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

Advisory Circular
AC43-13

Revision 1

5 April 2025

Calibration of tools and test equipment for maintenance of aircraft

General

Civil Aviation Authority 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

The AC describes an acceptable means of compliance regarding the calibration of tools, inspection, measuring and test equipment for aircraft maintenance engineers, maintenance organisations and manufacturing organisations. This AC does not provide instructions for carrying out calibration or who may provide the calibration service.

Related Rules

This AC relates specifically to Civil Aviation Rule Parts 43, *General Maintenance*, 145, *Aircraft Maintenance Organisations Certification*, and 148, *Aircraft Manufacturing Organisations Certification* .

Change Notice

Revision 1 moves the order of some sections, *References* and *Why Calibrate?* It also fixes typos and incorrect terms and reformats to present information more clearly.

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Version History

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Revision No.	Effective Date	Summary of Changes
AC 43-13, Rev 0	30 March 2007	Initial issue
AC43-13, Rev 1	5 April 2025	Moves the order of some sections, *References* and *Why Calibrate?* Fixes typos and incorrect terms. Reformats to present information more clearly.

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1. Background

Rule 43.53(3) requires a person performing maintenance on an aircraft or component to use methods, techniques and practices that are specified in the instructions for continued airworthiness issued for the aircraft or component, or equivalent methods, techniques, and practices acceptable to the Director.

Rule 43.53(6) requires a person performing maintenance on an aircraft or component to use the test equipment recommended by the manufacturer, or equivalent test equipment that provides the same capability for the person conducting the test to ensure that the component being tested is in an airworthy condition.

Rule 43.53(9) requires that on the completion of maintenance the condition of an aircraft or component is satisfactory for release-to-service (RTS), in respect to the original or properly modified condition. This includes results of measurements taken or tests carried out to prove this.

Rule 145.55 requires a maintenance organisation to:

- have access to the equipment, tools, and material necessary for all maintenance activities performed by the organisation, and
- establish a procedure to control the equipment, tools and material including, at a frequency and to a standard acceptable to the Director, the calibration of precision tooling and equipment.

Rule 148.55 requires a manufacturing organisation to:

- have access to the equipment, tools, and material necessary for all manufacturing activities performed by the applicant's organisation, and
- establish establish a procedure to control the equipment, tools, and material including the calibration of tools, jigs, process equipment, and test equipment.

2. Calibration

2.1 Why calibrate

Calibration ensures the accuracy of the tools, and inspection, measuring and test equipment used to return aircraft, engines and components to service. Calibration minimises measurement errors and uncertainties to acceptable levels.

For calibration of tools, and inspection, measuring and test equipment, acceptable levels of uncertainty are defined by the tolerance limits of the equipment's parameters established by the manufacturer. The outcome is maintenance of the equipment within the defined accuracy of the manufacturer's design tolerances.

2.2 Calibration

Calibration is as defined in the WATOG as:

The application of specifically known and accurately measured input to ensure that an item will produce a specifically known output which is accurately measured or indicated. Calibration includes adjustment or recording of corrections as appropriate.

3. Recommended practices

To comply with the requirements prescribed in Parts 43, 145, and 148 regarding the maintenance and manufacture of aircraft and components, various precision (calibrated) tools, and inspection, measuring and test equipment must be used to ensure aircraft, engines and components conform to the manufacturer's specification. These tools, and the inspection, measuring and test equipment must be periodically calibrated as recommended by the manufacturer or operator.

Where a process, or sequence of processes, requires calibrated tools or equipment to be used to determine conformance to specification of the aircraft or component for certification for RTS, then calibrated equipment must be used at each step in the process.

In various industrial, aerospace and defence organisations, it has been a long-standing practice to permit the use of workshop equipment that is not subjected to periodic calibration if no test data needs to be recorded. This may include:

- a null indication measurement
- waveform monitoring
- continuity checking
- troubleshooting, or
- determining or assessing the feasibility of repairing versus scrapping an item.

In these cases the equipment must be clearly identified as "NOT FOR CALIBRATED TESTING" or "NO CALIBRATION REQUIRED". Equipment so identified cannot be utilised for conformance acceptance or certification for RTS.

Note: *Where both calibrated and un-calibrated equipment are located in the same workshop, procedures must be established to ensure that un-calibrated equipment is used for trouble shooting only and not for final certification or for RTS.*

4. Options for calibration

Tools and inspection and test equipment that require calibration must be calibrated by:

- an Accredited Calibration Laboratory, or
- a Non-Accredited Calibration Laboratory

5. Calibration facility or laboratory

A calibration facility or laboratory can be any person or organisation who tests and/or calibrates measurement devices or working standards, in a controlled environment, to ensure repeatability.

Documented calibration procedures must be used and documented evidence of the traceability of the standards used must be provided.

A calibration laboratory can be provided by a Part 145-certificated Aircraft Maintenance Organisation, a Part 148-certificated Aircraft Manufacturing Organisation or a Part 66 LAME provided it meets the requirements of a calibration facility or laboratory.

6. Acceptable procedure for test equipment

An acceptable procedure is one that has been published or received from the equipment manufacturer. The manufacturer may consider that only certain test equipment is acceptable to calibrate their equipment. If alternate test equipment is required the manufacturer or an appropriate person, qualified in metrology, should attest to the use of alternate test equipment.

Procedures based on industry standards may need to be developed, accepted and used by a calibration laboratory if the manufacturer's data is not available or sufficient.

7. Traceability

All inspection, measuring and test equipment used to establish the conformance of an aeronautical product or an aircraft system should be tested using reference standards that have been calibrated, so that values indicated or represented by the equipment are traceable back to an acceptable national standard. The purpose of the traceability of calibration measurements is to ensure that the measurements are accurate and credible, by referencing them to a recognised national or international physical standard. Calibration measurement values of the master equipment should be of a higher resolution than that of the test equipment being calibrated.

Many pieces of modern test equipment have automatic or self-calibration features designed within the instrument itself. This type of equipment generally has a reference standard built into the instrument and, at regular or predefined times, performs a calibration of the instrument. This is normally only a one-point check and is not considered to be a verification of the item's overall performance, so traceability of this check may be questionable. The manufacturer may specify further calibration requirements.

Other instruments, such as electronic scales, have an auto zero feature. Auto zeroing instruments only remove the drift inherent in the design of an instrument to reset the zero point each time the instrument is used. This type of instrument generally requires a regular calibration check.

***Note**: Partial or limited calibration of test equipment is acceptable as long as the ranges that are calibrated, and any limitations, are clearly identified to the user, by labelling the equipment. It must also be recorded on the calibration report/record (in case the labelling is removed/becomes unreadable/falls off).*

8. Calibration interval and labelling

The equipment manufacturer's recommended calibration interval should be used where available.

Where an equipment manufacturer does not specify a calibration interval, an evaluation should be carried out and documented to support the selected interval, by assessing the:

- quality of the tool or instrument
- operating environment (usage level, where used, storage etc)
- calibration interval for other similar tools or instruments, and
- accuracy of measurement required.

The resultant interval is then established as the initial calibration interval. This may be increased or reduced based on the process outlined in section 8.

The calibration interval should be varied (increased or decreased) based on the reliability of the equipment in maintaining its accuracy as determined from the equipment calibration history. Any interval should be appropriate to the accuracy of measurement to be performed.

Any variation from the manufacturer's recommended interval must be documented and include the justification.

Where a tool is marked "Calibrate Before Use" the transfer standard against which that tool (working standard) is checked should have a log book where each calibration of each tool is recorded. This activity ensures that there is an auditable trail relating to the use of that tool. The policy regarding the use of such tools and reference standards should be highlighted within the Policy and Procedures Manual (or equivalent document).

Calibration of equipment should be performed at certain periods of the equipment life. Generally calibration should be performed:

- at initial purchase, prior to use unless it comes with a calibration certificate
- after repair
- when it is time for periodic calibration, and
- whenever accuracy is in doubt.

There may be some instances where the aircraft or equipment manufacturer specifies more stringent calibration requirements for a particular piece of equipment than the test equipment manufacturer recommends. This additional requirement must be considered when setting calibration intervals and procedures.

9. Procedures for variation of intervals

Determining a calibration interval for a particular item of equipment involves the analysis of the calibration history for the equipment, with the data arranged as an observed percentage of in-tolerance vs. time since a calibration or test. The data should be assembled from recorded results of calibration or testing, organised into a calibration history, that is an unbroken sequence of calibration or testing results accompanied by the date of service against a given serial number.

9.1 Examples of methods of analysis

- AS/NZS ISO 10012:2004, Measurement management systems - *Requirements for measurement processes and measuring equipment* [1]
- National Conference of Standards Laboratories International (NCSLI) RP-1, *Establishment and Adjustment of Calibration Intervals.* Available online at http://www.ncsli.org/

9.2 Description of calibration data management

9.1.1 Continuity

The calibration history record for an item of equipment that requires calibration should be free from missing service actions. If there is a missing service action, then that should be detectable.

9.1.2 Completeness

Each record should provide all information necessary for analysis. This information needs to include as a minimum:

- identification (serial number, tag number etc) of the item serviced
- any special usage classification or designation
- date of service
- condition as received, prior to adjustment or other corrective service
- service action taken
- condition released (serviceable/unserviceable/limited calibration etc), and
- identification of the reference standards used in calibration of the item.

9.1.3 Consistency

Each record in the calibration history of a serial numbered item should reflect uniformity with respect to parameters calibrated, tolerances used, procedures used, etc.

9.1.4 Environment (storage and usage)

The storage and usage of a calibrated item of equipment has a direct relationship to the calibration assessment program. If the location or usage changes this needs to be taken into consideration. For example, a torque wrench used daily that has a transit container and is stored on a tool board may have a six-month calibration interval. If it is transferred for use in a different working environment such as the tarmac, then consideration should be given to reducing its calibration interval.

10. Personal Equipment

A maintenance or manufacturing organisation should detail, in its Policy and Procedures Manual (or equivalent document), its policy relating to the use of personal tools within the organisation.

[1] Note that this standard has been withdrawn in Australia, but is current in New Zealand as of December 2024.

If the use of personal tools is permitted, then the policy should require those personal items of equipment to be appropriately identified as personal equipment, whether they are calibrated or not. The organisation may elect to control the calibration of employees' personal equipment (this includes hand-held tools such as crimping tools, multimeters, torque wrenches etc). If the organisation elects to control the calibration of personal equipment, then details of the process need to be included in the Policy and Procedures Manual (or equivalent document). If the organisation elects not to control the calibration of such personal equipment, then all that equipment must be suitably marked as un-calibrated personal tooling and cannot be used for return to service activity.

11. Out of Tolerance Action (OOTA)

OOTA occurs when a piece of calibrated equipment is found to be out of tolerance, for example as a result of a scheduled calibration check or if there is a suspicion of an out of tolerance situation.

An OOTA provides a warning that all aircraft, engines and components whose RTS was based on the use of that item of calibrated equipment are potentially non-compliant with the required specification. A risk analysis therefore needs to be carried out to determine the extent of any remedial action that may be required on those aircraft, engines or components that are affected by the OOTA associated with the out of tolerance item of equipment.

For Individual engineers this OOTA should include a review of all work carried out using the out of tolerance equipment and maintaining a record of any re-work required.

A maintenance organisation and a manufacturing organisation should detail, within its internal quality assurance system, processes that will be applied as a result of an OOTA including:

- a risk assessment of the effect of the OOTA
- the procedures used to assess the risk
- an audit trail to determine what aircraft, engines, components, etc the item of calibrated equipment, (tool, inspection or test instrument) was used for certifying an RTS. A good practice is to detail any item of calibrated equipment used as part of a work package
- procedures for any recall of aircraft etc that may be determined necessary, and
- documentation to support the above process.

12. Policy and Procedures Manual

The calibration processes within the Policy and Procedures Manual (or equivalent document) should contain as a minimum:

- a method of:
    - listing all items of equipment that require calibration
    - listing the calibration service providers for those items of calibrated equipment
    - tracking when a calibration is due and a notification procedure for each item of calibrated equipment, and

- retaining calibration reports, both current and historical, with recommended timelines, and

- A process to control:
  - publications issued to calibration service providers, and
  - the use of personal equipment, and
- Procedures for:
  - varying the calibration interval for an item of calibrated equipment
  - OOTA
  - acceptance of calibration certificates from both internal and external service providers, and
- Details of any contracts for tool calibration management, and
- The audit requirements and processes for accepting calibration service providers.

13. References

- ISO 10012:2003: *Measurement management systems — Requirements for measurement processes and measuring equipment*
- *Airline Industry Standard World Airlines Technical Operations Glossary* (WATOG)
- SAA/SNZ HB18.58:1993 ISO/IEC Guide 58:1993. *Guidelines for third-party certification and accreditation - Guide 58 Calibration and testing laboratory accreditation systems - General requirements for operation and recognition*
- AS ISO/IEC 17025:2018 General requirements for the competence of testing and calibration laboratories.
- AC21-35(1.1), Calibration of Inspection and test equipment, August 2015, CASA
- AS IEC 60300.1-2004, Dependability Management Dependability Management Systems
- AS/NZS IEC 60300.1:2015, Dependability management, Part 1: Guidance for management and application

Appendix 1 - Guidance to determining the suitability of a calibration facility.

As there is no requirement for CAA to approve a calibration facility, the facility that an aircraft maintenance provider or an aircraft manufacturing organisation selects may not have the appropriate procedures in place to provide an auditable process.

As a guide, persons who require the services of a calibration facility could compile a checklist with the following or similar questions. The answers will assist in determining the suitability or otherwise of a calibration facility. The provider of a suitable calibration facility should be able to answer "Yes" to the majority of the questions. An aircraft maintenance organisation may need to be more specific or detailed in its requirements.

Is the organisation accredited by a national standards certification body (IANZ, NATA, UKAS etc)?

Does the organisation follow applicable New Zealand Standards (NZS) standards?

If not, then consider:

Quality Management System (QMS)

- Is there a Quality Assurance/Quality Control program/manual?
- Are there internal/external audit programs?
- Does the audit program have appropriate corrective actions processes for findings?
- Are audit findings available to the customer?
- Are there audit procedures for sub-contractors?

Inspection

- Is there a documented receipt inspection procedure?

Data Control

- Is there a procedure to ensure that technical data is current?
- Is there a process to revise, maintain and record the current status of required documents and technical data?
- Is there a process to revise and control manuals that are provided by customers or other third parties?
- Is there a process that records deviations from manufacturer's specifications?

Tool calibration

- Is there a calibration program for equipment and tooling that is used by the calibration facility?
- Are all the calibration facility's calibrated equipment and tools listed?

- Are the standards used to calibrate the calibration facility's equipment and tooling traceable back to an acceptable National Standard?
- Are there procedures in place to prevent the use of uncalibrated equipment/tooling?

Training

- Is there a documented training program?
- Are the technicians/inspectors included in the training program?
- Does the training program include any refresher training?

Facilities

- Are storage areas segregated from the work area?
- Is their storage area environmentally controlled?
- Is there an Electrostatic Discharge Sensitive Equipment policy and is that policy supported by training (where appropriate)?
- Are packing facilities adequate to ensure integrity of product?

Work processing

- Is there a process to validate tooling or equipment used in the calibration process that differs from the manufacturer's requirements?
- Has the alternate equipment been certified as an equivalent and how was it substantiated?
- Is there a copy of its operating and maintenance manuals?
- Is there a process to identify and track customer's equipment?

Work records

- Do the work records contain:
  - A description of work performed?
  - Pre-calibration check details?
  - Date of completion?
  - A work package reference number to allow full traceability?
- Are there procedures relating to OOTA and discrepancies noted during calibration?

Calibration certification

The calibration facility should provide a calibration report for all work carried out and include:

- Name and address of facility
- Unique identification of report
- Description of item being calibrated
- Identification of specific method
- Results of measurement including correction charts and tables
- A statement of measurement uncertainties achieved and any limitations of detection that apply
- An indication of any tests (if applicable) that have been subcontracted out to other facilities
- Printed details, signature and title of an authorised member of the facility that accepts responsibility for the report and the testing work upon which it was based
- Means of traceability of the measurement results to the NZS standard, including identification of the test equipment
- Environmental conditions under which the calibration was performed.

***Note**: Refer to NZS ISO/IEC 17025:2018,* General requirements for the competence of testing and calibration laboratories.