Jordanian Accreditation System
نظام الاعتماد الأردني
Accreditation Unit

ACCREDITATION UNIT

POLICY ON METROLOGICAL TRACEABILITY

Purpose

To explain the concept of metrological traceability, the methodology achievement and demonstration.

Scope

This policy is intended to explain the acceptable sources of metrological traceability, how it can be achieved, and how it can be demonstrated. The Accreditation Unit (JAS-AU) requirements pertaining to metrological traceability are described in compliance with ILAC-P10. This document shall be implemented by all JAS-AU accredited and applying for accreditation calibration, testing laboratories, **medical laboratories and inspection bodies**. JAS-AU assessors are also responsible for assuring the implementation of this policy.

Authorship

This publication has been written by the Technical Committee, and approved by the Accreditation Director.

Official language

The text may be translated into other languages as required. The English language version remains the definitive version.

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Further information

For further information about this publication, kindly contact JAS-AU.

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1. Introduction

The quality of products and services is becoming increasingly dependent on reliable measurements. The importance attached to measurements is reflected in relevant standards (ISO/IEC 17025, ISO 15189) by the requirement that measurements shall be “traceable” to national or international standards of measurements.

2. Terminology: Calibration, Testing and Metrological Traceability

The definitions below apply in addition to JCGM 200:2012 "International vocabulary of metrology – Basic and general concepts and associated terms (VIM) 3rd edition".

2.1 Calibration

Calibration is defined as the “set of operations which establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure, or a reference material, and the corresponding values realized by standards”.

In general, “calibration” means determining and documenting the deviation of the indication of a measuring instrument (or the stated value of a material measure) from the conventional “true” value of the measured.

A proper calibration result should include: the measured value, Reference value, a stated uncertainty, identification of the standards used in the calibration and the specification of any environmental conditions of the calibration where correction factors should be applied, if the standard or equipment were to be used under different environmental conditions

2.2 Testing

A test is defined as “a technical operation that consists of the determination of one or more characteristics of a given product, process or service according to a specified procedure.”

2.3 Metrological Traceability:

- Metrological traceability (VIM 3 clause 2.41)

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.

ISO/IEC 17025 and ISO 15189 refer to the VIM's term of "Metrological traceability" and the term "metrological traceability" is used throughout this document.

- Metrological traceability chain (VIM 3 clause 2.42)

Sequence of measurement standards and calibrations that is used to relate a measurement result to a reference.

- Metrological traceability to a measurement unit (VIM 3 clause 2.43)

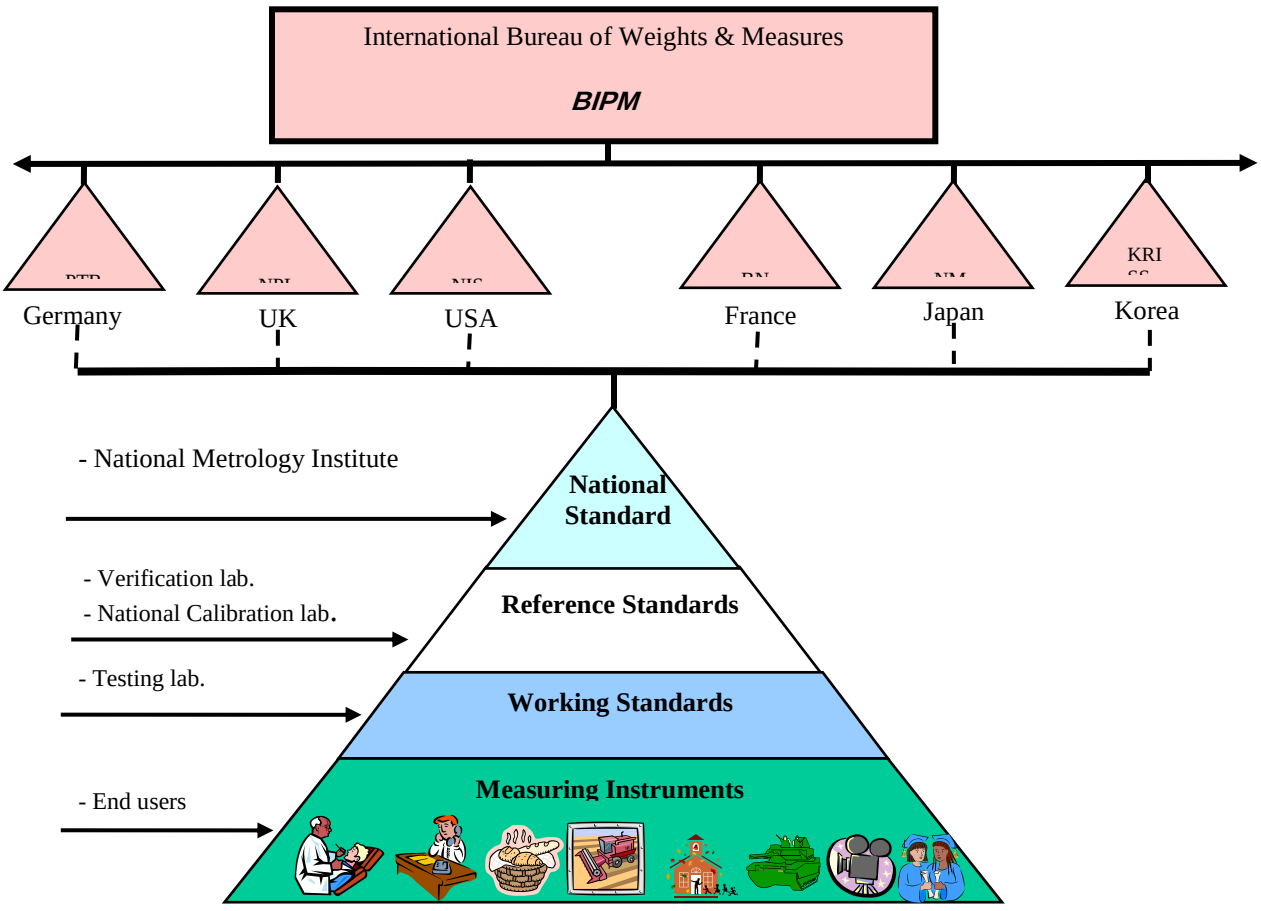
Metrological traceability where the reference is the definition of a measurement unit through its practical realization

* The expression "traceability to the SI" means metrological traceability to a measurement unit of the International System of Units.

2.4 JNMI:

Jordan National Metrology Institute, which maintains the national measurement standards in Jordan.

This metrological traceability chart shows the position of JNMI with respect to BIPM.



2.5 JCGM 2000:2012: Joint Committee for Guides in Metrology, chaired by the Director of the BIPM, was formed by the seven International Organizations that had prepared the original versions of the Guide to the expression of uncertainty in measurement (GUM) and the International vocabulary of basic and general terms in metrology (VIM).

2.6 BIPM: International Bureau of Weights and Measures

2.7 CIPM MRA: International Committee for Weights and Measures Mutual Recognition Arrangement

The CIPM MRA is an arrangement between National Metrology Institutes which provide the technical framework to assure the mutual recognition of national measurement standards and for recognition of the validity of calibration and measurement certificates issued by National Metrology Institutes.

2.8 KCDB: Key Comparison Database /BIPM.

2.9 JCTLM: Joint Committee for Traceability in Laboratory Medicine

2.10 CRM: Certified Reference Material

Reference material characterized by a metrologically valid procedure for one or more specified properties, accompanied by a reference material certificate that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability

[SOURCE: ISO 17034:2016]

2.11RM: Reference Material

Material, sufficiently homogeneous and stable with respect to one or more specified properties, which has been established to be fit for its intended use in a measurement process.

[SOURCE: ISO 17034:2016]

2.12RMP: Reference Material Producer

Body (organization or company, public or private) that is fully responsible for project planning and management; assignment of, and decision on property values and relevant uncertainties; authorization of property values; and issuance of a reference material certificate or other statements for the reference materials it produces [SOURCE: ISO 17034:2016]

3. Characterization of Metrological Traceability

Metrological traceability is characterized by six essential elements:

3.1 An unbroken chain of comparison:

Metrological traceability begins with an unbroken chain of comparisons originating at national, international or intrinsic standards of measurement and ending with the working reference standards of a given metrology laboratory.

3.2 Measurement uncertainty:

The measurement uncertainty for each step in the metrological traceability chain shall be calculated according to defined methods and shall be stated at each step of the chain so that an overall uncertainty for the whole chain can be calculated.

3.3 Documentation:

Each step in the chain must be performed according to documented and generally acknowledged procedures and the results must be recorded, i.e., in a calibration or test report.

3.4 Competence:

The laboratories or bodies performing one or more steps in the chain must supply evidence of technical competence, e.g., by demonstrating that they are accredited by an internationally recognized accreditation body.

3.5 Reference to SI Units:

Where possible, the primary national, international or intrinsic standards must be primary standards for realization of the SI units.

3.6 Recalibrations:

Calibrations must be repeated at appropriate intervals in such a manner that metrological traceability of the standard is preserved.

4. Sources of Metrological Traceability

4.1 JAS-AU requires that all calibrations of measuring and test equipment, reference standards, and reference materials are conducted and traceable to :

a- A National Metrology Institute (NMI) whose service is suitable for the intended use and is covered by the CIPM MRA. Services covered by the CIPM MRA can be viewed in the BIPM KCDB which includes CMCs for each listed service. Or,

b- An accredited calibration laboratory whose service is suitable for the intended use(i.e., the scope of accreditation specifically covers the appropriate calibration) and the Accreditation Body is covered by the ILAC Arrangement or by Regional Arrangements recognized by ILAC. Or,

c- Any national calibration laboratory recognized by the national authorities (Jordan Standards and Metrology Organization JSMO) as the holder of national reference standards subject that this laboratory is accredited or competent according to ISO/IEC 17025 (see annex 2). JSMO is responsible for ensuring the metrological traceability of measurements in Jordan. Assessor can verify this recognition by contacting JAS-AU or JSMO; or,

d- A calibration laboratory whose service is suitable for the intended usebut not covered by the ILAC Arrangement or by Regional Arrangements recognized by ILAC. In this case the compliance of the calibration lab to the requirements of ISO/IEC 17025, shall be verified by fulfillment of the requirements in annex 2.

Conformity assessment bodies (CABs) that have demonstrated metrological traceability of their measurements results through the use of calibration services offered according to a) or b) above have made use of services that have been subject to relevant peer review or accreditation. In the situation where c) or d) applies, this is not the case, so these routes should only be applicable when a) or b) are not possible for a particular calibration. CABs must therefore ensure that appropriate evidence for claimed metrological traceability and measurement uncertainty is available and the accreditation body shall assess this evidence.

Accepted calibration laboratories are accredited by JAS-AU or an internationally recognized accreditation body that is a signatory to **EA MLA/**ILAC MRA, or calibration laboratories which are signatory to CIPM MRA. Calibration certificates or reports must hold the symbol of its accreditation body or otherwise make reference to accreditation status (i.e. through use of a statement that the laboratory is accredited by XYZ via certificate number xxxx.yy) in order to verify its accreditation

status. All calibration certificates should provide a statement of uncertainty in addition to the statement of compliance, if appropriate. In case the symbol does not appear on the calibration certificate, then the certificate cannot be accepted, unless the laboratory fulfills the requirements stated in annex 2.

4.2 JAS-AU policy in regard to metrological traceability provided by RMPs through CRMs is that the certified values assigned to CRMs are considered to have established valid metrological traceability when::

a. **CRMs are produced by NMIs using a service that is included in the BIPM KCDB; or**
b. **CRMs are produced by an accredited RMP under its scope of accreditation and the accreditation body is covered by the ILAC arrangement or by regional arrangement recognized by ILAC; or**
c. **The certified values assigned to CRMs are covered by entries in the JCTLM database.**

The majority of RMs and CRMs are produced by other RMPs. These can be considered as critical consumables and the organization shall demonstrate that each RM or CRM is suitable for its intended use as required by of ISO/IEC 17025: 2017, ISO 15189: 2012, ISO/IEC 17043: 2010, or ISO 17034: 2016.

4.3 When metrological traceability to the SI units is not technically possible, **it is the responsibility of the applicant and the accredited organization to** demonstrate metrological traceability to an appropriate reference such as:

a) **Certified** values of certified reference materials provided by a competent producer; or

b) **Results** of reference measurement procedures, specified methods or consensus standards that are clearly described and accepted as providing measurement results fit for their intended use and ensured by suitable comparison. **The results for this comparison will be assessed by JAS-AU.**

4.4 If a calibration is not a dominant factor in the testing result, the laboratory shall have quantitative evidence to demonstrate that the associated contribution of a calibration contributes little (insignificantly) to the measurement result and the measurement uncertainty of the test and therefore metrological traceability does not need to be demonstrated.

4.5 All laboratories shall define their policy for achieving metrological traceability and it shall be in compliance with this policy.

Note1: Further information on the evaluation of sources of metrological traceability is provided in Annex 1.

5. Scopes of Accreditation

Scopes of accreditation are documents that define specifically the measurements a laboratory is accredited to make. In addition, the scope defines the ranges of the accredited measurand along with the associated calibration and measurement capability expressed as an expanded uncertainty for each measurand and range; also the coverage factor shall be stated

Accreditation is generally given for specified measurands and for the smallest uncertainties that can be achieved with the suitable measuring devices available in the respective calibration laboratory (calibration and Measurement Capability).

Before placing work with an accredited laboratory, it is important that the customer request a copy of the laboratory's scope of accreditation in addition to the accreditation certificate so that the customer can ensure that the laboratory is accredited to perform the needed measurements. In addition, customers must ensure that the laboratory's measurement uncertainties are suitable for their needs.

6. Accredited Calibration certificates & Reports and Statements of Metrological Traceability

Calibration Certificates or reports must contain a metrological traceability statement to national or international standards of measurement and should provide the measurement result and associated uncertainty of measurement. This statement will affirm that the calibration was conducted using standards whose values are traceable to an appropriate national, international, intrinsic, or mutual consent standard.

7. Determination and Statement of Uncertainty

Refer to JAS-AU Policy for Evaluation of Measurement Uncertainty and its Implementation (JAS-

P03).

8. References

- International vocabulary of metrology – Basic and general concepts and associated terms (VIM) 3rd edition, JCGM 200:2012 (JCGM 200:20008 with minor corrections).
- ISO/IEC17025**:2017**; General Requirements for the competence of testing and calibration laboratories.
- ISO 15189:2012, Medical laboratories — Requirements for quality and competence.
- **ISO 17034:2016, General requirements for the competence of reference material producers**
- JAS-AU Policy for Evaluation of Measurement Uncertainty and its Implementation (JAS-P03)
- **JAS-AU Policy on In-House Calibration (JAS-P21)**
- A2LA Policy on Metrological Traceability (P102), **May 2019.**
- IAS Policy Guide on Calibration, Traceability, and Measurement Uncertainty for Calibration Laboratories, January (**IAS/CL/014**), 2019.
- ILAC **P10:07/2020** ILAC Policy on Metrological Traceability OF Measurement Results.
- **NABL 142:2020 Policy on Traceability of Measurement Results.**
- **UKAS Policy on Metrological Traceability (TPS41) edition 5:2019**

Annex 1

Evaluation of Sources of Metrological Traceability

☒ Acceptable Accreditation bodies of Calibration and Testing laboratories

Accredited test and calibration results, reported by laboratories that are accredited by an accreditation body that has signed **EA MLA**/ILAC MRA , and stated in a test or calibration report endorsed by the accrediting body's symbol, or which otherwise makes reference to accreditation status (i.e. through use of a statement that the laboratory is accredited by XYZ via certificate number xxxx.yy), are recognized by JAS-AU as satisfying the requirements pertaining to metrological traceability.

The list of ILAC MRA signatories can be viewed at:

https://ilac.org/signatory-search/

The list of EA MLA signatories can be viewed at:

https://www.european-accreditation.org/ea-members/directory-of-ea-members-and-mla-signatories/

Assessors during the onsite assessment will review the related calibration certificates or reports and will evaluate the fulfillment of the requirements of this policy.

☒ National Metrology Institutes and Signatories to CIPM MRA

National Measurement Institutes (NMIs) and intergovernmental and international organizations that participate in the CIPM/BIPM Mutual Recognition Arrangement MRA are accepted.

Acceptability is limited to the uncertainty levels published in the CIPM calibration measurement capability (CMC) tables that comprise an integral part of the MRA and can be viewed at www.bipm.org.

Annex 2

Considerations when metrological traceability is not established through the CIPM MRA and the ILAC Arrangement

When metrological traceability is established through either 4.1c or 4.1.d of this policy, in this case the laboratory shall provide appropriate evidence for the technical competence of the calibration service supplier and claimed metrological traceability is likely to include but not be restricted to the following:- (numbers refer to clauses in ISO/IEC17025:**2017**):

1. Records of calibration method validation (**7.2.2.4**).
2. Procedures for **evaluation** of Measurement Uncertainty (**7.6**).
3. Documentation and records for metrological traceability of measurement results (**6.5**).
4. Documentation and records for ensuring the validity of results (**7.7**).
5. Documentation and records for competence of personnel(**6.2**).
6. Records for equipment which can influence laboratory activities (6.4)
7. Documentation and records for facilities and environmental conditions (**6.3**).
7. Audits of the calibration laboratory (6.6 and **8.8**).
8. Reporting of results (**7.8**).

For non-accredited calibration service suppliers, it is JAS-AU responsibility to perform a practical assessment of the calibration supplier used, similar to that which would be undertaken against the standard ISO/IEC 17025, to ensure that competent work is actually being performed.