assurance~~ System for Safety Management (SMS)**

Responsible for:

- helping the CE to establish, implement and maintain a system for safety management in accordance with rule 100.3
- providing day-to-day leadership for people carrying out SMS work, noting the final responsibility sits with the CE
- ensuring the oversight and coordination of all SMS-related policies, procedures and activities
- reporting to and providing advice to the CE and line managers on SMS, including the resources needed to carry out this work effectively.

***Note 1:*** *AC100-1, section 2.5.2,* Training and Competency Guidance Material*, is a useful reference point for managers responsible for this function, as it is an in-depth list of typical tasks and responsibilities associated with the person responsible for SMS in an organisation.*

***Note 2****: CAA will require the person who carries out this role to have direct access to and be responsible to the CE. For larger organisations where the post holder may report to a position other than the CE for administration purposes, direct access is still required for matters of safety. This is normally shown in the organisation chart as a dotted reporting line.*

***Note 3:*** *In addition to rule 148.65, organisations also have obligations under the Health and Safety at Work Act (2015) (HSWA) to make sure their operation is safe, including minimising the risk of fatigue for all workers. Further information and guidance can be found on the CAA Fatigue Risk Management webpage and the WorkSafe New Zealand website.*

~~**Responsibility for ensuring that—**~~

- ~~the organisation remains in compliance with Part 148~~
- ~~the exposition and the associated procedures remain adequate for the scope of the organisations activities~~
- ~~any exemptions required are processed in accordance with the organisation's procedures and Part 11~~
- ~~personnel meet the initial and on-going training and qualification criteria defined in the exposition~~
- ~~staff are authorised appropriately for performing certifications on behalf of the organisation~~
- ~~support systems are effective in providing for the activities of any internal quality assurance personnel~~
- ~~any corrective action relating to the exposition, procedures, qualifications, personnel, or support systems resulting from the internal quality assurance programme is quickly and effectively carried out~~

## 148.53 Facility requirements

Office accommodation should provide for the management, planning, records, quality, production, and other staff. The offices should be sufficient to meet the requirements for the scope of manufacturing work to be undertaken.

As there is an ongoing requirement to retain production records, the provision of storage and the methods of cataloguing and preventing deterioration of this material is required.

Testing facilities may include calibrated and critical equipment and this test and measurement equipment should have adequate protection and control. AC43-13, *Calibration of tools and test equipment for maintenance of aircraft,* provides more information.

~~*Information on calibration will be published as an AC at a later date.*~~

The manufacturing organisation's arrangement of production areas should provide for:

- ~~provide for~~ the segregation of manufacturing processes or operations which may adversely affect other operations, and
- ~~provide for~~ the storage of equipment, tooling, material and components.

The separation of precision inspection areas from each area where, for example, grinding, cutting, sanding, or painting operations are performed allows for the compliance with the applicable process specifications.

Suitable storage areas provide the manufacturing organisation with control over the deterioration of, damage to, and acceptability of those items stored. Correct storage of inspection tooling, for example, ensures accurate checks to be carried out on the manufacturing process.

## 148.55 Equipment, tools, and material

This rule requires the manufacturing organisation to not only have the necessary equipment but to also have the procedures to ensure control of the process.

The requirements extend to the provision of:

- production data from organisations such as libraries, New Zealand Standards, CAA, the military, and other manufacturing organisations
- tools and testing facilities requiring hanger, workshop, or other specialised environments
- equipment including measurement, drawing, and computer support equipment.

The procedures should ensure that each process is performed by trained and qualified personnel in accordance with acceptable specifications containing definitive standards of quality.

The procedures would provide for periodic inspection of gauges, solutions, or any critical equipment including the associated documentation. Special processes and services, such as welding, brazing, heat treatment, and plating, would include the close control of factors such as temperature, curing time, and solution.

~~In undertaking manufacturing work the~~ An organisation ~~should ensure that it identifies,~~ must identify, in its exposition, the processing and testing locations it intends to use regularly. If tools,

equipment, or special processes are located at these other premises, then controls should be in place to ensure the equipment is controlled and calibrated as necessary.

Outside organisations, or organisations certificated under other Civil Aviation Rules, may be acceptable to provide the equipment, tools, and manufacturing facilities. In these instances, a contractual arrangement would be expected, and this agreement should be referenced in the exposition.

As an example of tool or equipment control, a procedure may require that:

- adequate manufacturing equipment and tooling would be provided
- equipment and tooling would have the capability and reliability to ensure production of uniform duplicate parts and products conforming to the type design.
- the acceptance of non-conforming parts, or rejection of conforming parts, due to improperly controlled tools and gauges, be avoided by:
    - inspecting and calibrating the equipment to appropriate measurement standards
    - inspecting tools, gauges, and testing equipment, as well as production jigs, fixtures, and templates which are depended upon as means of inspection
    - establishing inspection intervals on the basis that such tools and gauges would be inspected prior to their becoming inaccurate, or requiring adjustment, replacement, or repair.
- a records system is provided to ensure that each piece of equipment, tooling, or storage container is:
    - checked prior to first usage and at the proper periodic interval
    - marked to indicate the date that the next inspection is due
    - removed from inspection and shop areas, or conspicuously identified, to prohibit usage after expiration of the inspection due date.

## 148.57 Type certificates and design approvals

### Type certificates

The suitable arrangement between a manufacturing organisation and the holder of a type certificate or supplemental type certificate should be detailed in the organisation's procedures. This arrangement may take any appropriate form but must enable the organisation to exercise the appropriate quality assurance over the manufacturing tasks. The quality assurance should include checking of the completed products for conformity to the type design.

Each manufacturing certificate may be related to one or more type certificates, but the manufacturing certificate may not always authorise manufacture of every product listed on a type certificate.

For different type certificates ~~the~~ CAA may authorise similar products to be manufactured under a single manufacturing certificate. The authorised products and parts will be listed on the manufacturing certificate, or accepted in the exposition, with the appropriate type certificate references.

The arrangement with the type certificate holder ensures that the necessary type design information and requirements to be met during manufacture are available. The manufacturer and designer should be closely linked to ensure that the design is interpreted correctly, and potential problems identified. This liaison is particularly important in the early stages of manufacture, such as prototyping.

### Design approvals

For products that do not have type certificates and ~~that~~ those a manufacturing organisation wishes to design, a design approval should be held, or a relationship with a design approval holder arranged. For a manufacturing organisation, the common design approvals are NZTSO ~~New Zealand Technical Standard Order~~ authorisations and New Zealand Parts Manufacturing Approval authorisations, both in accordance with Part 21. The design approval function may or may not be required by a manufacturing organisation, but the NZTSO and NZPMA authorisations provide for the manufacturing organisation to design and develop the part themselves. If significant design issues are involved there should be some collaboration with a design organisation.

Design approval considerations are detailed further in Appendix G.

The procedures for the development of designs to achieve an authorisation should detail the requirements the organisation expects to be met to enable submission of the proposal for approval. These requirements would likely take into account commercial-in-confidence issues, corporate image issues, and other considerations that may not directly relate to the development of the design.

## 148.59 Production control procedures

This rule details the process control elements of a manufacturing organisation. These elements ensure that conformity is assured at each step of manufacture. Process control is expanded in Appendix A but includes provisions for:

- supply
- process control
- testing and inspection
- stores
- issue.

### Supply

***Note:*** *Supply is generally referred to in relation to those activities where items enter the organisation.*

The holder of a manufacturing certificate is responsible for any parts, assemblies or services used in the manufacture of their product. The ~~holder's~~ procedures should include methods to monitor and control all parts or services obtained from suppliers and all suppliers to whom the holder has delegated inspection duties for controlling conformity and quality.

The inspections and tests of a holder of a manufacturing certificate are extended to include their supplier's inspections and tests when parts or services cannot or will not be completely inspected upon receipt. In effect, each supplier's facilities constitute extensions of the facilities of the holder of a manufacturing certificate.

## Process control

Production planning procedures should be used. ~~To~~ These provide control over the fabrication and assembly operations and ~~to~~ ensure that necessary inspections and tests are conducted in the proper sequence~~,~~. ~~production planning procedures should be utilised~~. The manufacturing organisation should establish its production procedures, taking into consideration:

- the establishing of appropriate inspection stations and programmes
- the arrangement of production areas to provide segregation of manufacturing processes or operations which may adversely affect other operations
- a system to control the integrity of all special processes and services
- the identification and control of products and controlling documentation.

The process control procedures would include, for non-destructive inspection as an example:

- the operator qualifications required by the manufacturer
- the currency requirements for an operator by the manufacturer
- inspection procedures in specifications that are approved as part of quality control data
- inspection and calibration of equipment
- the establishment of realistic, current acceptance criteria
- the recording and retention requirements for records.

**Sub-contractors**

Any sub-contracted work is considered to be an extension of the manufacturer's organisation and should be controlled by the manufacturer's procedures. Sub-contractor information is included at Appendix C.

## Testing and Inspection

The manufacturer should establish and comply with test and inspection procedures applicable to the products. These procedures should include:

- an inspection planning system
- production testing requirements
- final testing requirements.

The final testing requirements are expanded in Appendix D ~~to this advisory circular~~.

The holder of a manufacturing certificate should establish procedures for the dealing with materials and parts not conforming to the type design or specifications. These procedures should enable the manufacturing organisation to:

- control the identification, rework, and use of non-conforming parts, including the isolation and scrapping of unusable parts
- ensure that any parts which will not conform to the type design are not used until the necessary design changes have been approved

- provide ~~for~~ corrective action for ~~with regard to~~ discrepancies in manufacturing procedures, processes, designs, or any other condition which caused the non-conforming parts, to ensure that all affected and subsequent products will be in conformity with the type design
- maintain charts or records to show the effectiveness of the corrective action program and to reveal problem areas as they arise
- ensure that only those parts and processes which have been accepted and found to conform to acceptable design data are used in the product.

### Stores

***Note:*** *Stores is generally referred to in relation to those activities where items move within the organisation.*

The stores system in many manufacturing organisations is linked closely to the supply system. The stores system is generally the internal supply processes controlling product and material distribution and flow through the organisation.

Stores requirements are expanded in Appendix A and Appendix B ~~to this advisory circular~~.

### Issue

Although normally associated with the completed product, a manufacturing organisation may issue products from one production area to another, either directly or through a stores control mechanism.

At each stage where a product leaves a production area, the issue may be controlled by a statement of compliance. This is the confirmation by an authorised company person that the product, whether complete or at a step in the process:

- has been checked
- complies with the airworthiness requirements
- is acceptable for approval.

**Compliance versus conformity**. The terms compliance and conformance are often used interchangeably but this is not strictly correct.

Conformance generally refers to the conformity of a product to an applicable type design. It is correct, therefore, that a statement of conformity attests to the product showing conformity with the type design.

Compliance has a much broader meaning and better reflects the entire production concept. A design comprises several parts and conformance to the type design is only one aspect. A product must meet the relevant airworthiness requirements and these requirements include:

- conformity to the type design
- applicable design standards
- special conditions set by CAA
- general safety aspects of the product

- the product's fitness for use.

The statement of compliance therefore refers to the wider considerations that must be ~~taken into account~~ considered when checking a product.

The airworthiness release documentation used by the holder of a manufacturing certificate includes:

- statements of compliance, used both internally and externally
- authorised release certificates, ~~the~~ CAA Form One, used externally.

### 148.61 Continued airworthiness

The manufacturing organisation has a responsibility to ensure that the products manufactured are monitored and supported. As with design organisations, part of this monitoring includes the investigation and analysis of defect incidents.

Defects that have no effect on safety, in any form, can be considered ~~to be~~ economic or ease-of-use defects. ~~By this we mean that to~~ In other words, correcting the defect may aid production or make the item easier to use. In turn, this may result in an economic advantage to the organisation.

Defects that may result in injury, accidents, or hazards to other aviation activities are considered defect incidents. The manufacturer has a responsibility to keep the users of their products informed of associated improvements.

The defect reporting responsibility of a manufacturing organisation ~~will generally cover~~ includes those product features that are causing a problem. That is, problems introduced by poorly controlled manufacturing processes and poor material performance rather than design faults or maintenance practices. Defect reporting to ~~the~~ CAA is covered in Part 12.

As part of the documentation of a design, particularly a product design, there is a requirement for Instructions for Continued Airworthiness (ICAs). These instructions should be developed by the design organisation but will involve collaboration with the maintenance or manufacturing organisations.

For design approvals held by the manufacturing organisation (NZTSO ~~New Zealand Technical Standard Order~~ authorisations or New Zealand Parts Manufacturing Approval authorisation) the process of developing ~~Instructions for Continued Airworthiness~~ ICAs. rests solely with the manufacturing organisation.

~~Advisory circular~~ AC146–1 contains additional information on the continued airworthiness responsibilities of a design organisation.

For in-service products, the holder of a manufacturing certificate should establish procedures for recording, investigating cause, and assuring corrective action of all known or reported failures, malfunctions, and defects. Procedures should ensure that:

- in-service problems are investigated, and prompt corrective action is taken on all affected products as appropriate
- users of the product are informed of the service difficulties and resultant changes to the type design

- feedback on service problems is received from the users of the products to the extent practicable
- requirements relative to the reporting of certain malfunctions and defects are satisfied.

The procedures required may form part of a totally integrated ~~quality control system~~ SMS.

### 148.63 Records

The holder of a manufacturing certificate should provide procedures that ensure correct technical data control, including that:

- only applicable drawings, drawing change notices, engineering data, and quality control data are available to production and inspection personnel
- ~~that~~ unauthorised, inappropriate, and obsolete drawings and data are promptly removed from production areas
- ~~prior to~~ before final acceptance of products or parts, all changes to the type design are either incorporated in the applicable drawings, or described in change notices attached to such drawings.

The holder of a manufacturing certificate should have procedures detailing the record keeping requirements of the organisation that satisfy the requirements of this part.

~~For airworthiness certification and recording compliance with the airworthiness requirements,~~ To comply with airworthiness requirements, and for certification purposes, all significant inspection and test records ~~attesting to~~ showing the conformity and safety of the completed part or product ~~are required~~ need to be retained.

The procedures should detail the method of identification of records that are no longer current but are required to be held for research or other purposes.

All documents also form an important part of the reference material for other manufacturing and design tasks, staff training, and continued airworthiness responsibilities.

~~As the records should be legible and of a permanent nature, the retention of facsimile paper records should be avoided due to its likelihood of fading.~~

The records described under this paragraph should be stored in a manner that ensures protection from damage, alteration and theft. Computer back-up media should be stored in a different location from that containing the working server, discs, tapes etc., in an environment that ensures they remain in good condition.

Records can be kept electronically but certificate holders should have systems that ~~should~~ ensure the information security, integrity, and retrieval. A system of backing up electronic data is highly recommended ~~would be considered appropriate~~. Procedures for electronic record and document keeping should consider:

- how to avoid~~ance of~~ data loss in the event of power interruptions
- software control, including amendments and prevention of corruption
- how to prevent unauthorised access
- audit trail facilities

- archiving of data in a similar manner to hard copies, and for a similar period
- backup of critical information, preferably once a day, with storage for that backup information
- data verification, on entry and retrieval
- publication provision
- staff training
- amendment of stored data
- setting up a problem report register, including the problem details and solutions.

***Note:*** *AC00-6,* Electronic Signatures, Electronic Record-keeping and Electronic Manuals*, or FAA AC120-78A,* Electronic Signatures, Electronic Recordkeeping, and Electronic Manuals*, contain more information on electronic record keeping systems.*

~~For ease of access records may also be microfilmed or magnetically stored but the original documents should be retained in a secure environment.~~

~~The rule requires the~~ The ideal retention of records is ~~to be 2~~ two years from the date of the withdrawal of the last example of the product from service. This is a very onerous requirement but ensures that the information is available ~~no matter how~~ for as long as the product remains in service. The rule recognises the need for varying this time limit in special cases, for example when: ~~The cases that may support the reduction of this period will vary considerable but may include, but not be limited to, the following—~~

- the only examples of the product being operated are on limited experimental operations
- the number of products is finite and the necessary information can be provided to each owner for inclusion in the product's service records
- the only known examples of a product are operated in countries not contracted to ICAO
- although products still exist, the likelihood of restoring an operating example of the product is considered extremely rare, or
- the type certificate has been ~~is~~ cancelled and the owners of each example of the product informed as to the non-type-certificated nature of the product.

### 148.65 Safety Management System (SMS) ~~Internal quality assurance~~

To comply with this rule, organisations seeking certification must develop, document, implement, and maintain an SMS. This system should include internal audits and regular reviews of the system for safety management.

AC100-1, *Safety Management,* provides comprehensive guidance material to help organisations implementing an SMS. Development and implementation of an SMS will not only give a structured set of tools, it will also provide significant business benefits.

~~Quality assurance is the process of self checking which assures management that the complete system relating to airworthiness is effective. The quality assurance system should provide a system of internal checks which will ensure the integrity of the quality control system. The quality assurance system should also take account of occurrences which may not involve the quality~~

~~control system but which may indicate the level of quality of the service. These could include the continuing airworthiness requirements relating to accidents, incidents, and defects affecting users of the product.~~

~~The level of self checking will depend largely on the size and activities of the organisation. The holder of a manufacturing certificate should decide what statistics and other information will provide the best assurance that the quality control system is effective.~~

~~Compliance with NZS 9000 series of standards would be an acceptable means of meeting the requirements of Part 148. NZS 9004 (ISO 9004) also provides guidance information for establishing quality systems.~~

~~The requirements for the internal quality assurance programme are extensively detailed in the rule and AC00-3 expands on the procedures a system should include.~~

~~The smaller organisations could achieve internal quality assurance in a number of ways.~~

~~The organisation could pick up the senior person responsibilities in respect of quality assurance but in order to achieve the necessary independent overview the organisation would need to have in place very specific procedures to spell out the task. The person responsible would need to convince the CAA that they were able to separate this function from any other tasks. It may also be necessary for the CAA to be more active in overseeing this type of set up.~~

~~Alternatively the organisation could contract an independent quality assurance person specifically to carry out the internal quality assurance task. It should be clearly understood that this person is not an auditor but is in fact a senior person responsible for quality assurance and would carry out the senior person responsibilities detailed in this advisory circular.~~

~~Quality assurance is the process of self checking which assures management that the complete system relating to airworthiness is effective. The quality assurance system will be expected to provide a system of internal checks which will ensure the integrity of the quality control system. The quality assurance system should also take account of occurrences which may not involve the quality control system but which may indicate the level of quality of the service. These could include accidents, incidents, and defects affecting users of the product.~~

~~The level of self checking will depend largely on the size and activities of the organisation. The holder of a manufacturing certificate will have to decide what statistics and other information will provide the best assurance that the quality control system is effective.~~

~~A complete quality control system would provide control over all phases of manufacture, including control over the manufacture of all supplier furnished parts. A totally integrated quality control system would cover—~~

- ~~Technical data control~~
- ~~Supplier control~~
- ~~Manufacturing processes~~
- ~~Special processes dependent on the skill of operators~~
- ~~Tool and gauge control~~
- ~~Testing~~

- Non-destructive inspection
- Dealing with parts not conforming to the type design
- Identification of parts
- Protection of parts being delivered
- Storage
- Certification of conformity with the type design and airworthiness rules
- Issue of release documents
- Retaining records relating to quality control
- Dealing with service difficulties

The holder's internal quality assurance procedures would—

- define the items to be checked and the level and frequency of the checks
- specify who will carry out the checks
- state how the checks are to be documented and how the results are to be communicated to management
- specify who is responsible for reviewing the results of the checking and taking the action necessary to rectify any deficiencies found

The procedures would include, or refer to, supplementary data such as—

- copies of all inspection and acceptance forms and check-lists for parts and completed products, together with instructions for their use
- imprints of the various inspection and process stamps, and their meaning
- schedules of inspections and calibration intervals for production jigs and fixtures, precision inspection tools, testing equipment, including gauges and recording equipment used in controlling processes
- listings of manufacturing processes which are relied upon to assure quality, conformity, and safety of the completed product

For the manufacturing processes, the provision of an inspection planning system would provide the means for selecting and controlling specific procedures that—

- select the appropriate inspection methods and plans for products and parts to ensure—
    - that all characteristics affecting safety will be inspected as required
    - conformity to design data
    - the elimination of discrepancies from completed products and replacement parts
- ensure that any defects which might be in a lot accepted under a statistical quality control plan will not result in an unsafe condition in an end product or replacement part

~~The manufacturing organisation's quality control system would ensure that test procedures are established and maintained for products or parts which require—~~

- ~~test equipment to be controlled and calibrated to assure their accuracy~~
- ~~re-testing to acceptable test procedures after they are subjected to adjustment or rework following initial inspection acceptance~~
- ~~other inspections and tests to be implemented to assure conformance and safety where sampling inspection tests have been utilised~~
- ~~records of all tests conducted to be maintained~~

## Relationship between SMS and QMS

As explained in more detail in AC100-1, SMS and QMS share a number of common purposes and processes, and they both:

- depend upon measuring and monitoring
- strive for continual improvement
- use some of the same tools, such as auditing and review.

However, a QMS does not include all the elements, features and activities of an SMS, as it focuses mainly on compliance, conformance and monitoring. SMS goes further and requires the organisation to identify and manage risk to achieve an acceptable level of safety performance.

It is not so much a case of replacing QMS by SMS, but instead, realising that they are complementary and inextricably linked - one cannot build an effective SMS without applying QMS principles.[1]

The SMS incorporates QMS concepts that can result in more structured management practices and continual improvement of operational processes. The guidance material in AC100-1 is designed to encourage and facilitate integration of safety thinking into the organisation's current business practices already in place such as quality, health and safety at work and environmental control systems.

### 148.67 Manufacturing organisation exposition

The purpose of an exposition is to express the CE's requirements for the conduct of the organisation. It sets out the procedures, means and methods of a certificated organisation in order to establish compliance with the rules. An exposition will only be accepted if it meets all the requirements of Part 146 appropriate to the organisation. A certificate cannot be issued until the exposition is accepted by the Director.

The exposition is the means by which an organisation defines its operation, and shows both its employees and CAA how it will conduct its day-to-day business. It is intended to be a tool to help management in the operation of the business. It also gives CAA assurance that an organisation has procedures to maintain compliance with applicable rules before CAA grants entry into the system.

[1] AC100-1, *Safety Management Systems*, section 1.6.1, p 19

An exposition should commence with the safety policy by the CE. The remaining parts of the exposition may be produced as any number of separate procedures manuals provided that they are cross-referenced to the management part of the exposition.

Managers should have ready access to or hold copies of those parts of an exposition which affect their areas of responsibility. Maintenance staff should have ready access to and be familiar with those parts of an exposition which affect their area of employment.

### Senior persons

The titles and names of the senior persons within the organisation must be listed in the exposition. Their duties and responsibilities and the areas in which they are directly responsible for liaison with the Director must be clearly defined.

### Organisational structure

There must be an organisation chart showing the reporting lines of the organisation. The chart must show the lines of responsibility and means of communication from the design office to the CE. The exposition must show the details of the staffing structure at each place where the organisation intends to carry out the design activities. The details should include an 'approximate' number of staff separated between certifying staff and other staff. There is no requirement to list names as this information is normally held in the staff records.

### Work locations

The organisation is required to identify each location at which it intends to carry out design activities other than places provided for under rule 148.67(a) (5). The level of activity at these locations must be defined and adequate facilities shown to be available.

### Capability of the organisation

The organisation must define its capability in the exposition. The capability listing could take the form of a list of aircraft, or aircraft components, which the organisation is equipped and staffed to maintain. The method used to assess capability and, where permitted, add or remove items from the list through a process of indirect approval, must be specified in the exposition. Although the certificate rating gives the broad definition of the approval, the scope against which CAA will assess the organisation will be the scope set out in the exposition. Subsequently, audit visits will determine if the organisation is performing work not covered by its capability list, or is no longer equipped or staffed to carry out all the work listed. Under these circumstances it will be in non-compliance with the rule.

### Detailed procedures

The procedures listed in these paragraphs provide the working documents for the organisation's activities. The headings are generally self-explanatory and must be addressed by all applicants to the extent that they apply to the particular scope of intended activity. The procedures must accurately describe the organisation's working procedures related to its maintenance activities.

In order to be effective a procedure should describe the *who, what, when, where, why* and *how* of the task or action to be carried out, as follows:

(a) Who:

(i) the procedure is relevant to

(ii) will accomplish the procedure

(iii) is responsible to see that the procedure is done

- an individual – engineer, inspector, pilot
- a position – chief engineer, safety manager, certifying engineer
- an organisation – Part 148 certificate holder.

(b) What:

(i) the procedure is about

(ii) the procedure is trying to accomplish

(iii) the person performing the procedure should do.

(c) When:

(i) the procedure is to be accomplished

- the frequency in hours, cycles, or calendar time
- the actual date or time.

(d) Where:

(i) the procedure will be accomplished

- the specific facility
- the specific type of facility.

(e) Why:

(i) the procedure is required.

(f) How:

(i) the procedure will be accomplished, according to:

- an identified manual, process control, or standard
- the operator's maintenance programme
- data approved by or acceptable to CAA

(ii) the person determines what procedure will be used and if it has been accomplished.

Finally, the procedures must show how an organisation controls, amends and distributes its exposition. They must detail the origin of amendments to the exposition when any deficiency is found, in the normal course of an organisation's activities, or during an internal quality control procedure, or CAA audit. The procedures must also detail how the amendments will be controlled and distributed to holders of any affected parts of the document.

## Exposition acceptance

The acceptance of an organisation's exposition by the Director will be one step in the process of approval. Evidence of acceptance of the exposition is the issue of a certificate.

## Multiple certification

When an organisation seeks certification under more than one rule part that requires an exposition, it may be possible for some parts of the exposition to be common to each certificate. For instance, if the same management set-up is used for each certificate, the management part of the exposition could be common. Equally, all of the SMS procedures for one or more certificates could be placed in one manual.

Whatever format of exposition is chosen, it must be possible to clearly show how each part of the applicable rule is satisfied. It is desirable that a supplement is provided showing where compliance is achieved for each rule part. This could take the form of a cross-referencing table or matrix showing where the common requirements of the applicable parts are covered, such as the CAA 24145/02 which includes Parts 12 and 43 elements as appropriate.

***Note:*** *Any difficulty in establishing compliance will require more investigation time, resulting in additional cost to an applicant organisation.*

~~The exposition is the publication that governs the operation of the organisation. An organisation already certificated under another Civil Aviation Rule may not require a completely separate exposition if provision is already made for the administrative functions. A top level manual may be common across different areas of a company but the exposition for manufacturing would need to address issues specifically related to Part 148.~~

~~The exposition details the—~~

- ~~management definition of the organisation~~
- ~~senior persons~~
- ~~organisational structure~~
- ~~work locations~~
- ~~capability of the organisation and the manufacturing activities to be performed~~
- ~~procedures used in the provision of the manufacturing activities~~
- ~~control and availability of the exposition~~

~~*An advisory circular may be issued in the future to explain what the Civil Aviation Authority is looking for in an exposition.*~~

~~This rule requires the organisation, by means of an exposition, to show the CAA that the requirements for the issue of a manufacturing certificate will be complied with. When the manufacturing certificate is in force, the exposition provides a continuing description of the organisation and its systems relating to airworthiness. The exposition includes procedures which the organisation must require its personnel to follow.~~

~~The manufacturer's organisational structure description should ensure that any decisions with regard to workmanship, quality, conformity, safety, and corrective action are not unduly influenced by other considerations. This could be achieved by having the quality control organisation report directly to the Chief Executive, or a senior person with direct access to the Chief Executive.~~

~~The exposition should also identify—~~

- ~~the person or persons responsible for managing the quality assurance system~~
- ~~the person or persons responsible for liaison with the CAA~~
- ~~the person or persons responsible for making exposition changes on behalf of the organisation~~
- ~~those persons authorised by the organisation to apply for airworthiness certificates or issue airworthiness release documents~~

~~The manufacturing organisation's scope of work description should—~~

- ~~state the types and models of product to be manufactured~~
- ~~state the type certificates or supplementary type certificates involved~~
- ~~provide an overall description of the work to be performed~~

~~When references to other company documents or data are utilised, the organisation's manual would briefly summarise the procedure, method, or system which is referenced. Any such referenced material becomes part of the exposition.~~

### Flight testing new production aircraft

Part 47 and Part 91 provide for the operation of new production aircraft without registration. A Part 148 organisation should include procedures for the control of the Special Flight Permit – Continuing Authorisation system to manage these non-registered flights.

***Note:*** *The reference in 148.67(a)(8) should read 148.57. The reference in 148.67(a)(10)(iii) should read 148.53(b)(3). The rule will be amended in due course.*

## Subpart C — Operating Requirements

### 148.101 Continued compliance

A certificated organisation is required to ensure that copies of its exposition are available at each work location specified in its exposition. This is to ensure that all members of its staff have access to the exposition while at work. The organisation must comply with all the procedures detailed in the exposition. It must also continue to meet the standards and conditions, that were required for initial certification, during the validity period of the certificate.

~~The organisation is required to comply with their exposition and the procedures and systems included in it.~~

~~The organisation is required to maintain compliance with Part 148 and the exposition should reflect this.~~

~~A manufacturing organisation is primarily certificated to produce, and in some cases design, products for the aviation industry. In the completion of these tasks the manufacturing organisation should ensure that their products comply with the applicable airworthiness requirements, have no unsafe features, and are fit for use.~~

### 148.103 Identification of products

The basic requirement for product identification is in Part 21 Subpart Q. ~~The advisory circular~~ AC21-6, *Identification of product and parts - Identification information, provision, and replacement,* expands on the requirements.

### 148.105 Changes to certificate holder's organisation

An organisation should always ensure that its exposition continues to be ~~remains~~ an accurate description of the organisation and its activities. ~~When there are changes to staff, structure, location, or documented procedures the organisation should ensure the exposition reflects these changes.~~ However, before any of the changes listed in rule 148.105(d) occur, a certificate holder must gain CAA's prior acceptance. CAA may prescribe conditions to be applied, either during the change-over period, or permanently, if it does not consider that the new conditions will achieve the same level of safety.

These *transitional conditions* allow an organisation to continue to operate while not fully meeting the conditions of its approval. The organisation can then negotiate with CAA as to the permanent changes that are required. Without this dispensation the approval would be effectively invalidated as the company would no longer comply with its exposition.

CAA may, at any time, require the organisation to amend its exposition if it considers that this is necessary in the interests of safety.

To summarise:

(a) An organisation may make changes to its exposition to reflect changes in its operating procedures. Sending an amendment of its exposition to CAA is accepted as notification to CAA.

(b) Certain designated changes require prior acceptance by CAA.

(c) The Director may require the organisation to make changes to its exposition if such changes are considered necessary in the interests of safety.

~~Prior acceptance by the Director is required for certain changes including —~~

- ~~the Chief Executive~~
- ~~the listed senior persons~~
- ~~the manufacturing activities~~
- ~~the final flight testing activities carried out under a special flight permit – continuing authorisation, in particular the production flight testing of non-registered aircraft~~
- ~~the locations at which work is carried out, including the manufacturing tasks, and design tasks, and the testing and inspection locations.~~

#### ~~Organisational changes~~

~~When the holder of a manufacturing certificate changes their organisation in such a way as to necessitate a revision of their manuals or exposition, the CAA is to be kept informed. An acceptable means of compliance with the notification requirements is to notify the CAA in writing of any changes. A facsimile message may be accepted as a notice in writing.~~

~~The CAA's agreement to the change may be more readily obtained if the proposed wording of the change is fully defined and any supplementary information is provided to assist the CAA in deciding whether the change is acceptable.~~

A change of supplier, or in the delegation of quality functions to suppliers, which results in a change to the exposition of the holder of a manufacturing certificate should be considered as a change to the holder's process control system.

### Manufacturing certificate amendments

An application to amend a manufacturing certificate is made in the same form and manner as the original issue. Where the changes include changes to the manufacturing organisation's exposition, only the changes need be submitted.

Since a manufacturing certificate may be amended for several different purposes, the following paragraphs provide examples as to methods applicable in differing circumstances:

- The holder of a manufacturing certificate may make an application to add a new type certificate, new model, or a supplemental type certificate to the manufacturing certificate. Upon evaluation and approval of the process control data and manufacturing facilities, as applicable, ~~the~~ CAA will issue a new certificate. The new certificate will automatically cancel the existing one. For the new certificate, supplemental type certificates which are referenced in, and become a part of, the type design data will not be listed.

- When manufacture of completed products as well as spare parts has ceased, the holder of a manufacturing certificate should request deletion of the applicable type certificate from the manufacturing certificate. This can be accomplished by writing to ~~the~~ CAA. A revised certificate will be issued and any superseded certificate would be revoked.

If the holder of a manufacturing certificate ceases to manufacture complete products, but continues to manufacture replacement parts, the certificate does not require an amendment.

# Appendix A – Process Control

## Supply

The holder of a manufacturing certificate is responsible for any parts, assemblies, or services used in the manufacture of their product. The holder's procedures should include methods to monitor and control all parts or services obtained from suppliers. Appendix B provides further information on the supply responsibilities.

## Process control

**Production planning system** To provide control over the fabrication and assembly operations, and to ensure that necessary inspections and tests are conducted in the proper sequence, production planning procedures should be ~~utilised.~~ used. The use of fabrication and inspection instructions, shop travellers, checklists, or similar media will ensure that parts and processes are in a condition to be inspected when necessary. Such a system would provide for inspection and tests appropriate to all phases of the production cycle, from raw materials and related processes and services, to the completed product.

The manufacturing organisation should establish its production processes taking into consideration the:

- the establishment of appropriate inspection stations and the programming of inspections at each stage of production to ensure that parts, assemblies, processes, and assembly operations are inspected, and applicable tests are conducted, in accordance with data, technical materials, and procedures maintained at the station for that particular stage of production.
- the arrangement of production areas which require segregation of manufacturing processes or operations which may adversely affect other operations. For example, the separation of precision inspection from each area where grinding, cutting, sanding, or painting operations are performed.
- the integrity of processes and services utilised in the construction of products which is dependent upon the skill with which the work is performed, the capabilities of the equipment used, and the close control of temperatures, solutions, curing time, or other critical factors.
- the control of all processes and services, such as welding, brazing, heat treatment, and plating, that ensures that each process is performed by trained and qualified personnel and in accordance with acceptable specifications containing definitive standards of quality, and that periodic inspection of gauges, solutions, or any critical equipment is controlled and documented.
- the identification of products or controlling documentation with appropriate stamps or marks traceable to the individual inspector, as a means of ensuring that only those products and processes which have been accepted and found to conform to acceptable technical data are used in the product. For example, products detected as being unusable would be conspicuously identified and subsequently controlled to preclude absolutely either their installation on the product or their use as spare items.

**Sub-contractors.** A manufacturing organisation may utilise the services of an outside agency to provide for some of the manufacturing activities. It is appropriate that a manufacturing organisation use contractual arrangements to formalise these authorities.

**Aspects for consideration when setting up contracts are included in Appendix C.** Commonly used sub-contractors should be listed in the exposition and be acceptable to the Director. The scope of the tasks assigned to these sub-contractors should be dependent on their competency and the assessment of the organisation. Common examples of these arrangements will be for testing requirements that may be met by recognised laboratories and testing establishments.

In all cases a manufacturing organisation should require statements of compliance or written reports attesting to the satisfactory completion of the sub-contracted tasks.

## Testing and inspection

**Inspection planning system**. For the holder of a manufacturing certificate, the provision of an inspection planning system would provide the means for selecting and controlling procedures that ensure:

- the selection of appropriate inspection methods and plans to ensure that all characteristics of products and parts affecting safety will be inspected as required, and
- that any defects which might be in a lot accepted under a statistical quality control plan will not result in an unsafe condition in an end product or replacement part.

**Testing.** The manufacturer should establish and comply with test procedures applicable to the products. These procedures should ensure that:

- test equipment is controlled and calibrated to assure its accuracy
- products subjected to adjustment or rework after inspection are re-tested in accordance with the procedures
- where inspections and tests utilise sampling, other inspections and tests should be implemented as required to assure the integrity of the sampling programme
- records of all inspections and tests required to be conducted during manufacture of the final product are made, and those significant records attesting to the compliance and safety of the completed product are retained for an appropriate period.

**Final testing**. The effectiveness of the control exercised throughout the manufacturing cycle to ensure that quality objectives have been met is ultimately determined by the final assembly and test inspections. An acceptable quality control system would, therefore, incorporate final assembly and test procedures.

The holder of a manufacturing certificate should ensure that each completed product is subjected to a final inspection for completeness, up-to-date adjustments, safety calibration, markings, and placards, in accordance with the design data for the product and model involved. Each product should also be inspected for freedom from damage, contamination, and for safe operating condition. The results of final testing should be recorded against the product and be retained for the periods specified in rule 148.67. Final testing requirements are expanded in Appendix D of this ~~advisory circular~~ AC.

## Stores

The stores system in many manufacturing organisations is linked closely to the supply system. The stores system is generally the internal supply processes controlling product and material distribution and flow through the organisation. The organisation should ensure that:

- only those products which are identified as having passed company inspection are received into stores
- there is identification, segregation, and protection of products in storage
- products are lubricated, preserved, and packed in a manner to preclude corrosion or damage in shipment, especially internal damage not readily detectable by inspection upon receipt
- periodic re-inspection and disposition of materials subject to deterioration from prolonged storage is carried out
- protection is provided from damage to products being delivered to fabrication or shipping areas or while stored in these areas prior to use
- any incorporation of applicable design changes is carried out prior to release of stored products for use.

### Issue

Although normally associated with the completed product, a manufacturing organisation may issue products from one production area to another, either directly or through a stores control mechanism.

At each stage where a product leaves a production area the *issue* may be controlled by a statement of compliance.

The holder of a manufacturing certificate has a basic responsibility for controlling the manufacture of completed products in compliance with the airworthiness requirements, including the quality control data and type design requirements.

Completed products are issued with an airworthiness release document.

**Airworthiness release documents.** The airworthiness release documentation used by the holder of a manufacturing certificate includes:

- statements of compliance, used both internally and externally
- authorised release certificates, ~~the~~ CAA Form One, used externally.

The holder of a manufacturing certificate should include procedures for the issue of airworthiness release documents that:

- prescribe the documents to be used
- specify the persons who may issue the documents for stated products or parts and the means of identifying these persons on the documents
- ensure that a document is not issued until the product or part is shown to conform to the type design and is in a safe condition for use
- ensure that a document is not issued until the flight manual, maintenance manual, or other documents required to be supplied with the product by the airworthiness standards or Part 21 are assembled
- require copies of the documents to be retained for an appropriate period.

The holder of a manufacturing certificate should have procedures ensuring that when completed products are ~~considered to be~~ submitted for airworthiness certification, an application is submitted to ~~the Civil Aviation Authority~~ CAA for an:

- airworthiness certificate
- export airworthiness certificate.

**Statements of compliance.** This is the confirmation by an authorised company person that the product, whether complete or at a step in the process:

- has been checked
- complies with the airworthiness requirements
- is acceptable for approval.

A statement of compliance may be used by the manufacturing organisation during the manufacturing process to identify the satisfactory completion of a step in the process.

The statement of compliance may also be used by the holder of a manufacturing certificate to identify:

- that each product complies with its airworthiness requirements and is in a condition for safe operation
- for each aircraft, that the aircraft has been finally inspected and flight tested
- for each engine or propeller, that the engine or propeller has been finally inspected and operationally tested.

Statements of compliance must be signed by the person authorised to do so in the holder's exposition.

**Authorised release certificates**. The holder of a manufacturing certificate should issue airworthiness release certificates for completed products and parts. These certificates certify that the product or part:

- was manufactured in accordance with the airworthiness regulations
- conforms to the type design data and specifications
- is in a condition for safe operation
- for a product to be exported, has had incorporated any special requirements of the importing country.

For completed parts ~~the~~ CAA Form One may be used to record the airworthiness status after manufacture. ~~Advisory circular AC43-3~~, AC00-5, *Parts Documentation-CAA Form One-Authorised Release Certificate,* contains the general guidelines for the use of ~~the CAA orm One~~ this form.

All airworthiness release certificates, including any CAA Form One issued, must be signed by the person authorised to do so in the holder's exposition.

# Appendix B – Supply

The holder of a manufacturing certificate is responsible for any parts, assemblies, or services used in the manufacture of their product. The holder's procedures should include methods to monitor and control all parts or services obtained from suppliers and all suppliers to whom the holder has delegated inspection duties for controlling conformity and quality.

The inspections and tests of a holder of a manufacturing certificate are extended to include their supplier's inspections and tests when parts or services cannot or will not be completely inspected upon receipt. In effect, each supplier's facilities constitute extensions of the facilities of the holder of a manufacturing certificate.

## Supply Procedures

The holder of a manufacturing certificate should ensure that there are procedures detailing the identification, handling, storage, and packing of raw materials, parts, assemblies, and completed products.

The ~~storage and issuance~~ procedures should ensure that:

- raw materials, parts awaiting company inspection, and parts which may not be used for production are held in separate stores. These stores may be termed *quarantine* stores
- only those parts identified as having passed company inspection are received into stores. These stores may be termed *bonded* stores
- there is identification, segregation and protection of parts in storage
- there is periodic inspection and disposition of materials subject to deterioration from prolonged storage
- parts are protected from damage during delivery to fabrication or shipping areas or while stored in these areas prior to use
- the applicable design changes have been incorporated prior to release of stored parts for installation in the product.

Procedures to control the packing, preservation, and condition of replacement parts should ensure that:

- replacement parts conform to applicable type design data and have not exceeded their shelf-life limits
- ~~Prior to~~ before shipping ~~shipment of~~ replacement parts, all required modifications are accomplished in accordance with applicable design changes
- replacement parts are lubricated, preserved, and packed in a manner to ~~preclude~~ prevent corrosion or damage in shipment, especially internal damage not readily detectable by inspection for condition upon receipt.

To permit a complete aircraft to be exported prior to final assembly, inspection, and flight test the manufacturing organisation should ensure that:

- the extent of disassembly is the same as for an aircraft which has been disassembled for shipment purposes

- the aircraft is provided the same identification, handling, storage, and packing considerations of other parts and products.

## External Suppliers

**Relaxation of inspection duties**. The responsibility of a holder of a manufacturing certificate never changes, but the holder may be relieved of some of the burden of inspection and testing duties when they:

- use type-certificated products manufactured under another organisation's manufacturing certificate
- use parts fabricated under a parts manufacturing approval
- use parts produced under an NZTSO authorisation
- use products or parts manufactured under the control of a foreign aviation authority
- install used parts that conform to the type design
- delegate specific inspection and testing duties to suppliers.

In all cases, the manufacturing certificate holder remains responsible for controlling the physical configuration and operating condition of the products or parts furnished by any such supplier. All changes made by a supplier, to the design or the physical product or part, must be submitted to the holder of the manufacturing certificate for evaluation and approval as applicable under Part 21.

The holder of a manufacturing certificate is responsible for obtaining CAA approval of actions for dealing with materials or supplier furnished parts not conforming to the holder's type design data or product specifications.

**Monitoring of suppliers**. The holder of a manufacturing certificate should establish a system to evaluate, monitor, and control suppliers that have been delegated inspection duties for controlling conformity and quality. The holder's procedures should include:

- an up-to-date listing of all suppliers by name and address
- the ~~general nomenclature~~ identification of parts or services provided by each supplier
- a reference to the supplier's quality control manual by title and date
- the delegation of authorities to deal with materials, parts, and services not conforming to the type design or specifications
- the name and title of the supplier's quality representative who can make available purchase orders, drawings and other applicable data.

Such a system is not required for suppliers who hold an approval for the part being supplied.

**Suppliers holding approvals.** The holder of an approval, such as a parts manufacture approval, who furnishes parts or services to the holder of a manufacturing certificate, should be made responsible for those parts or services. In particular, they should be made responsible for parts or services that:

- do not conform to the supplier's design data

- were not manufactured or overhauled in accordance with the supplier's quality control system
- contain any defects which would not normally be found by the manufacturing organisation during receiving inspections and functional tests.

The holder of a manufacturing certificate should provide for the evaluation, surveillance, or both, of suppliers when the holder relies to any degree upon a supplier's quality control system or has delegated inspection duties to the supplier. Minimal source surveillance by the manufacturing certificate holder is an acceptable means of control when the supplier provides a certification of conformance that includes reports of quality measurement data and standards that have been met.

**Foreign suppliers.** Parts obtained from foreign suppliers are under the same degree of control that is exercised over domestic suppliers. For a manufacturing organisation this can be assured if:

- the parts are certified, by the National Aviation Authority ~~foreign civil aviation authority~~ of the country of manufacture or under that authority's rules, as conforming to applicable type designs or specifications and are in a condition for safe operation
- the New Zealand manufacturing organisation has completely inspected such parts for conformity and condition upon receipt in New Zealand and the procedures for such inspections are contained in the organisation’s manuals.

**Purchasing and receiving system.** An effective purchasing and receiving inspection system precludes release to production of non-conforming or unsafe parts procured from outside sources. All incoming raw materials and parts should be held in quarantine stores until the purchasing and receiving system has been applied. Such a system would ensure that:

- purchase orders provide the detail necessary to ensure procurement of parts or services which meet the requirements of the type design or specifications
- all incoming parts conform to type design data prior to their acceptance and release to production
- parts which are not designed or manufactured by the manufacturing certificate holder are of the same design configuration as specified in the type design data
- records are maintained of all inspections and tests performed by, or for, the holder of a manufacturing certificate in controlling the design configuration and conformity of all supplier furnished parts
- inspection and test records are ~~utilised~~ used, as appropriate, to document the accomplishment of all required inspections, tests, rework, or rejections.

# Appendix C – Sub-contracting

## Introduction

This Appendix describes an acceptable means of complying with the requirements of Part 148 when work is carried out by a sub-contracting organisation or person not certificated under Part 148. This work is an extension of the work carried out by the certificated organisation and under the control of its SMS. The responsibility for providing the necessary documentation for all maintenance carried out and authorisation of staff certifying that maintenance rests with the contracting organisation.

*Note: Refer to AC100-1, section 1.4.3,* Managing suppliers*, for more guidance.*

~~This appendix details the considerations for any a manufacturing organisation in subcontracting manufacturing activities to a subcontractor that may or may not be certificated in accordance with Part 148.~~

~~This subcontracted work is considered to be an extension of the work carried out by the certificated organisation and under the control of its process control and quality assurance systems.~~

~~The responsibility for providing the necessary documentation and liaison rests with the certificated manufacturing organisation~~.

## General Conditions

Any manufacturing organisation certificated under Part 148 may sub-contract maintenance to a non-certificated organisation if there is provision in its exposition for such sub-contracting.

The following general conditions should be considered:

(a) When manufacturing activities are carried out under the sub-contract control system, the Part 148 certificate has been temporarily extended to include the sub-contractor for the duration of those activities. Those parts of the sub-contractor's facilities, personnel, and procedures, involved with a certificated manufacturing organisation, must meet Part 148 requirements for that time.

(b) A manufacturing organisation does not need to have its own facilities to carry out all manufacturing that it wishes to sub-contract. It does need to have its own expertise to decide that the sub-contractor meets the necessary standards and that any manufacturing is carried out to the acceptable manufacturing instructions.

(c) A manufacturing organisation may find it necessary to include in its documentation several specialist sub-contractors to enable it to be acceptable to manufacture a particular product. To approve such a sub-contract the Director will need to be convinced that the contracting manufacturing organisation has the necessary expertise and procedures to control such sub-contractors.

(d) The manufacturing organisation is responsible for all manufacturing activities carried out by its sub-contractors. Where that organisation fails to control a sub-contractor, it may put at risk part or all of its own Part 148 certification.

The extent of sub-contracting is only limited by the expertise and procedures of the manufacturing organisation.

Approval to sub-contract is shown by the Director accepting the exposition containing a specific section on the control of sub-contractors and a list of the sub-contractors.

~~When manufacturing activities are carried out under the subcontract control system the Part 148 certificate has been temporarily extended to include the subcontractor for the duration of that production activity. Those parts of the subcontractor's facilities, personnel, and procedures involved with the certificated manufacturing organisation should meet Part 148 requirements.~~

~~Any manufacturing organisation certificated to Part 148 may subcontract manufacturing activities to a non-certificated organisation provided there is provision in its exposition for subcontracting.~~

~~A Part 148 manufacturing organisation may not need to have its own facilities to carry out all the production activities it wishes to subcontract. The organisation should have its own expertise to decide that the subcontractor meets the necessary standards and that any production activity is carried out in accordance with their manufacturing instructions.~~

~~A Part 148 manufacturing organisation may find it necessary to include several specialist subcontractors in its exposition to enable the production and testing of particular products. The organisation should provide the Director with evidence that it has the expertise and procedures to control the subcontractors.~~

~~The manufacturing organisation is responsible for all production activities carried out by its subcontractors. Where a Part 148 organisation fails to control a subcontractor it may put at risk part or all of its own Part 148 certification.~~

~~The extent of the subcontracting is only limited by the expertise and procedures of the Part 148 organisation.~~

~~Approval of the subcontract is shown by the Director accepting the exposition containing a specific section on the control of subcontractors and a list of those subcontractors.~~

## Procedures

When creating procedures for the control of sub-contractors, the following items should be considered:

- A pre-assessment procedure under which the certificated organisation's subcontract control section should visit a prospective subcontractor. ~~The visit will determine whether those activities of the subcontractor that it wishes to use, meet the requirements of Part 148 before any manufacturing work is placed with the subcontractor~~

  ***Note:*** *This visit will determine whether those parts of the sub-contractor that it wishes to use meet the requirements of Part 148 before any maintenance is placed with the sub-contractor.*

- A procedure to ensure the upgrade of the relevant activities of the sub-contractor to meet the intent of Part 148, if the contractor ~~initially~~ does not already meet the requirements

- An assessment of the extent that the Part 148 manufacturing organisation will use the sub-contractor's facilities

- Where the sub-contracted activities will be certificated without significant further checking by the Part 148 organisation, procedures for the issue of statements of compliance by the authorised staff

- Where the sub-contracted activities require~~s~~ further checking, procedures for the inspection during manufacture at the sub-contractor's facility

- Procedures for the control of sub-contractors, to record visits to sub-contractors, to have a corrective action follow-up plan, and to show when sub-contractors are being used

- Procedures for the audit of the sub-contract control section and for the sampling of sub-contractors' performance by the Part 148 manufacturing organisation's ~~quality~~ SMS ~~assurance~~ personnel.

# Appendix D – Final Testing

The holder of a manufacturing certificate should ensure that each completed product is subjected to a final inspection for completeness, up-to-date adjustments, safety calibration, markings, and placards, in accordance with the design data for the product and model involved. Each product should also be inspected for freedom from damage, contamination, and for safe operating condition. The results of final testing should be recorded against the product and be retained for the periods specified in Part 148.

An acceptable system of final assembly and test procedures could include a statistical plan used to determine that product uniformity is reliable. Sufficient statistical evidence should be available to support the manufacturing organisation's sampling system and the degree of such inspection may be based on:

- a statistical sampling plan
- evidence of product uniformity
- a satisfactory history of previous internal inspections
- service experience.

If used, the statistical processes supporting the sampling procedures should be listed in the organisation's manuals and ensure that the level of defective products passed by the sampling is:

- zero if no further installation checks are possible, or
- at a minimum that ensures all defective products can be detected by their installers.

The statistical plan used could include:

- ~~the utilising of~~ using an average empty weight and centre of gravity, ~~in lieu~~ instead of weighing each aircraft
- ~~the~~ sampling ~~of~~ any mass-produced product for performance to the required design standards.

## Aircraft

**Weight and balance**. The holder of a manufacturing certificate for the production of an aircraft must ensure that the means provided for levelling an aircraft are accurately installed, and that the empty weight and centre of gravity of each completed aircraft are accurately determined.

**Aircraft equipment list**. The final tests should ensure that the aircraft equipment list and, when applicable, loading charts and instructions are accurate.

**Functional test.** Each completed and assembled aircraft must be functionally tested to determine whether the operating characteristics meet the design provisions. The aircraft should be subjected to flight tests in accordance with documented flight test procedures and check lists.

Flight test procedures and check lists should be developed from operational characteristics and data which were found to comply with the applicable airworthiness requirements during the type test evaluation programme, and included as a part of the quality control data. Checks should include:

- the operational characteristics of the aircraft on the ground

- the handling qualities, both on the ground and in flight
- the flight performance using normal aircraft instrumentation
- the proper functioning of all aircraft equipment and systems
- a determination that all instruments are properly marked, and that all placards and required flight manuals are installed after flight test
- any other items peculiar to the aircraft being tested.

**Aircraft registration.** Part 47 and Part 91 provide for the flight testing of new production aircraft without those aircraft being registered. This is intended to ~~provide for~~ allow holders of continuing authorisations on special flight permits to use their quality system to control the operation of the aircraft during its post-production flight tests. The authorisation and details of the control procedures should be included in the exposition. The procedures should include:

- construction certification requirements
- test pilot requirements
- test area requirements
- test flight schedules and check lists.

Should any area of these procedures change the authorisation may be affected and ~~the~~ CAA is to be informed.

**Export of unassembled aircraft**. If the holder of a manufacturing certificate intends complete aircraft to be exported in accordance with Part 21, Subpart L prior to final assembly, inspection and flight test, the holder should ensure that:

- their exposition allows for such export
- the extent of disassembly is the same as for an aircraft which has been disassembled for shipment purposes
- their procedures require assembly and flight test procedures to be supplied for this purpose.

## Engines

Test runs and functional tests for engines may be made with the engine appropriately mounted and using current types of power and thrust measuring equipment.

Inspections required for engines should include:

- internal inspection as necessary to determine that the engine is in condition for safe operation
- determination of tolerances and corrections for the test instrumentation and power/thrust absorption devices to ensure that no production engine can be delivered with less than its type-certificated rated power/thrust.

Functional tests for engines should include:

- break-in runs to determine that engine operating parameters are as specified in the type design data
- engine runs to determine fuel and oil consumption and power characteristics
- engine runs for at least five hours of operation at rated maximum continuous power or thrust.

  ***Note:*** *For engines having a rated takeoff power or thrust higher than the rated maximum continuous power or thrust, the five-hour run should include 30 minutes at the rated takeoff power or thrust.*

### Propellers

In the case of variable pitch propellers, static and functional tests should determine that the propeller operates freely and smoothly:

- throughout its normal range of operation
- when maximum and minimum operating forces are alternately applied.

### Other products

In the case of other products, the inspections and final tests should ensure that the products meet their required performance standard and are fit for release.

# Appendix E – Approved data, design standards, and specifications

## Technical data

Technical data forms the basis for the design of aviation articles. The basic concept is that all designs and design changes must comply with acceptable technical data, or have data approved as part of the design process. The data should include the production support data for the manufacturing organisation.

~~Advisory circular~~ AC43-9, *Modifications, Repairs, and the CAA337*, details the procedures relating to modification approval and the use of the form CAA 337. The approval of a modification or repair in accordance with Part 21 is carried out by the approval of the technical data. ~~The new rules system recognises that incorporation of modifications and repairs to acceptable data is appropriate without further approval.~~ Acceptable technical data is listed in Part 21, Appendix D.

If technical data is not approved or acceptable then the data must be substantiated by design activities. If data is already accepted, design activities may be required to confirm interactions between modifications. This means that data may or may not be acceptable dependent on its use. These design activities would require liaison between the manufacturing organisation and a design organisation, unless the manufacturing organisation has a design approval in the form of an NZTSO ~~a New Zealand Technical Standard Order~~ or New Zealand Parts Manufacturing Approval authorisation.

Technical data has limitations placed upon its use and these are generally described in any descriptive information supporting the data. The suitability of a modification, even to acceptable data, relies ultimately on the incorporating person's checking the compatibility of any new modifications with existing structure or equipment. Technical data provided by the manufacturer of a component may not be appropriate if it conflicts with data provided by the manufacturer of the product or assembly of which the component is to form a part.

The ability to approve technical data resides with the Director and any appropriate delegation holder. In approving data, it should be ensured that any applicable:

- ~~an~~ approved type design ~~is complied with~~
- ~~an~~ approved design change ~~is complied with~~, and/or
- ~~the applicable~~ airworthiness design requirements

are complied with.

## Airworthiness design standards

The basis for aircraft certification is taken in New Zealand largely from the USA Federal Aviation Administration. A list of design standards is in Part 21 Appendix C, but other standards may be acceptable to the Director if a design organisation can provide:

- any documentation necessary to define and support the data
- the basis for the suitability of the data as an airworthiness design standard
- confirmation that the data provides an equivalent level of safety to those standards already listed in Part 21, Appendix C, for the type of aircraft operation, or both.

AC21-1, *Product Certification - Type Acceptance Certificates*, expands on the acceptable standards that may be utilised.

## Specifications

Whereas design standards apply to several areas and define overall compliance requirements, a specification is particular. A specification may be included in a design standard and will usually detail performance requirements of a material, part, process, or appliance.

A specification may be used:

- in a design to specify:
    - materials and standard parts
    - performance standards
    - manufacturing standards
    - quality control standards
    - processes.
- as an approved design for standard parts.
- to define suitable equipment for manufacture and maintenance including the selection of suitable materials for production or maintenance equipment.
- to supplement other specifications provided they do not conflict with the approved design.

A specification may include:

- composition
- selection
- testing
- finish
- maintenance and support data
- identification requirements.

If a specification does not include these details, any additional information required for the manufacture and incorporation of the design should be included in the design's descriptive data.

Commercial specifications in non-critical areas may be acceptable but may require additional testing to confirm suitability.

Specifications can be approved if a design organisation confirms the required information is available to show that the specification meets an acceptable minimum performance standard. An example of an approved specification would be an NZTSO ~~a New Zealand Technical Standard Order~~. ~~Advisory circular~~ AC21-4, *Special Category-Amateur-Built Aircraft Airworthiness Certificates,* provides more guidance on NZTSOs ~~New Zealand Technical Standard Orders~~.

A specification~~s~~ may be accepted if it is appropriate to the aviation environment and:

- has requirements applicable to a particular design standard

- is an established industry specification
- is a New Zealand national specification
- is a foreign national specification.

In most cases a design organisation will not be developing a specification and will require access to an existing specification. Various sources can provide specification detail that would be considered acceptable, including:

- International Standards Organisation
- New Zealand Standards
- other national standards organisations
- International Electrotechnical Commission
- Radio Technical Commission for Aeronautics
- British Standards (Aircraft series)
- USA Federal Aviation Administration
- USA Federal government specifications
- USA Society of Automotive Engineering Aerospace Material Specification
- DTD specifications
- Military Specifications (MIL-SPEC, MIL-STD)
- Military handbooks
- New Zealand Defence Force (particularly RNZAF).

# Appendix F – Concessions

A manufacturing organisation may have cause to request a concession from the type certificate or design approval holder. These requests may result from problems or variations related to:

- production processes
- material availability or performance
- supply
- assembly details.

A concession may be issued to permit the use of an individual component or number of components that deviate from the design or specification or to allow the temporary use of substitute materials or parts.

It should be shown that for each concession the applicable airworthiness design standards are complied with.

A concession is essentially a design change of limited applicability and as such they may be approved by a design delegation holder within the scope of their delegation. In limited cases a variation to a product manufactured under an NZTSO ~~a New Zealand Technical Standard Order~~ or New Zealand Parts Manufacturing Approval authorisation may be available if the manufacturing organisations considers it complies with Part 21 Subpart O or Subpart P, as applicable.

# Appendix G – Design approvals

Design approval is an important stage of development as it finalises the product, component, or appliance for manufacture and incorporation. The approving person for a design is the Director and they are issued to manufacturing organisations in the form of an NZTSO ~~New Zealand Technical Standard Order~~ or New Zealand Parts Manufacturing Approval authorisations.

## Design approval

The complete design should be checked for compliance with the airworthiness requirements before approval and issue of an authorisation. An authorisation will only be issued if the Part 148 manufacturing organisation:

- has prepared to produce the product
- if the Director has determined the specification includes significant airworthiness design requirements:
    - is the holder of or the applicant for a design organisation certificate issued under Part 146
    - has arranged for the holder of a design organisation certificate to show compliance with the specification.
- can:
    - comply with the design and performance requirements of the specification
    - consistently reproduce each product and ensure that each completed product conforms to its design data and is safe for installation.

The holder of an authorisation may make design changes to a product it manufactures, other than significant design changes, without further authorisation by the Director. If the holder of an authorisation is intending to make a significant design change to a product it manufactures an application for a new authorisation is required. This application ensures that the authorisation is issued after the design approval process is complete.

Designs should consist of:

- the drawings and specifications necessary to define the configuration and the design features of the product which have been shown to comply with the applicable airworthiness requirements
- a list of those drawings and specifications
- the information on dimensions, materials, and processes necessary to define the structural strength of the product
- any inspections, tests, and computations required, have been completed and documented to show that the product complies with the technical conditions of the applicable airworthiness standards
- evidence that the product, when operated in accordance with the flight manual or other prescribed operating limitations and conditions:

- meets the airworthiness design standards, or the provisions not complied with are provided for by equivalent levels of safety
- has no unsafe feature or characteristic that makes it unsafe for its intended use

- the maintenance data required for the proper maintenance of the product.

### The design package

Designs generally consist of several distinct sections that together make up a package. The design package should consist of ~~the following sections~~:

- descriptive data
- substantiating data, and
- other supporting data and consequential information.

The package as a whole should be arranged inductively so that the purposes and summary of the design is provided in a covering document. Each subsequent section should be deductive permitting the person approving the work to follow the logical development of the design in each section.

***Note:*** *Further details on NZTSO ~~New Zealand Technical Standard Order~~ and New Zealand Parts Manufacturing Approval authorisations are provided in ~~advisory circulars~~ ACs to Part 21.*

### Descriptive data

The completed design package requires descriptive data that fully describes all aspects of the design for manufacturing purposes.

The descriptive data should include:

- use and application of the design
- purpose of the design
- maintenance, operating, and performance data including any limitations for the use of the design
- installation properties including any factors that affect the interaction of the design with other equipment
- references to standards and specifications used during the development of the design
- drawings, diagrams, and other physical descriptions of the design, including:
    - special processes and their required outcomes, including:
        - heat treatments
        - surface finishes
        - weld quality
    - wiring diagrams
    - an equipment list that details the items that make up the completed item.

- A summary of particular manufacturing considerations, including:
    - pressures
    - temperatures
    - environments.
- A list that details the substantiating data for ease of reference.

### Limited descriptive data

In some cases, the descriptive data may not be fully available, or considered required, by the manufacturing organisation. Limited descriptive data may be appropriate in the following cases:

- acceptance by the approving person
- the design is a trial installation to be used for a limited time and under the direct control of the approving person
- the design has been previously approved by acceptable military authorities
- where the design is inadequately described for manufacture, the design can be fully checked by inspection during manufacture and installation.

### Substantiating data

The substantiating data makes up the majority of the design package. It contains the supporting calculations and descriptions of special processes chosen to provide compliance with the airworthiness requirements.

Substantiating data should include:

- load analyses
- failure analyses
- the requirement and suitability of any special processes chosen
- installation considerations
- methodology and results of test as to the interaction and compatibility between existing units and the new items.
- for an avionics design:
    - an electrical load analysis
    - a failure analysis ensuring that essential equipment is ~~are~~ sufficiently independent to prevent complete system failure
    - the layout and ergonomics of applicable units, in particular, instruments.
- performance confirmation
- crashworthiness assessments.

## Other supporting data

Other data that a design package should address includes manufacturing data, manual amendment requirements, and installation or incorporation instructions.

**Manufacturing data**. The manufacturing details should ensure that the equipment can be produced within the design limits. Considerations should include the application of special processes, ~~particular~~ specific pressures, temperatures, and environments, and the repeatability of production standards if appropriate.

Manufacturing data for designs that are subsequently sold for incorporation should consider the different environments that production may be conducted. In many cases, the ideal production of a prototype will not be achievable subsequently, from either the airworthiness or economic standpoints.

**Amendments.** Amendments to manuals is an important aspect of a complete design package. Maintenance manuals, illustrated parts catalogues, and flight manuals are three documents that may require amendment when a design is incorporated.

In many cases the manuals will not be controlled by the manufacturing organisation and to amend the document would require approval of the issuing organisation. A design package may provide supplements to these types of manuals that would subsequently be provided to the purchaser of the design or equipment manufactured to that design. In many cases, if the design is significant enough to require substantial changes to manuals some liaison with the manual issuer would be expected.

**Installation data.** For designs that progress to sale and/or installation there should be some installation data provided. In many cases this is provided in a booklet to assist the person carrying out the work. Although a booklet is not required in all cases, design packages should include considerations for maintenance actions pre and post installation, performance testing when installed, and subsequent operation instructions.

## Design Checking

It is important that compliance with airworthiness requirements is adequately proven and checked. In some cases, there is no need for the calculations to be checked by independent persons. For example, where structural testing confirms the results of structural calculations an independent calculation check would not normally be required.

Where the proof of compliance depends on calculations alone, and these calculations are extensive or are based on other than fundamental technical procedures, it is important that checking is done by suitably qualified persons other than those originally performing the work.

# Appendix H – Prototypes and testing

## Prototypes

The liaison between a manufacturer and a design organisation is critical in the development of a product, component, or appliance. This is particularly true during any prototype phase of design development.

There will be problems during the prototype stage because some manufacture and assembly may occur while the design has not been properly documented. The control of the prototype development needs to be flexible to cater for any problems that may arise, but it is essential not to lose sight of the fundamental principle - the final product must meet an acceptable design.

All stages of the design development should be documented so that the design organisation can analyse the design and the prototype for the development of the production product, component, or appliance. The manufacturing organisation should be quite clear as to the design organisation's requirements to support the product development.

Ongoing inspection and testing of each stage is required. This inspection should confirm to the approving person the conformity to the design and the suitability for placing in production. If approval is required by the Director, then inspections may be required by ~~the Civil Aviation Authority~~ CAA.

In constructing a prototype, the manufacturer should ensure that they have:

- the necessary drawings and documents to satisfactorily construct the prototype
- a quality control system that ensures the prototype reflects the designer's concept
- procedures to:
    - raise concessions on areas that do not conform to the design
    - raise queries regarding test results, drawing inadequacies, and production and assembly problems with the designer
    - identify required items that have no drawings and raise deficiency reports if necessary
    - require drawing amendment to fulfil their construction function.

## Testing

With all designs a level of inspection and test is required. This testing ensures that the product, component, or appliance complies with the applicable airworthiness design requirements.

Although the testing at this point is part of the design process, the manufacturer will normally be using their own system of inspection and test to support the design organisation. To issue statements of compliance the tests must ensure:

- the product, component or appliance conforms to the type design and any modifications
- an aircraft has been flight tested to the production flight schedule
- any functional checks have been completed
- all additional airworthiness requirements have been met.

Tests to show particular compliance with an airworthiness requirement should be witnessed by a representative of the manufacturing organisation or ~~the Civil Aviation Authority~~ CAA.

Final approval of a design may be withheld until flight testing is satisfactorily accomplished.

### Critical parts

For use in prototypes some parts may be fabricated to fulfil specific functions during the construction or assembly phase. The parts may be one-off designs in themselves and drawings should be supplied if they are to be used for production units.

If a part is considered critical to the design, and that part is a standard, mass-produced part, there are considerations relating to testing that should be addressed. If the manufacturer of the part is using sampling as their own quality control system, the products produced under that sampling system may not be acceptable for critical situations. In these cases, consideration should be given in the prototype and production manufacturing phases to adding a requirement that critical standard, mass-produced parts be independently tested prior to incorporation.