
BHUTAN CIVIL AVIATION AUTHORITY



Guidance Material

GM-AIR-10

Guidance on Tools & Equipment

Issue 01

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Foreword

This Guidance Material (GM) is explanatory and interpretative material developed by the Bhutan Civil Aviation Authority (BCAA) to assist in the application of the requirements of BCAR-145 and the associated Acceptable Means of Compliance (AMC). It provides examples, best practices, and clarifications to facilitate a consistent understanding and application of the regulatory requirements without introducing additional regulatory obligations.

The scope, applicability, purpose, and entry into force of this GM are provided in para 0.3, 0.4, and 0.5, respectively.



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0. Introduction

0.1 Revision History

Issue	Issue date	Summary of Change
Issue 01	04 September 2026	First issue

0.2 Definitions & Abbreviations

Abbreviations	
AMC	Acceptable Means of Compliance
AML	Aircraft Maintenance Licence
AMO	Aircraft Maintenance Organisation
BARNs	Bhutan Air Navigation Regulations
BCAA	Bhutan Civil Aviation Authority
BCAR	Bhutan Civil Aviation Requirements
AMTO	Approved Maintenance Training Organisation
AOG	Aircraft On Ground
C/S	Certifying Staff
CC/S	Component Certifying Staff
EASA	European Union Aviation Safety Agency
EU	European Union
ESM	Engine Shop Manual
FAA	Federal Aviation Administration (U.S.A)
GM	Guidance Material
ICAO	International Civil Aviation Organization
ILAC	International Laboratory Accreditation Cooperation
IORS	Internal Occurrence Reporting System
ISO	International Organization for Standardization
MOA	Maintenance Organisation Approval
MOAP	Maintenance Organisation Approval Procedures
MOE	Maintenance Organisation Exposition
MOR	Mandatory Occurrence Reporting
NDT	Non-Destructive Testing
NDI	Non-Destructive Inspection
OEM	Original Equipment Manufacturer
PMA	Parts Manufacturer Approval
PPB	Principal Place of Business
SRM	Structural Repair Manual
S/S	Support Staff
STCH	Supplemental Type Certificate Holder
TCCA	Transport Canada Civil Aviation
TCH	Type Certificate Holder
WH	Working Hours

0.3 Scope & Applicability

The Bhutan Civil Aviation Authority (BCAA) is the competent authority responsible for the approval and oversight of Approved Maintenance Organizations (AMOs) in accordance with the applicable provisions of BCAR-145. BCAA is responsible for granting, renewing, varying, suspending, or revoking AMO approvals and for establishing procedures governing the application, approval, and continued oversight of maintenance organizations.

This user guide is applicable to applicants for BCAR-145 approvals and Approved Maintenance Organizations (AMOs) holding or seeking approval under BCAR-145 (hereinafter referred to as "maintenance organizations"). It provides guidance to assist maintenance organizations and BCAA inspectors in demonstrating and assessing compliance with the applicable requirements of BCAR-145.

The provisions of this user guide are complementary to the requirements of BCAR-145 “as amended” and does not supersede or replace the associated regulatory requirements.

0.4 Purpose

This user guide is designed to be used by maintenance organization and the BCAA when:

- The maintenance organization is:
 - Defining the processes and procedures related to:
 1. the tools/equipment classification;
 2. the tools /equipment equivalence assessment;
 3. the tool/equipment calibration;
 - Evaluating compliance with BCAR-145.A.40(a) with particular reference to the availability of the tools to perform the approved scope of work and BCAR-145.A.40.(b) with regards to tool/equipment calibration;
- BCAA is:
 - Evaluating by sampling the Compliance of the maintenance organization with Part-145.A.40 (a) and Part-145.A.40 (b);

0.5 Entry into Force

This User Guide comes into force 30 days after publication on the BCAA website. Within this time frame the maintenance organisation shall assess the impact of this User Guide revision on the organisation’s procedures and when relevant, propose a revision of the affected procedures to the BCAA.

The entry into force date of this User Guide does not supersede the need to comply with any other entry into force date(s) established by applicable regulatory requirements.

0.6 Associated Instructions

BCAA has developed associated instructions including Guidance, Checklists, Forms and Templates, that detail specific matters which have to be considered as an integral part of this GM. The organisations must refer to BCAA website (www.bcaa.gov.bt) for further information and necessary guidance.

0.7 Communication

All documents and correspondences between the maintenance organisation and BCAA shall be in the English/Dzongkha language. The official email is airworthiness@bcaa.gov.bt.

1. Processes flow chart

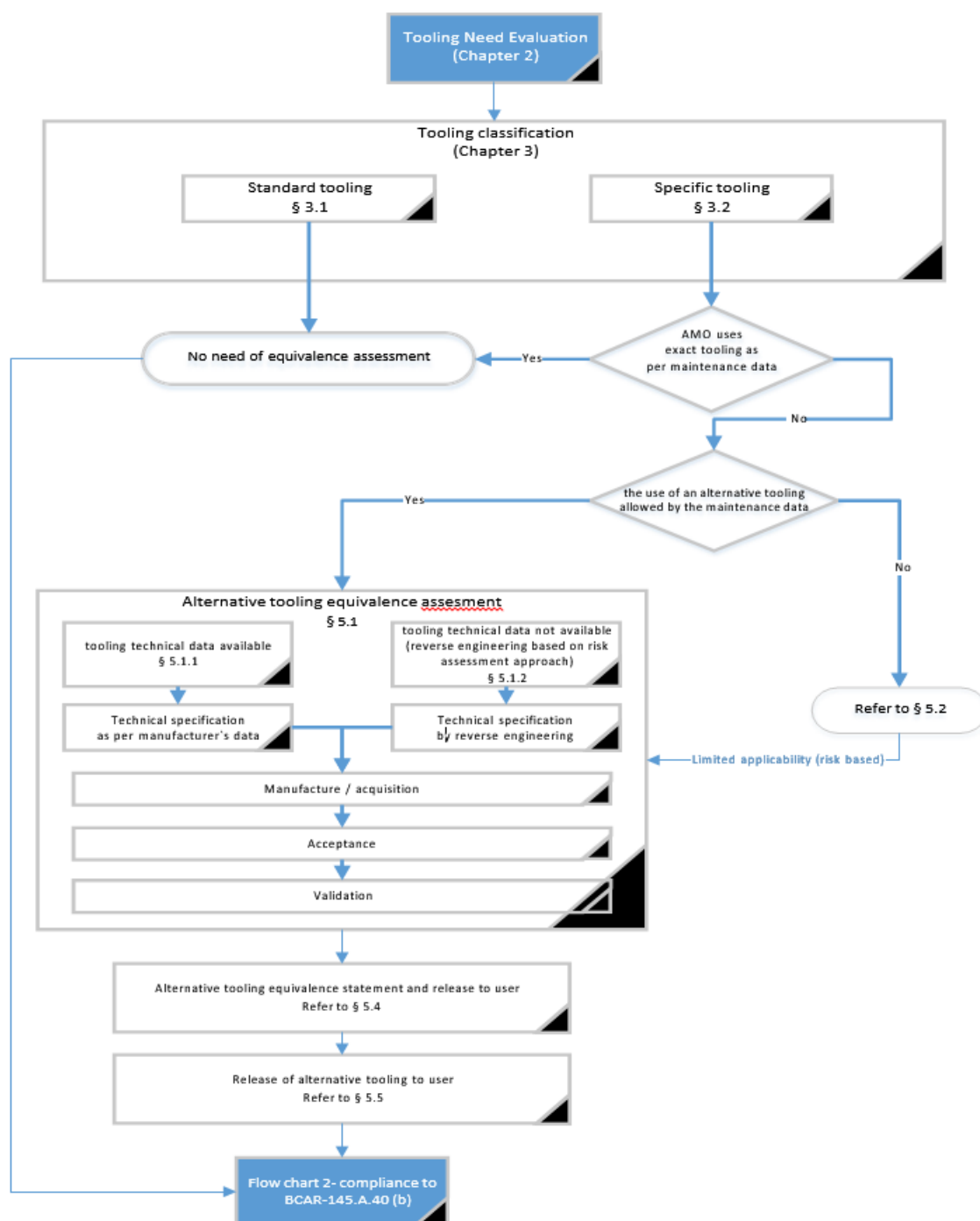
This user guide intends to describe the two main processes that shall be used by a maintenance organization to demonstrate compliance with BCAR-145.A.40 (a) and BCAR-145.A.40 (b).

In particular those processes represent the basic elements expected to be described in the MOE chapter 2.6 “Use of Tooling and Equipment by Staff (including alternate tools)” and in the chapter 2.5 “Calibration of Tools and Equipment”.

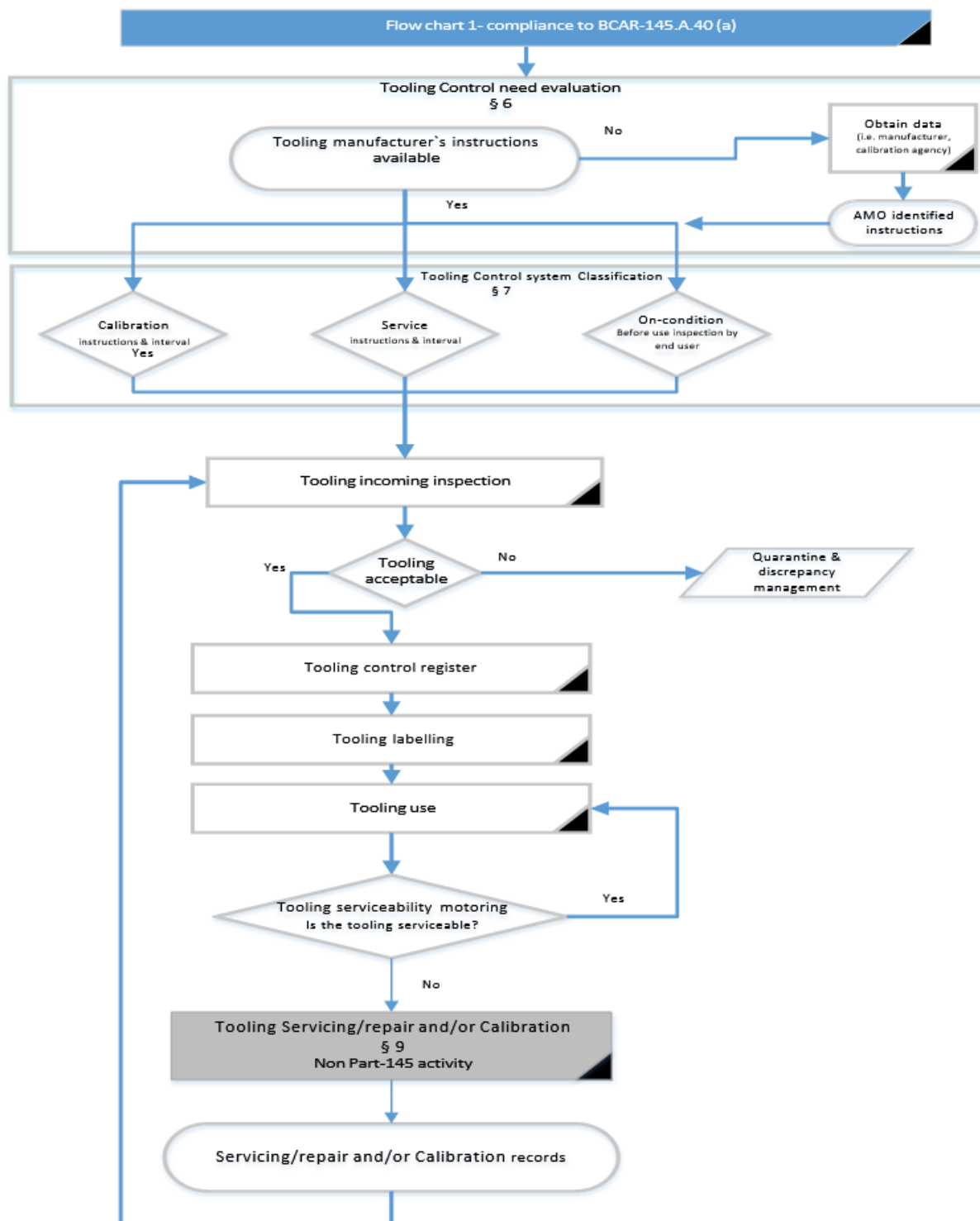
For the purpose of this user guide the term **“tooling”** is used to indicate any tool or equipment. The maintenance organization may vary in the terminology used to define and classify the tooling; therefore, adherence to any particular designation shown in this user guide may not match each maintenance organization’s structure.

Note: Other requirements apply to the use of tooling within the maintenance organization, which are however not intended to be covered in this user guide (e.g. 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 to BCAR-145.A.40 (a)



Flow chart 2- compliance to BCAR-145.A.40 (b)



2. Tooling need evaluation

As mentioned in BCAR-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 the BCAA, it will be necessary to show that all tools and equipment as specified in the maintenance data¹ can be made available when needed”.

This demonstration is to be achieved with a “**tooling need evaluation**” which consist in:

- Identifying, classifying and listing all tooling required to perform the intended scope of work by analyzing the maintenance tasks;
- Identifying and listing the tooling that is permanently available in the maintenance organization and those that are leased or loaned²; in the case of tooling which is not permanently available (limited to infrequently used ones), the maintenance organization needs to ensure that they can be made available when needed (a contract is an acceptable way for demonstration);
- Demonstrating that the tooling in use is the one specified by the maintenance data or in the case the maintenance organization is using alternative tooling, as agreed by BCAA through an MOE procedure, such tooling has been assessed to be equivalent.

¹ The AMC 145.A.45 (b) indicates which maintenance data is to be considered applicable under the rating (e.g. Aircraft maintenance manual, non-destructive testing manual, component maintenance manual, service bulletin, etc.).

² In the case of leased or loaned tooling it remains the responsibility of the maintenance organization using the tooling to make sure the tooling complies with BCAR-145 and therefore this user guide also applies in such cases.

3. Tooling classification

For the purpose of this user guide, due to the need to have different level of tooling assessment depending from the related complexity, the tooling is classified in the following categories:

- 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 (e.g. being commercially available) and being generically identified by the maintenance data by type and/or family and/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 $\pm 5\%$ accuracy used to measure 115 V, 28 V, and 28 volts DC; Torque wrench 0 to 300 inch•pounds / 0 to 33.9 Nm; Pressure Gage, 800 to 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 tooling³ are those tools and equipment designed for the particular Aircraft/Engine/Component/NDT/etc. maintenance task and specifically identified in the maintenance data (e.g. by P/N, vendor and description). The following examples extracted from maintenance data are considered to be “Task Specific Tooling”:

- MLG wheel adapter, P/N J32032-22, vendor:81205;
- pin - Locking, Valve, Hydraulic Reservoir Pressurization Shutoff (Part #: A29002-6, Vendor: 81205, A/C Effectivity);
- jack adapter-fuselage, reference 98D07013500000;
- temperature switch tool, P/N 622, vendor: 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, vendor: 41364);
- dolly wheel/brake change P/N 175, vendor 94861;
- jack Axle, 8398-012, 65 Ton, Regent Manufacturing, vendor 02708;
- GFCI Tester - AC Hydraulic Pump (Part #: J24014-24, vendor: 81205);
- adapters – air data system flushing, reference 98D34103002000;
- adaptor-charging pitot probe, reference 36122;
- standby compass calibration, reference 2591553-903.

³ When the maintenance organization is using an automated bench test operated by software, the maintenance organization is responsible to ensure that the software complies with the CMM requirements at the latest revision.

4. Use of tooling

On the basis of the tool's classification given in the previous chapter of this User guide, the maintenance organization 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 user⁴ (e.g. technician, certifying staff, etc.) 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 formalized equivalence assessment is not required. However, the maintenance organization may decide to develop such an equivalence assessment if deemed useful.

4.2 Use of “task specific tooling”

When dealing with a “task specific tooling”, the maintenance organization may proceed according to one of the following options to:

- a) acquire/use the “task specific tooling” as indicated by the maintenance data (exact P/N, vendor) and in such case, there is no need of any further equivalence assessment⁵;
Note: when the maintenance data itself identifies for the same task a main tooling plus other(s) possible(s) substitute(s), the maintenance organization may use the main or the substitute tooling without any need of further equivalence assessment.
- b) acquire/use a different tooling⁶ from the one specified in the maintenance data. Such replacement tooling is defined, in this user guide, as “**alternative tooling**” and may be used only subject to compliance with the conditions specified in the following chapter “alternative tooling equivalence assessment” of this user guide.

⁴ The end user is intended to be the person formally authorized by the maintenance organization to perform and sign-off the maintenance task for which the tooling is to be used.

⁵ The maintenance organization remains however responsible for the acquisition, acceptance, identification, control or calibration of the tools according to Part-145 requirements and its MOE procedures.

⁶ This option may be considered for various reason (e.g. the tool specified is not available in the necessary time frame, another tool is already available in the maintenance organization, etc.).

5. Alternative tooling equivalence assessment

5.1 Maintenance data allowing the use of alternative tooling

The maintenance data are normally providing clear statements on the cases where alternative tooling to the one specified may be used⁷. Only when this possibility is given in the maintenance data, the maintenance organization is entitled to proceed with an equivalence assessment process in order to use alternative tooling. Alternative tooling may be obtained by different means⁸, however, regardless of the type of acquisition process, the two possibilities given in the following paragraphs have to be considered by the maintenance organization.

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 (e.g. manufacturing drawing, technical characteristics, manufacturing procedure, etc.), or;
- the maintenance organization obtains additional data (e.g. manufacturing drawings, etc.) from the relevant manufacturer (may be the applicable TCH, STCH, OEM or the tool manufacturer which is specified in the maintenance data of the product or component being maintained).

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

- **Technical Specification:** engineering document establishing:
 - the technical characteristics of the tooling to be acquired/manufactured to demonstrate it is in conformity to the relevant technical data (e.g. dimensions, material, functions, accuracy, etc.), and;
 - the applicable inspection/service/calibration need (refer to chapter 7 of this user guide for definitions);
- **Manufacture/acquisition:** process in use to manufacture the tool and/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 (e.g. functional check, etc.) that the alternative tool is capable of correctly performing the relevant maintenance task;
- **Alternative tooling equivalence statement:** the satisfactory completion of the process mentioned above is finalized with a formal approval by the maintenance organization, as described in paragraph 5.4 “Alternative tooling equivalence statement” of this user guide;
- **Release to user:** process describing how the user is informed of the use of alternative tooling, as described in paragraph 5.5 “release to user” of this user guide.

⁷ May be in the “front matter” of the aircraft maintenance manual, in a specific tools/equipment manual when published, in the TCH aircraft maintenance task card manual, in the special tools section of the component maintenance manual, etc. A declaration or other data from the tooling manufacturer stating that its tooling is equivalent or may be used in lieu of 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.);

⁸ 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.

5.1.2 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 organization, 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 shall be considered by the maintenance organization 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 shall be assessed by the organization 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 needs to be described in the MOE:

- **Technical Specification:** engineering document establishing:
 - the technical characteristics of the tool to be acquired/manufactured based on a reverse engineering approach (e.g. 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 (refer to chapter 7 of this user guide for definitions);
- **Manufacture/acquisition:** process in use to manufacture the tool and/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 (e.g. functional check, etc.) that the alternative tool is capable of correctly performing the relevant maintenance procedure;
- **Alternative tooling equivalence statement:** the satisfactory completion of the process mentioned above is finalized by a formal approval by the maintenance organization, as described in paragraph 5.4 “Alternative tooling equivalence statement” of this user guide;
- **Release to user:** process describing how the user is informed of the use of alternative tooling, as described in paragraph 5.5 “release to user” of this user guide.

5.2 Maintenance data not stating the possibility to use alternative tooling.

There are cases, where the maintenance data neither allows nor prohibit the use of alternative tooling. In those cases, the maintenance organization may either:

- Acquire the specific tooling P/N by the identified vendor (s), or;
- Request a revision of the maintenance data directly to the TCH or STCH to include the alternative tooling proposed by the maintenance organization before its use.

However, the use of an alternative tooling maybe still acceptable in limited circumstances. The main driver to evaluate the applicability of this option is a risk-based approach that shall be considered by the maintenance organization 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 shall be assessed by the organization 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 paragraphs 5.1. of this User guide, can be used with the additional requirement of notification to the TCH/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 organization shall have staff assigned to this activity who needs to be appropriately qualified according to an MOE procedure acceptable to the BCAA.

In addition, the compliance monitoring function 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;
- competency assessment and issuance of the related individual authorizations;
- 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 (e.g. ultrasonic probes, etc.), only a person qualified as NDT level III 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 shall be signed by an NDT level III.

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 the MOE Part 5.1 “sample of documents”. This Form shall 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 organization;
- the reference to technical specification which has been developed by the maintenance organization to acquire/manufacture the alternative tooling;
- a statement that the alternative tooling is equivalent to the one specified by the maintenance data;
- Identification/signature of the person performing the assessment;

Note: the form described above need to be kept on-file 3 years after the tool has been permanently withdrawn from service by the maintenance organization.

5.5 Release of alternative tooling to user

Updated documentation on the alternative tooling shall be provided to the user. In particular, a system shall be in place so that maintenance staff can easily identify the alternative tooling to be used as replacement of 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 BCAR-145, the maintenance organization shall ensure that “all tools, equipment and particularly test equipment, as appropriate, are controlled and calibrated according to an officially recognized standard at a frequency to ensure serviceability and accuracy”.

In order to comply with this requirement, the maintenance organization shall, for any tooling in use, identify the related inspection/service/calibration needs.

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

This will allow the maintenance organization to ensure/demonstrate that the need of 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 user guide, 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 organization to retrieve the necessary documentation (e.g. by 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 paragraph 3.2 “task specific tooling” of this User guide) 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.

ISO 10012 states that the measuring equipment metrological characteristics (MEMC) are often determined by calibration. This means that calibration is related to the determination of metrological characteristics of measuring tools and equipment.

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, etc.

There are some precision and other tools that require adjustments and maintenance to ensure proper functioning but not used for measurements. Consequently, calibration in such cases is not necessary.

8. Tooling control management

The tooling control management system is composed by 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 to proceed with the entry of relevant data in the control register as described in the following paragraph “Control register” of this User guide.

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 receiving inspection of calibrated tooling. The following minimum elements shall be verified by the maintenance organization:

- calibration laboratory meets the MOE specified requirements (e.g. accreditation of the laboratory, etc.). In the case of accredited laboratories, this also includes verification that the accreditation of the laboratory is valid (e.g. 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 (e.g. EN/ISO 837-1 for the calibration of pressure gauges);
 - traceability to master instrument used for calibration;
 - measurement/calibration results;
 - person(s) performing the calibration;
 - where applicable, reference to any accreditation hold by the laboratory;
- conformity to the calibration order (ref. par. 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 organization.

The system in use shall 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 previous chapter 7 “tooling control system classification” of this User guide;
 - 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 organization (e.g. wheels workshop, Line stations, hangar, line maintenance);
 - status (e.g. serviceable, unserviceable, scrapped, sent for calibration, loaned, etc.).

The tooling control register can be in the form of a paper or electronic system (e.g. electronic list, database, etc.), as appropriate depending from the size and complexity of the maintenance organization. In particular, where for a small component workshop a simple paper or electronic list could be acceptable, for a major maintenance organization having several workshops, line station, hangar, a database should be expected, which is capable to manage 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 or 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 condition to ensure the information displayed remains at any time legible. After the labelling, the tooling enters the maintenance process and remains in serviceable condition subject to the serviceability monitoring system.

It is not the intent of this User guide to describe the tooling labelling system. For further guidance on this matter refer to the *AIR-GM-08 Guidance on BCAR-145 Maintenance Organisation Exposition, chapter 2.4 "Acceptance of Tools and Equipment"*.

8.4 Serviceability monitoring

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

- segregated when in unserviceable⁹ condition;
- sent for inspection/service/calibration when reaching any applicable due date;
- sent for repair when necessary;

The maintenance organization shall ensure that any servicing or calibration interval required by the tooling manufacturer is complied with. This interval may be modified where the maintenance organization 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 BCAA. However, when a servicing/calibration interval is recommended or required to be reduced based upon the servicing/calibration results, such change is to be systematically and immediately implemented by the maintenance organization.

It is not the purpose of this User guide to describe the tooling serviceability monitoring system. For further guidance on this matter refer to the *GM-AIR-08 Guidance on BCAR-145 Maintenance Organisation Exposition chapter 2.5 "Calibration of Tools"*

⁹ The unserviceable condition may occur for several reasons:

- due to an incident which requires a repair to the tooling; or
- due to reaching the inspection/servicing due date (for "service" or "calibration" tooling); or
- due to reaching the calibration due date (for "calibration" tooling); or
- due to phase-out, etc.;

9. Tooling Servicing/Repair and/or Calibration

BCAR-145 states that the maintenance organization “*shall ensure that all tools, equipment and particularly test equipment, as appropriate, are controlled and calibrated according to an officially recognized standard*”.

However, performing tooling servicing, repair and calibration is NOT a BCAR-145 privilege, and the activities described in the following paragraphs 9.1 “Tooling servicing/repair” and 9.2 “Tooling Calibration”, are formally outside the BCAR-145 remit.

The intent of these paragraphs is to describe how the maintenance organization may adequately discharge its responsibilities.

The “tooling service provider(s)” which carry out those activities have to be identified in a list under the control of the Quality System function referred in the MOE chapter 2.4 (refer to the *GM-AIR-08 Guidance on BCAR-145 Maintenance Organisation Exposition*)

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/repair

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

- The activity is done according to the tooling manufacturer’s instruction, and;
- A record is kept on file by the maintenance organization for each tooling, providing evidence of:
 - the expected servicing activities to be performed and related frequency, and;
 - servicing accomplishment to demonstrate that content and frequency requirements are met, and;
 - any repair carried out, including replacement of parts, and;
 - 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). The International Laboratory Accreditation Cooperation (ILAC) 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 organization 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 recognized 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 compliance monitoring 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 BCAR-145 the maintenance organization shall 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. These standard details both the generic requirements and guidance for the implementation of measurement management systems.

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

When using tooling requiring test, calibration or measurement, a maintenance organization shall ensure that the calibration or measurement interval required by the tooling manufacturer is complied with. This process is detailed in paragraph 8.4 "serviceability monitoring" of this user guide.

9.2.3 Selection of the calibration provider

When selecting a calibration provider, the maintenance organization shall ensure that the provider falls into one of the cases below provided that the MOE chapter 2.5 "Tools Calibration" is reflecting those cases.

9.2.4 Calibration in “acceptable” laboratories

Tooling shall be calibrated by any of the following laboratories:

- a) a 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), or;
- 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, or;
- c) original tool manufacturer identified in the approved maintenance data, provided it is supported by a calibration or accuracy statement, or;

9.2.5 Interpretation of calibration standards

The term “*standard*” used in BCAR-145.A.40(b) has different meanings depending on the context in which the term used.

With this regard BCAR-145.A.40(b) requires that certain tools shall be controlled and calibrated according to an “*officially recognized standard*”. It also requires that records of such “*calibration and traceability to the standard used shall be kept*”.

Concerning tools and equipment AMC 145.A.40(b)1 explains that a register should be maintained together with record of calibration and “*standards used*”.

Simultaneously, AMC 145.A.40(b)3 clarifies that “*an officially recognized standard means those standards established or published by an official body*”.

It should be noted that ISO 10012 (in relation to “traceability”) states that the management of the metrological function shall ensure that all measurement results are “traceable to SI¹⁰ unit standards”. Therefore, in this context the term “*standard*” used by AMC 145.A.40(b)1 is related to a specific measuring tool used for calibration to ensure traceability to an SI unit standard.

However, the term “*standard*” used by AMC 145.A.40(b)3 is related to a document (e.g. an ISO Standard) established or published by an official body.

Maintenance organizations are expected to ensure that the term “*standard*” is properly used in the MOE taking into consideration the above described two different meanings.

¹⁰ International System of Units