



MINISTRY OF DEFENCE

**Secretariat General of Defence and National Armaments Directorate
Directorate of Air Armaments and Airworthiness**

REQUIREMENTS TO MAINTAIN THE CALIBRATION OF MEASURING EQUIPMENT

Basic Edition: 26th June 2017

English Edition: 25th March 2019

LIST OF EFFECTIVE PAGES

ATTENTION: This regulation is valid if composed by the pages listed below, duly revised.

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The issue dates of the original and amended pages are:

Original.....0.....of.....25/03/2019

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1. GENERAL

1.1 INTRODUCTION

The AER(EP).P-2005 (§ 5.7.1) regulation requires that the instrumentation used to ensure continuing Airworthiness of Weapon Systems be calibrated according to an officially recognized standard when necessary.

The requirements of the existing quality management systems based on ISO 9000 series standards are not sufficient to meet the required national and international standards.

In consideration of the foregoing, there a need that, in maintenance operations the measurement activities are performed with suitably tuned/calibrated instruments that are able to ensure the required level of accuracy.

1.2 Aim

The scope of this standard is to define the requirements to be met to ensure that the measurement instruments, used by maintenance organizations of the Air Forces (AF) and State Bodies (SB), are properly calibrated and functional.

Specifically, this Technical Publications (TP) defines:

- the management requirements for the measurement instrumentation and the related calibration intervals;
- the documents to be produced in relation to the adjustment/calibration activities;
- possibility to use software to manage the above activities.

1.3 Applicability

All AFs and SBs, using measuring instrumentation for inspection and testing of military aircraft (and their components) in configurations approved by the DAAA, shall comply with this regulation.

Particularly, it applies to all measuring instrumentation – and related standards – that base their principle of operation and/or application on the following physical quantities:

ELECTRICAL

- Frequency;
- Capacity;
- Inductance;
- Attenuation in high/low frequency;
- Power in high/low frequency;
- Direct and alternating voltage;
- Direct and alternating current;

- Resistance.

MECHANICAL

- Length;
- Mass;
- Force;
- Temperature;
- Pressure;
- Relative humidity;
- Volume and flow rate;
- Acoustics.

The regulation does not apply to devices installed on board aircraft or to the peculiar AGE of Weapon Systems.

1.4 Validity

This TP applies and will come into effect upon its approval.

1.5 Reference Documents

- AER.(EP).P-2005 "Mantenimento della Aeronavigabilità"
- UNI EN ISO 9001 "Quality Management Systems – Requirements"
- UNI EN ISO 10012 "Measurement Management Systems: Requirements for measurement processes and measuring equipment"
- UNI CEI EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories"
- STANAG 4704 "NATO requirements for calibration support of test & measurement equipment"
- UNI CEI 70099 "International Vocabulary of Metrology (VIM3)"

1.6 Definitions

The terms and definitions set out in the standards UNI EN ISO 9000 and UNI CEI EN ISO/IEC 17000, UNI EN ISO/IEC 17011, UNI CEI EN 45020, UNI CEI EN 4546, UNI CEI 70099 International Vocabulary of Metrology (VIM3) shall apply to this regulation. All the abbreviations, acronyms and terms in the TP AER.Q-2010 apply to this TP, supplemented by the following definitions:

SB	State Body
DAAA/ARMAEREO	Directorate of Air Armaments and Airworthiness
AF	Armed Force
SI	International System of Units (<i>Sistema Internazionale</i>)

Some definitions commonly used in metrology are listed below:

- **reference measurement standard (reference standard):** a measurement standard designated for the calibration of other measurement standards for quantities of a given kind, in a given organization or at a given location;
- **first line standard:** a reference standard of the Laboratory/Centre that is routinely calibrated by a Primary Metrological Institute or by another accredited Centre/Laboratory in the EA and ILAC with a suitable level of uncertainty, that is the reference of the metrological chains Centre to the national or international standard of the International System of Units;
- **second line standard:** a working standard of the Laboratory/Centre that is routinely calibrated by the Laboratory/Centre itself by comparison with the first line standard and is used for the calibration of the Customer's standards or of instruments;
- **travelling standard:** a working standard sample of the Laboratory/Centre that is routinely calibrated by the Laboratory/Centre itself and that is used for external calibrations at the premises of the customer of the testing and/or calibration service;
- **reference material (RM):** a material that is sufficiently homogeneous and stable with respect to the specified properties and identified as appropriated for its intended use in measurement or in the examination of nominal properties;
- **certified reference material (CRM):** reference material, accompanied by documentation issued by an authoritative body, that provides one or more specific property values, with associated uncertainties, referability and traceability, defined using valid procedures;
- **calibration and measurement capability:** the availability of specialized personnel, of the necessary equipment and the adoption of procedures that are metrologically correct for measurements of a determined physical quantity inside to measurement ranges and with levels of uncertainty specified in the accreditation table;
- **management procedure:** a document that sets out the modalities and conditions of implementation of the quality system elements and that describes the relationships between the personnel involved in a specific activity and their responsibilities;
- **technical procedure:** a document that describes the methods, modalities, conditions and responsibilities necessary to perform a technical activity (such as calibration, metrological confirmation, maintenance, use, etc.);
- **field of measurement:** identifies, for a specific quantity, the metrological chains, the measurement ranges and parameters, the models of instruments that have in common procedures and calibration methods;

- **calibration:** operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication;
- **adjustment:** operation in which a measuring instrument is adjusted so as to improve the accuracy by comparison with reference measurements produced using a standard instrument.

2. TECHNICAL AND MANAGEMENT REQUIREMENTS FOR MEASURING EQUIPMENT

Each measuring equipment shall comply, over time, with the usage requirements.

Normally this is ensured through a "Measurement Management" or metrological confirmation system, the purpose of which is to prevent a measuring device from produce results with unacceptable errors.

To do so, the intervals for the periodic confirmations shall be such that a new confirmation is performed before any likely alteration of its accuracy, significant for the use of the instrument, and that therefore can negatively affect any checks carried out on aircraft and related parts or even lead to damage to the parts being maintained.

To be able to implement the above, it is important that the characteristic data of all equipment is properly managed and recorded. Therefore, it is necessary to set up documents that make it possible, at any time, to trace the data and the status of each instrument.

Each AF/SB shall specify, by means of a specific directive, how this technical prescription is to be applied in relation to the requirements to set for its laboratories.

2.1 Technical Card

Each device shall be accompanied by a card as per Attachment "A". In particular, the following data shall be reported:

- a) the indication of the User Department/Unit;
- b) the description and the unique identification of the equipment;
- c) the details of manuals and/or construction specifications of the equipment;
- d) the detailed description of the use for which it is intended;
- e) calibration interval set;

- f) calibration requirements (data or declaration of conformity to specification) and any related reasons;
- g) the identification of the calibration procedure;
- h) the uncertainty;
- i) any limitation of use;
- j) the history of calibrations (with reference to the number of the corresponding certificate/report), repairs, adjustment and any technical intervention in general.

The information on these cards shall be collected in the Unique Register established under the AER(EP).P-2005.

2.2 Documentation Certifying the Conformity

First line instruments shall be calibrated at an Accredited Laboratory, which therefore shall issue a Calibration Certificate in accordance with (i.a.w.) the UNI CEI EN ISO/IEC 17025 standard.

The remaining instruments shall be calibrated by laboratories that shall issue a Calibration Report (AR; Attachment "B").

2.2.1. Calibration Report

The report shall include at least the following information:

- a) the name of the laboratory (Body) and the place where the calibrations have been performed, if different from that of the laboratory;
- b) the unique identifier of the report (report number) that shall be shown on each page that makes up the report itself;
- c) the name and the address of the User Department/Unit;
- d) the identification of the method and of the procedure used;
- e) the description, together with the related condition, and unambiguous identification of the calibrated instrument(s);
- f) the date of receipt of the tested or calibrated instrument(s) when this is critical for the validity and for the application of the results, and the calibration date(s);
- g) the date of calibration, the interval and the expiration date (calculated on the basis of the content of the Technical Card);
- h) the number of the work order (or equivalent);
- i) the conditions (for example environmental) in which the calibrations were performed;
- j) the used reference standard (first line and/or second line and/or travelling) and its data (model, Serial Number, number of certificate/calibration report, date of calibration or expiration);
- k) the results of calibration (data) of the measurements, which shall also specify the units of measure used and the measurement uncertainty; these results can be expressed by means of a calibration chart, a calibration curve, a table, etc.; alternatively a declaration of conformity to either

(metrological) specifications or technical manuals may be provided, indicating which requirements of the specification are satisfied or not (for first line, second line and travelling instrumentation, the declaration of conformity to specifications is not allowed);

- l) any limitations that became evident during the calibration (for example in the range of the calibrated measurement units);
- m) a declaration relating to any tuning or repairs carried out. In this case, the results of the calibration before and after the tuning or repair shall be entered, if available;
- n) a statement that the calibration certificate shall not be reproduced in whole or in part without the written approval of the laboratory that issued it;
- o) the name(s), the function(s) and the signature(s) or equivalent identification of the person(s) that has/have carried out the calibration and the Head of the Laboratory that authorizes the issue of the calibration certificate.

2.2.2. CALIBRATION LABEL

Each device shall have a calibration label as per the Attachment "C", that is readable and not easily removable, which indicates the compliance status of the device on which it is affixed.

In particular, it shall include:

- a) the indication of the Laboratory that performed the calibration;
- b) the model or P/N or NATO Stock Number (NSN) of the equipment;
- c) the Serial Number of the equipment;
- d) the calibration date;
- e) the calibration expiration date, if applicable;
- f) the details of its Calibration Report.

The device for which calibration is not necessary (for example instrumentation defined "for reference only"), shall be clearly identified as such, so that it can be distinguished from measurement equipment subject to calibration.

Labels shall be applied on these devices showing the words "Calibration Not Required".

2.3 Calibration Frequency

The periodic calibration intervals shall be set taking into account factors such as:

- the specifications of the manufacturer;
- the international standards (e.g.: ILAC-G24 OIML D 10);
- the frequency of use of the instrument;
- the influence of the environment;
- the accuracy of the measurement required;
- the results of previous calibrations.

2.4 Sealing

Access to adjustable devices of the measurement equipment, whose adjustment can affect performance, shall be sealed or otherwise protected to prevent any tampering.

2.5 Use of Management Software

The production, update, management and archiving of the documentation described in this TP can be handled by using IT systems and software designed to electronically manage the subject documentation, which shall be compliant with the requirements.

3. FINAL PROVISIONS

From the date of adoption of this TP, all maintenance organizations approved i.a.w. the AER(EP).P-2005 standard will have 12 months to adapt their Maintenance Quality Management System (MQMS) to the content of this regulation.

User Department, Unit /Laboratory
Address

TECHNICAL CARD
N° _____

__/__/__

Equipment Model: _____

N° _____

APPLICABLE AND REFERENCE DOC.			
ID		Title	
ID		Title	
ID		Title	

DESCRIPTION OF THE USE	
CALIBRATION PROCEDURE N°:	
CALIBRATION INTERVAL:	

CALIBRATION REQUIREMENTS FOR THIS EQUIPMENT:

NOTE	
UNCERTAINTY:	
LIMITATION:	

HISTORY OF ACTIVITIES			
#	TYPE	DATE	N° AR/CC
1			
2			
3			
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14			
15			
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User Department, Unit /Laboratory
Address

CALIBRATION REPORT

__/__/__

N° _____

TITLE

Delivered to: _____
Address: _____
Order n° _____

Instrument: _____

Manufacturer: _____

S/N: _____

N.S.N.: _____

Receipt Date	
Calibration Date	
Expiration Date (if applicable)	

INSTRUMENT DESCRIPTION AND CONDITION

Calibration Place: _____

Environmental conditions	
Temperature [°C]	Humidity [%]

Identification of the method: _____

Identification of the procedure: _____

Reference standard model: _____

RESPONSABILITY

Declaration relevant to the data validity for the specific instrument

Declaration of conformity to metrological specifications or its points (if relevant)

Declaration relevant to the measurement uncertainty (if applicable)

person that has carried out the calibration
(function)

(First and surname name)

(signature)

the Head of the Laboratory
(function)

(First and surname name)

(signature)

CALIBRATION LABEL

Laboratory Identification	
Laboratory Address	
Model, P/N, NSN of the equipment	Serial Number
Calibration/adjustment date (expiration date if applicable)	
N° AR/CC	