สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

GUIDANCE MATERIAL FOR TOOLS AND EQUIPMENT

CAAT-GM-AIR-511
Revision: 00
Date: 16 September 2022

Approved By

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ABBREVIATIONS

AMC	Acceptable Means of Compliance
AMM	Aircraft Maintenance Manual
CAAT	The Civil Aviation Authority of Thailand
CMM	Component Maintenance Manual
IEC	The International Electrotechnical Commission
ISO	The International Organisation for Standardisation
LDG	Landing Gear
MOE	Maintenance Organisation Exposition
NDT	Non-Destructive Testing
OEM	Original Equipment Manufacturer
P/N	Part Number
S/N	Serial Number
STCH	Supplemental Type Certificate Holder
TCAR	Thailand Civil Aviation Regulation
TCH	Type Certificate Holder

0. INTRODUCTION

0.1 Scope and Applicability

The Civil Aviation Authority of Thailand (CAAT) is the Competent Authority for maintenance organisations[1] that are involved in the maintenance of Thai registered aircraft and components intended for fitment thereto as established by TCAR Part 145.A.1 General. CAAT is therefore responsible for the final approval of these maintenance organisations and for establishing procedures detailing how TCAR Part 145 applications and approvals are managed.

This Guidance Material (GM) is applicable to TCAR Part 145 applicants and TCAR Part 145 maintenance organisations regardless of whether their principal place of business is located within Thailand or internationally. The provisions of this GM are complementary to the maintenance organisation certification requirements detailed in TCAR Part 145 and do not supersede or replace any associated regulatory requirements.

0.2 Purpose

The purpose of this GM is to provide guidance regarding key elements, which must be considered as minimum requirements in order to comply with TCAR Part 145, when the maintenance organisation is:

- defining processes and procedures related to tools and equipment
  - classification
  - equivalence assessment
  - calibration
- evaluating compliance with TCAR Part 145, 145.A.40 (a) with particular reference to the availability of the tools to perform the approved scope of work and TCAR Part 145, 145.A.40 (b) with regards to tool and equipment calibration

0.3 Associated Instructions

CAAT has developed associated provisions (guidance, forms, and templates) that detail specific matters, which need to be considered as an integral part of this GM. This information is available on the CAAT Web Site (www.caat.or.th)

0.4 Communication

All documents and correspondence between the maintenance organisation and CAAT should be in English. The official e-mail is air-amo@caat.or.th.

0.5 References

- Air Navigation Act B.E. 2497
- Requirements of the Civil Aviation Authority of Thailand Issue 2 on Repair Station Certificate
- Requirements of the Civil Aviation Authority of Thailand Issue 5 on Foreign Repair Station Certificate
- Thailand Civil Aviation Regulation on Repair Station Certificate Requirements (TCAR PART 145)
- Acceptable Means of Compliance to Thailand Civil Aviation Regulation on Repair Station Certificate Requirements (AMC to TCAR Part 145)

[1]The terms “Maintenance Organisations” and “Repair Stations” should be read interchangeably in this Guidance Material.

1. PROCESSES FLOW CHARTS

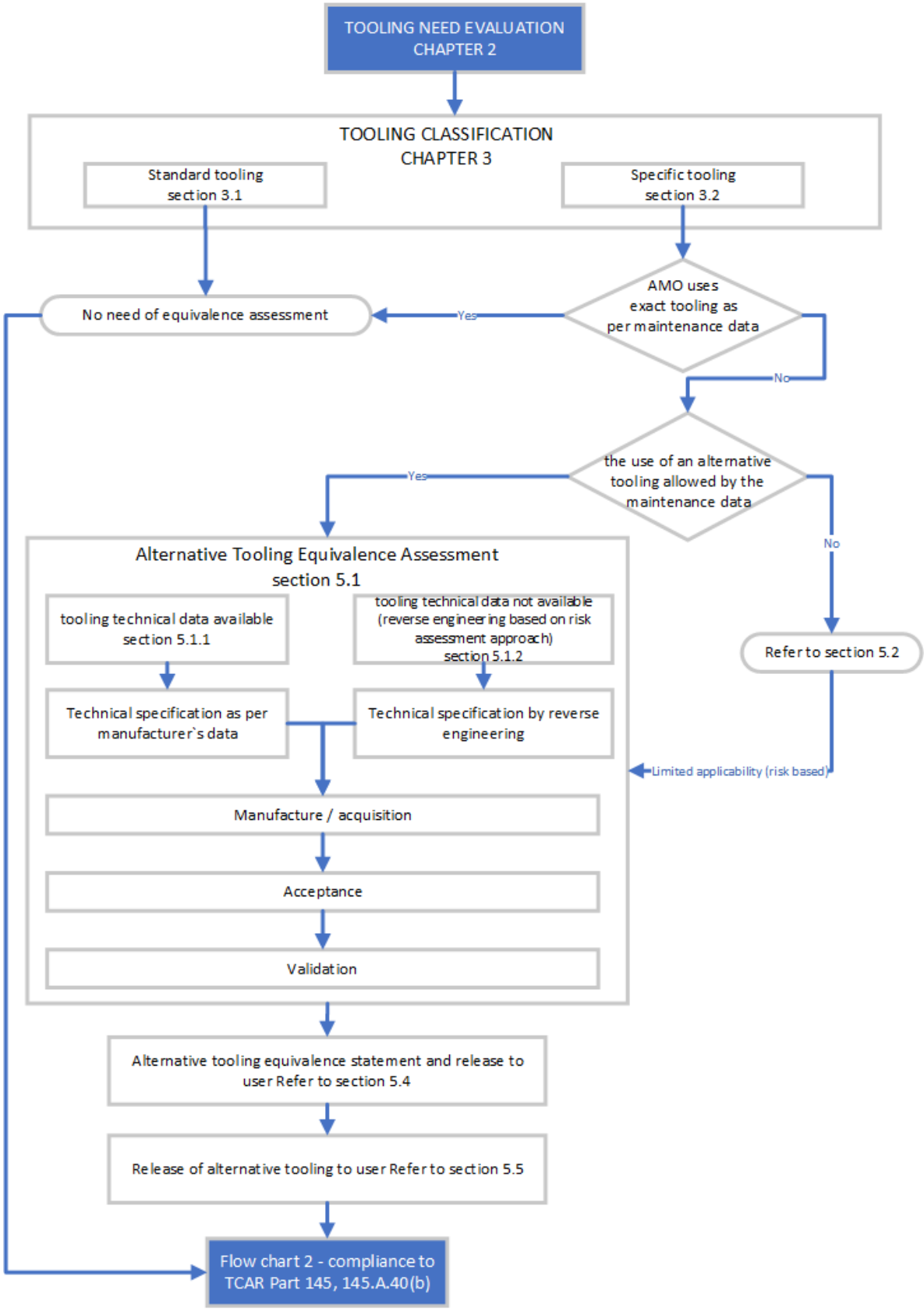
This GM describes the two main processes that must be used by a maintenance organisation to demonstrate compliance with TCAR Part 145, 145.A.40 (a) and (b).

In particular, those processes represent the basic elements expected to be described in MOE chapter 2.5 “Calibration of Tools and Equipment” and in chapter 2.6 “Use of Tooling and Equipment by Staff (including alternate tools)”, refer to CAAT-GM-AIR-501 Guidance Material for Development of Maintenance Organisation Exposition (MOE).

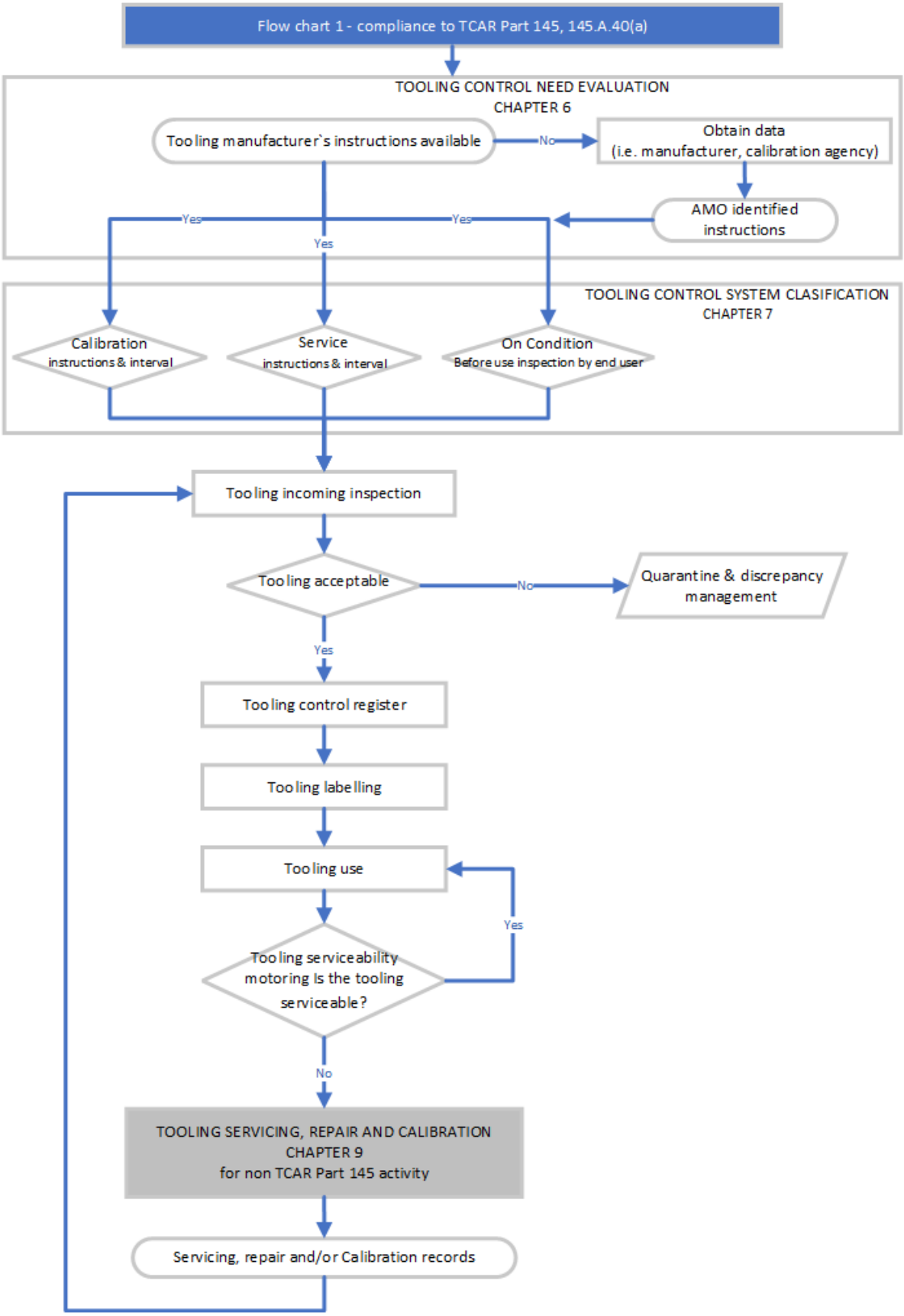
The term “tooling” is used to indicate any tool or equipment. The maintenance organisation may vary the terminology used to define and classify the tooling, therefore, adherence to any particular designation shown in this GM may not match each maintenance organisation’s structure.

Note: other requirements apply to the use of tooling within the maintenance organisation, which are not intended to be covered in this GM (after completion of all maintenance a general verification must be carried out to ensure the aircraft or component is clear of all tools, use of personal tools, etc.)

Flow Chart 1: Compliance with TCAR Part 145, 145.A.40(a)



Flow Chart 2: Compliance with TCAR Part 145, 145.A.40(b)



2. TOOLING NEED EVALUATION

As mentioned in TCAR Part 145 "once the applicant for an initial approval or for a change of an approval has determined the intended scope of approval for consideration by CAAT, it will be necessary to show that all tools and equipment as specified in the maintenance data can be made available when needed".

Note: AMC to TCAR Part 145, AMC1 145.A.45(b) indicates which maintenance data is to be considered applicable under the rating (aircraft maintenance manual, non-destructive testing manual, component maintenance manual, service bulletin, etc.).

This demonstration is to be achieved with a tooling need evaluation which consists of:

- identifying, classifying and listing all tooling required to perform the intended scope of work by analysing the maintenance tasks
- identifying and listing the tooling that is permanently available in the maintenance organisation and those that are leased or loaned. In the case of tooling which is not permanently available (limited to those infrequently used), the maintenance organisation needs to ensure that they can be made available when needed (a contract is an acceptable method of demonstration)

  Note: In the case of leased or loaned tooling it remains the responsibility of the maintenance organisation using the tooling to make sure the tooling complies with TCAR Part 145 and therefore this GM also applies in such cases

- demonstrating that the tooling in use is the one specified by the maintenance data or where the maintenance organisation is using alternative tooling, such tooling has been assessed to be equivalent

3. TOOLING CLASSIFICATION

For the purpose of this GM, tooling is classified as follows:

- Standard tooling
- Task specific tooling

3.1 Standard Tooling

Standard tooling are those tools and equipment not being of exclusive use in the aviation industry (i.e. being commercially available) and being generically identified by the maintenance data by type, family or characteristics.

The following examples extracted from maintenance data are considered to be standard tooling:

- ladder, access platform 4m, screw driver, standard wrench, protective cover, circuit breaker safety clip, syringe, nitrogen bottle charged to 3000 PSI, caps and plugs, grease gun, container suitable for oil (4 Liters), etc.
- multimeter ±5% accuracy used to measure 115, 28, and 28 V DC, torque wrench 0-300 inch pounds / 0-33.9 Nm, pressure gauge, 800-2500 PSIG, hydraulic jack nose gear minimum capacity 10.000 daN (22480.89 lbf), portable hydraulic cart capable of 3000 PSI and a minimum flow of 50 GPM, etc.

Note: the values mentioned above are not intended to be used as parameters defining the standard tooling. These values are only typical examples extracted from the maintenance data.

3.2 Task Specific Tooling

Task specific tooling are those tools and equipment designed for the particular aircraft, engine, component, NDT, etc. maintenance task and specifically identified in the maintenance data (i.e. by P/N, supplier and description). The following examples extracted from maintenance data are considered to be task specific tooling:

- MLG wheel adapter, P/N J32032-22, supplier:81205
- pin - locking, valve, hydraulic reservoir pressurization shutoff (Part #: A29002-6, supplier: 81205, A/C Effectivity)
- jack adapter-fuselage, reference 98D07013500000
- temperature switch tool, P/N 622, supplier: Desco Cort, Walnut, CA
- oil service dispenser, Malabar WF150-1
- A10444 tire removal machine
- analyzer - databus, datatrac models 600, 650, 650H (Part #: 01-1405-00, supplier: 41364)
- dolly wheel/brake change P/N 175, supplier 94861
- jack Axle, 8398-012, 65 Ton, Regent Manufacturing, vendor 02708
- GFCI Tester - AC Hydraulic Pump (Part #: J24014-24, supplier: 81205)
- adapters – air data system flushing, reference 98D34103002000
- adaptor-charging pitot probe, reference 36122
- standby compass calibration, reference 2591553-903

Note: when the maintenance organisation is using an automated bench test operated by software, the maintenance organisation is responsible for ensuring that the software complies with the CMM requirements at the latest revision

4. USE OF TOOLING

On the basis of the tool classification, the maintenance organisation may use tooling, as detailed below.

4.1 Use of Standard Tooling

For standard tooling, the assessment of the particular tool or equipment to be used, starting from the information given in the maintenance data, is self-explanatory and the end user should have the necessary knowledge in order to determine, before starting the maintenance task, that the tooling is adequate to perform the intended work and a formalised equivalence assessment is not required. However, the maintenance organisation may decide to develop such an equivalence assessment if deemed useful.

Note: the end user is intended to be the person formally authorised by the maintenance organisation to perform and sign-off the maintenance task for which the tooling is to be used

4.2 Use of Task Specific Tooling

When dealing with task specific tooling, the maintenance organisation may proceed according to one of the following options to:

a) acquire or use the task specific tooling as indicated by the maintenance data (exact P/N, supplier) and in such case, there is no need for any further equivalence assessment
   - the maintenance organisation remains responsible for the acquisition, acceptance, identification, control or calibration of the tools according to TCAR Part 145 requirements and its MOE procedures

- when the maintenance data itself identifies for the same task a main tooling plus other possible substitutes, the maintenance organisation may use the main or the substitute tooling without any need of further equivalence assessment

b) acquire or use a different tooling from the one specified in the maintenance data. Such replacement tooling is defined, in this GM, as alternative tooling and may be used only subject to compliance with the conditions specified in chapter 5 below.

Note: this option may be considered for various reason (the tool specified is not available in the necessary time frame, another tool is already available in the maintenance organisation, etc.)

5. ALTERNATIVE TOOLING EQUIVALENCE ASSESSMENT

The possibility to use alternative tooling requires a previous verification in the maintenance data of the product or component being maintained. The maintenance organisation will have to proceed differently depending if:

a) the maintenance data allows the use of alternative tooling
Note: A declaration or other data from the tooling manufacturer stating that its tooling is equivalent to a tooling specified by the CMM (or AMM, etc) is not sufficient to consider such tooling an equivalent alternative, unless such tooling manufacturer is also the OEM issuing the CMM (or TCH issuing the AMM, etc)
b) the maintenance data does not allow or not clearly state the possibility of using alternative tooling

5.1 Maintenance Data Allowing the use of Alternative Tooling

The maintenance data normally provides clear statements on cases where alternative tooling to the one specified may be used. Only when this possibility is given in the maintenance data, is the maintenance organisation entitled to proceed with an equivalence assessment process in order to use alternative tooling. Alternative tooling may be obtained by different means, however, regardless of the type of acquisition process, the following two possibilities must be considered by the maintenance organisation.

Note:

- maintenance data statements may be in the front matter of the aircraft maintenance manual, in a specific tools or equipment manual when published, in the TCH aircraft maintenance task card manual or in the special tools section of the component maintenance manual, etc.
- obtained by different means can refer to internal or external manufacture, purchase from an external provider not being identified by the manufacturer, loan, use of an already available tool approved for another product or component, etc.

5.1.1 The tooling technical data is available

Tooling technical data may be considered acceptable when:

- the maintenance data (AMM, CMM, etc.) already includes such data (manufacturing drawing, technical characteristics, manufacturing procedure, etc.), or
- the maintenance organisation obtains additional data (manufacturing drawings, etc.) from the relevant manufacturer (may be the applicable TCH, STCH, OEM or the tool manufacturer that is specified in the maintenance data of the product or component being maintained)

In both cases the following minimum steps must be considered and described in the MOE:

- **Technical Specification**: engineering document establishing the:
  - technical characteristics of the tooling to be acquired or manufactured to demonstrate it is in conformity with the relevant technical data (dimensions, material, functions, accuracy, etc.) and
  - applicable inspection, service, calibration need as described in chapter 7
- **Manufacture or acquisition**: process in use to manufacture the tool or to acquire it from any internal or external source
- **Acceptance**: incoming inspection process to verify the tooling meets the requirements established in the Technical Specification and is identified accordingly
- **Validation**: practical demonstration (functional check, etc.) that the alternative tool is capable of correctly performing the relevant maintenance task
- **Alternative tooling equivalence declaration**: the satisfactory completion of the process mentioned above is finalised by the formal approval by the maintenance organisation, using a form as described in section 5.4
- **Release to user**: process describing how the user is informed of the use of alternative tooling, as described in section 5.5

5.1.2 The tooling technical data is not available

This case applies when no acceptable tooling technical data is available to establish conformity of an alternative tooling. The maintenance organisation, may still intend in this situation to use an alternative tooling, applying its engineering judgment through a reverse engineering approach.

The main driver to evaluate the applicability of this option is a risk based approach that must be considered by the maintenance organisation on a case by case basis. This option is to be limited to the cases where the use of the alternative tooling does not affect the content and sequence of the maintenance task. Moreover, the use of an alternative tooling must be assessed by the organisation to be of low risk for the overall performance of the maintenance. The low risk assessment needs to be demonstrated and documented by a detailed engineering analysis.

The following minimum steps need to be described in the MOE:

- **Technical Specification**: engineering document establishing:
  - the technical characteristics of the tool to be acquired or manufactured based on a reverse engineering approach (dimensions, material, functions, accuracy, etc.) to demonstrate it is equivalent to the one specified in the maintenance data of the product or component being maintained, and
  - the applicable inspection, service, calibration need as described in chapter 7
- **Manufacture or acquisition**: process in use to manufacture the tool or to acquire it from any internal or external source
- **Acceptance**: incoming inspection process to verify the tooling meets the requirements established in the Technical Specification and is identified accordingly
- **Validation**: practical demonstration (functional check, etc.) that the alternative tool is capable of correctly performing the relevant maintenance procedure
- **Alternative tooling equivalence declaration**: the satisfactory completion of the process mentioned above is finalised by the formal approval by the maintenance organisation, using a form as described in section 5.4
- **Release to user**: process describing how the user is informed of the use of alternative tooling, as described in section 5.5

5.2 Maintenance Data Not Allowing or Not Clearly Stating the Possibility to use Alternative Tooling

There are cases, where the maintenance data does not allow or does not clearly state that alternative tooling may be used. In those cases, the maintenance organisation may either:

- acquire the specific tooling P/N by the identified supplier
- request a revision of the maintenance data directly to the TCH or STCH to include the alternative tooling proposed by the maintenance organisation before its use

However, the use of an alternative tooling may be still acceptable in limited circumstances. The main driver to evaluate the applicability of this option is a risk based approach that must be considered by the maintenance organisation on a case-by-case basis. This option is to be limited to the cases where the use of the alternative tooling does not affect the content and sequence of the maintenance task.

In addition, the use of an alternative tooling must be assessed by the maintenance organisation to be of low risk for the overall performance of the maintenance. The low risk assessment needs to be demonstrated and documented by a detailed engineering analysis. For this case the MOE procedure developed in compliance to section 5.1. of this GM, can be used with the additional requirement of notification to the TCH or STCH about the use of the alternative tooling.

5.3 Personnel Dedicated to the Alternative Tooling Equivalence Assessment

The alternative tooling equivalence assessment is considered to be a complex engineering task and in order to be allowed to follow this process, the maintenance organisation must have staff assigned to this activity who are appropriately qualified according to an MOE procedure acceptable to CAAT. In addition, the compliance monitoring and safety management department has to be involved in this process, at least but not necessarily limited to the following:

- definition of the job description and qualification requirements for the above staff
- competence assessment and issuance of the related individual authorisations
- definition of the forms and procedures to be used
- inclusion of this area of activity in the independent audit plan

5.3.1 Alternative tooling in the NDT activity

In the case of tools related to NDT activity (ultrasonic probes, etc.), only a person qualified as NDT Level 3 on the relevant method can determine if an alternative tool is equivalent to the one specified by the maintenance data. Therefore, in this case, the equivalence assessment must be signed by an NDT Level 3.

5.4 Alternative Tooling Equivalence Statement

The successful completion of the process related to establishing that an alternative tooling is equivalent to the one specified in the maintenance data, needs to be formally documented in a form to be included in MOE chapter 5.1 Sample Documents, refer to CAAT-GM-AIR-501 Guidance Material for Development of Maintenance Organisation Exposition (MOE). This form must include:

- the reference to the maintenance data requiring the tooling
- the identification of the tooling as given by the maintenance data
- the identification of the alternative tooling to be used by the maintenance organisation
- the reference to the technical specification which has been developed by the maintenance organisation to acquire or manufacture the alternative tooling
- a statement that the alternative tooling is equivalent to the one specified by the maintenance data
- Identification or signature of the person performing the assessment

Note: the form described above needs to be kept on file for 3 years after the tool has been permanently withdrawn from service by the maintenance organisation

5.5 Release of Alternative Tooling to User

Updated documentation on the alternative tooling must be provided to the user. In particular, a system must be in place for the maintenance staff so they can easily identify the alternative tooling to be used as replacement for the one identified in the maintenance data (e.g. by information provided in the maintenance task card, or by developing modified maintenance data, or in a system that can provide the same level of information and traceability).

6. TOOLING CONTROL NEED EVALUATION

As required by TCAR Part 145, 145.A.40(b) the maintenance organisation must ensure that "all tools, equipment and particularly test equipment, as appropriate, are controlled and calibrated according to an officially recognised standard at a frequency to ensure serviceability and accuracy".

In order to comply with this requirement, the maintenance organisation must, for any tooling in use, identify the related inspection, service and calibration needs.

This tooling inspection, service and calibration need evaluation must be carried out at any application for initial issue or renewal of a TCAR Part 145 approval or each time a certain type of tooling (P/N) is entering the maintenance organisation for the first time. This includes tooling that are infrequently used and leased or loaned by the maintenance organisation in order to ensure their availability at the time the maintenance is to be performed.

This will allow the maintenance organisation to ensure and demonstrate that the need for inspection, service and calibration for the tooling required to perform the intended scope of work has been considered.

7. TOOLING CONTROL SYSTEM CLASSIFICATION

For the purpose of this GM, the tooling control processes are classified in the following groups having different control requirements in order to establish serviceability:

- On condition
- Service
- Calibration

The main driver for establishing in which group a certain tooling should be entered depends on the applicable requirements defining the serviceability. This information is normally given by the tooling manufacturer instructions, when published.

In the absence of such data, it is the responsibility of the maintenance organisation to retrieve the necessary documentation (from the tooling manufacturer, a calibration agency, etc.).

7.1 On Condition

Tooling which requires a visual inspection prior to each use. The following examples are normally considered to be on-condition tooling:

- simple tooling (including task specific tooling as defined by section 3.2) which are not used for measuring purposes – LDG lock pin, LDG adapters, wheel dolly, screw driver, standard wrench, ladder, etc.

7.2 Service

Tooling which requires:

- a visual inspection prior to each use, and
- servicing at established frequency

The following examples are normally considered to be tooling subject to servicing:

- portable hydraulic pump, grease gun, movable platforms, etc.

7.3 Calibration

Tooling which requires:

- a visual inspection prior to each use, and
- calibration at established frequency and, when applicable, servicing

The following examples are normally considered to be tooling subject to calibration:

- all precision tooling used for measuring purposes according to maintenance data tasks, such as multimeter, torque wrench, manometer, test benches, crimping tools, etc.

8. TOOLING CONTROL MANAGEMENT

The tooling control management system is composed of the following minimum elements:

- Incoming inspection system
- Control register
- Labelling system
- Serviceability monitoring system

8.1 Incoming Inspection

The purpose of the tooling incoming inspection system is to verify the tooling meets all applicable standards.

The satisfactory result of the incoming inspection allows the entry of relevant data in the control register as described in the section 8.2.

The unsatisfactory result of the incoming inspection, requires to consider the tooling as unserviceable and to quarantine it in order to avoid its use until any identified problem is solved.

In addition, particular attention is needed during the receiving inspection of calibrated tooling. The following minimum elements must be verified by the maintenance organisation:

- calibration laboratory meets the MOE specified requirements (accreditation of the laboratory, etc.). In the case of accredited laboratories, this also includes verification that the accreditation of the laboratory is valid (proof of accreditation on file, etc.) and its scope of accreditation specifically covers the intended calibration activity

- calibration certificate includes:
  - standard used for the specific calibration (EN/ISO 837-1 for the calibration of pressure gauges, etc.)
  - traceability to master instrument used for calibration
  - measurement or calibration results
  - persons performing the calibration
  - where applicable, reference to any accreditation held by the laboratory
- conformity to the calibration order (see section 9.2.2) sent to the laboratory (availability of a confirmation that calibration results are within acceptable limits is expected as part of the incoming inspection process).

8.2 Control Register

The purpose of the control register is to maintain the inventory and status of all the tooling in use by the maintenance organisation.

The system in use must be able to provide the following minimum information:

- At the level of tooling P/N (family):
  - identification of the tooling P/N and description
  - classification of the tooling control system as defined in the chapter 7
  - identification of the reference instruction to be used for the inspection, servicing or calibration
  - identification of the servicing or calibration intervals where applicable
- At the level of each specific tool S/N:
  - identification of tooling S/N
  - location within the maintenance organisation (i.e. wheels workshop, line stations, hangar, line maintenance)
  - status (serviceable, unserviceable, scrapped, sent for calibration, loaned, etc.)

The tooling control register can be in the form of a paper or electronic system (electronic list, database, etc.) as appropriate depending upon the size and complexity of the maintenance organisation. In particular, where for a small component workshop a simple paper or electronic list could be acceptable, for a major maintenance organisation having several workshops, line stations, hangars, a database should be expected, which is capable of managing the complexity of the information and can be accessed from different locations.

8.3 Labelling

The purpose of the tooling labelling system is to:

- indicate to the end users that the item is within any inspection, service or calibration time-limit, and
- formally declare the tooling serviceability status

The labelling system in use has to be adapted to the tooling type and working conditions to ensure the information displayed always remains legible. After the labelling, the tooling enters the maintenance process and remains in serviceable condition subject to the serviceability monitoring system.

8.4 Serviceability Monitoring

The purpose of serviceability monitoring is to ensure that the status of any tooling is controlled by the maintenance organisation so that a tooling is:

- segregated when in an unserviceable condition
  Note: An unserviceable condition may occur for several reasons, such as:
  - an incident which requires a repair to the tooling
  - reaching the inspection or servicing due date (for service or calibration tooling)
  - reaching the calibration due date (for calibration tooling)
  - phase-out, etc.
- sent for inspection, service or calibration when reaching any applicable due date
- sent for repair when necessary

The maintenance organisation must ensure that any servicing or calibration interval required by the tooling manufacturer is complied with. This interval may be modified where the maintenance organisation can show by results that a different time period is appropriate in a particular case.

Additional serviceability verifications, such as for example torque wrench verification by a master torque tester, can be used to support the modification of the calibration intervals but does not supersede the requirement for calibration of the tools.

This process has to be done in accordance with an MOE procedure approved by CAAT. However, when a servicing or calibration interval is recommended or required to be reduced based upon the servicing or calibration results, such change is to be systematically and immediately implemented by the maintenance organisation.

It is not the purpose of this GM to describe the tooling serviceability monitoring system. For further guidance on this matter refer to CAAT-GM-AIR-501, Guidance Material for Development of Maintenance Organisation Exposition (MOE), chapter 2.5 Calibration of Tools.

9. TOOLING SERVICING, REPAIR AND CALIBRATION

TCAR Part 145 states that the maintenance organisation “shall ensure that all tools, equipment and particularly test equipment, as appropriate, are controlled and calibrated according to an officially recognised standard”

However, performing tooling servicing, repair and calibration is not a TCAR Part 145 privilege, and the activities described in sections 9.1 and 9.2, are formally outside the TCAR Part 145 remit. The intent of these paragraphs is to describe how the maintenance organisation may adequately discharge its responsibilities.

The tooling service providers which carry out those activities have to be identified in a list under the control of the compliance monitoring and safety management department (refer to CAAT-GM-AIR-501, Guidance Material for Development of Maintenance Organisation Exposition (MOE), chapter 2.4 Acceptance of Tools and Equipment). Any tooling related service provider (e.g. service, repair and calibration) is expected to meet the applicable requirements of this chapter.

9.1 Tooling Servicing and Repair

The repair and servicing process is to be carried out ensuring the following minimum requirements:

- the activity is done according to the tooling manufacturer’s instructions
- a record is kept on file by the maintenance organisation for each tooling, providing evidence of:
  - the expected servicing activities to be performed and related frequency
  - servicing accomplishment to demonstrate that content and frequency requirements are met

- any repair carried out, including replacement of parts
- the indication of tooling service provider which has carried out such activities

9.2 Tooling Calibration

9.2.1 Definitions

Accreditation bodies: there are many accreditation bodies that provide third-party laboratory accreditation, such as National and Regional Accreditation Bodies (NRAB, RAB) including National Institute of Metrology (Thailand). The International Laboratory Accreditation Cooperation (ILAC13) establishes a global network for accreditation of laboratory and testing facilities. Signatories to the ILAC MRA are in full conformance with the standards of ISO 17011/IEC "Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies"

Accredited Laboratory: means a laboratory which is accredited by an accreditation body

BIPM: The International Bureau of Weights and Measures is the intergovernmental organisation established by the Metre Convention, through which Member States act together on matters related to measurement science and measurement standards. The BIPM web site lists the National Metrology Institutes (NMI) from its Member States and Associate States and Economies that are signatory to the CIPM Mutual Recognition Arrangement (CIPM MRA see BIPM website)

CIPM: The International Committee on Weights and Measures. The CIPM is the governance body for the BIPM.

CIPM MRA: The CIPM MRA is the framework through which NMIs demonstrate the international equivalence of their measurement standards and the calibration and measurement certificates they issue. The outcomes of the CIPM MRA are the internationally recognised Calibration and Measurement Capabilities (CMCs) of the participating institutes. Participating NMIs are required to take part in regular "key comparisons" of national measurement standards and have their CMC claims validated through the peer review process of the CIPM MRA. This process also includes the approval of the laboratory quality system for conformance with ISO/IEC 17025. CMCs and supporting technical data are publicly available from the CIPM MRA database (KCDB see BIPM website), which is operated by the BIPM

ISO/IEC 17011 Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies

ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories

ISO 10012 - Measurement management systems - Requirements for measurement processes and measuring equipment

ILAC: International Laboratory Accreditation Cooperation. In addition to promoting mutual acceptance of measurement results and calibration or test certificates between its members, ILAC also promotes the acceptance of accredited test and calibration data by regulators and governments

Laboratory: means an entity performing tooling, equipment and test equipment calibration

Metrological traceability: property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty

MRA: Mutual Recognition Arrangement

NMI: National Metrology Institutes have the responsibility of maintaining the national measurement standards and provide metrological traceability

9.2.2 Calibration requirements

In order to comply with TCAR Part 145 the maintenance organisation must ensure that:

a) Tooling requiring calibration is periodically calibrated in accordance with the tool manufacturers' published standards and recommendations
b) Where no recommendations for calibration are published or where the calibration methods or standards are not specified, calibration is carried out in accordance with the requirements of the ISO 10012. This standard details both the generic requirements and guidance for the implementation of measurement management systems.

Based on the evaluation above the applicable requirements must be clearly specified in a calibration order sent to the calibration laboratory together with the tooling, including any relevant specific requirements and information (tool incidentally damaged or specific accuracy requirements contained in the aircraft, engine, CMM or tooling manufacturer instructions, etc.).

When using tooling requiring test, calibration or measurement, a maintenance organisation must ensure that the calibration or measurement interval required by the tooling manufacturer is complied with. This process is detailed in section 8.4.

9.2.3 Selection of the calibration provider

When selecting a calibration provider the maintenance organisation must ensure that the provider falls into one of the cases below provided that MOE chapter 2.5 Calibration of Tools and Equipment reflects those cases.

9.2.4 Calibration in acceptable laboratories

Tooling must be calibrated by any of the following laboratories:

a) an NMI whose scope specifically covers the intended calibration (scope means the services covered by the CIPM MRA and can be viewed in Appendix C of the BIPM KCDB including the range and uncertainty for each listed service; refer to "kcdb.bipm" website)
b) a calibration laboratory accredited to ISO/IEC 17025 by an accreditation body which is signatory of the ILAC MRA (Full Members) or an ILAC Recognised Regional Cooperation Body (Signatories and Recognised Regional Cooperation Bodies are listed on ILAC Membership website), where the scope of accreditation specifically covers the intended calibration, for example National Institute of Metrology (Thailand)
c) original tool manufacturer identified in the approved maintenance data, provided it is supported by a calibration or accuracy statement

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