INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES

INTERNATIONAL ORGANISATION OF LEGAL METROLOGY

INTERNATIONAL LABORATORY ACCREDITATION COOPERATION

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

JOINT

BIPM, OIML, ILAC, and ISO

DECLARATION ON

METROLOGICAL TRACEABILITY

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1. Background

The International Bureau of Weights and Measures (BIPM), the International Organization of Legal Metrology (OIML), the International Laboratory Accreditation Cooperation (ILAC) and the International Organization for Standardization (ISO) are four international bodies responsible for metrology, accreditation and standardization worldwide.

Recognizing the importance of metrologically traceable measurement results to the core missions of our Organizations, we have drawn up this declaration. We encourage our Members, as well as others for whom metrological traceability is important, to adopt the recommendations below. We also encourage other bodies to declare their support for the principles and practices embodied in this declaration wherever possible.

2. The importance of metrological traceability

We assert that international consistency and comparability of measurements are required if the missions of our Organizations are to be achieved. In particular, measurement comparability is an essential characteristic of an international system within which measurement results can be universally accepted. This international consistency and comparability can only be guaranteed if measurement results are metrologically traceable to internationally recognized references. In general, these references are those of the International System of Units (SI)[1]. Where such traceability is not yet feasible, measurement results should be traceable to certified values of reference materials or 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, (for example, hardness scales, reference standards established by the World Health Organization, and measurement procedures accepted by the JCTLM[2]). The international standard *ISO/IEC 17025 'General requirements for the competence of testing and calibration laboratories'* details the expected requirements and provides further information on metrological traceability.

All four bodies collaborate, with other international stakeholders, in the Joint Committee for Guides in Metrology, (JCGM) responsible for developing common documents. Two JCGM documents key to this Declaration are:

- *Uncertainty in Measurement - Part 3 - Guide to the Expression of Uncertainty in Measurement (GUM) – JCGM 100, (and related OIML G 1-100 and ISO/IEC Guide 98-3)* promote a consistent and common approach to the evaluation of measurement uncertainty in a variety of metrological situations; and
- *"International vocabulary of metrology - Basic and general concepts and associated terms (VIM) – JCGM 200, (and related OIML V 2-200 and ISO/IEC Guide 99).*

In particular, the VIM defines metrological traceability as:

> *"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".*

Metrological traceability therefore embodies the concepts of measurement uncertainty and calibrations against a hierarchy of reference standards.

Metrological traceability is one of the elements that establishes international confidence in the worldwide equivalence of measurements. The framework described in this document enables legislators, regulators and exporters/importers to take advantage of an international set of mutually supportive systems, which demonstrate equivalence of measurements, thereby significantly reducing technical barriers to trade (TBTs), which might otherwise result from a lack of equivalence.

[1] https://www.bipm.org/en/measurement-units/

[2] https://www.bipm.org/en/worldwide-metrology/jctlm-cooperation/

3. Recommendation

The BIPM, OIML, ILAC, and ISO endorse the following recommendations:

- In order to be able to rely on their international acceptability, calibrations should be performed
  - in National Metrology Institutes which should normally be signatories to the CIPM MRA[3] and have CMCs[4] published in the relevant areas of the KCDB[5] or
  - in laboratories accredited to ISO/IEC 17025 by accreditation bodies that are signatories to the ILAC Arrangement[6];
- measurement uncertainty should follow the principles established in the GUM[9];
- the results of the measurements made in accredited laboratories should be traceable to the SI[7];
- NMIs providing metrological traceability for accredited laboratories should normally be signatories to the CIPM MRA and have CMCs published in the relevant areas of the KCDB;
- within the OIML-CS[8], accreditation should be provided by bodies which are signatories to the ILAC Arrangement and the above policies on metrological traceability to the SI should be followed.

The above principles should be used whenever there is a need to demonstrate metrological traceability for international acceptability.

4. Use of this Declaration

These principles underpin a worldwide measurement system which provides a robust, internationally accepted framework within which users can have confidence in the validity and acceptability of measurement results. The parties strongly encourage legislators and regulators to refer to the CIPM Mutual Recognition Arrangement, the ILAC Mutual Recognition Arrangement, and the OIML Certification System and to accept measurement results made within them, thereby helping avoid technical barriers to trade. We also invite other interested parties to endorse these principles and to make use of them in their own work.

[3] http://www.bipm.org/en/cipm-mra/

[4] Calibration and measurement capabilities

[5] http://kcdb.bipm.org/

[6] Signatories are listed on ILAC website – www.ilac.org

[7] In the case that this is not possible, or not yet possible, to other internationally agreed references

[8] OIML Certification System

[9] https://www.bipm.org/en/committees/jc/jcgm/

5. Parties involved

The establishment and application of this declaration requires the involvement of a number of parties:

The **International Bureau of Weights and Measures (BIPM)** has the mission of establishing worldwide uniformity of measurement and the General Conference on Weights and Measures (CGPM) has the authority of approving the definitions of the SI. The BIPM, under the responsibility of the International Committee for Weights and Measures (CIPM) publishes the "SI brochure", which is an essential reference document for the application and correct use of the SI units.

The National Metrology Institutes (NMIs) are tasked with the realization, maintenance, improvement and dissemination of the SI units via traceable calibration and measurement services based on their Calibration and Measurement Capabilities (CMCs).

The International Committee for Weights and Measures (CIPM), recognizing the need to demonstrate, unambiguously, the equivalence of such national realizations of the SI units, and therefore of the calibration certificates issued by NMIs, drew up a Mutual Recognition Arrangement. This "CIPM MRA" provides a framework within which all participants validate and recognize the CMCs of other participants. These peer-reviewed CMCs are listed in the BIPM's key comparison database (KCDB). To provide the technical basis for this listing, 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 includes the approval of a reviewed quality system (accredited or self-declared), which conforms to appropriate internationally recognized standards, usually ISO/IEC 17025 for calibration and ISO 17034 for the production and certification of reference materials. The CIPM MRA is coordinated by the BIPM under the authority of the CIPM.

The **International Organisation of Legal Metrology (OIML)** promotes the global harmonization of legal metrology laws and procedures and provides its Members with guidance with respect to their national legislation, including that measurements used for trade and regulatory purposes should be made using standards legally traceable to the SI[5]. It has developed a world-wide technical infrastructure that provides its Members with metrological guidelines for the alignment of national requirements concerning the manufacture and use of regulated measuring instruments. This infrastructure supports the legal traceability of measurements used in regulated activities such as trade, health care, monitoring the environment, etc. OIML has also introduced an OIML Certification System (OIML-CS) within which a Declaration can be signed whereby signatories declare mutual confidence in the OIML type evaluation reports underpinning OIML Certificates issued on the basis of the requirements described in an OIML Recommendation. OIML Issuing Authorities and their associated test laboratories who issue OIML Certificates under Scheme A of the OIML-CS shall have their quality systems evaluated either by accreditation bodies or by peer assessment. The OIML-CS replaces two previous certificate systems; the OIML Basic Certificate System and the OIML Mutual Acceptance Arrangement (MAA).

The **International Laboratory Accreditation Cooperation (ILAC)** is the global association for the accreditation of laboratories, inspection bodies, proficiency testing providers and reference material producers, with a membership consisting of accreditation bodies and stakeholder organisations throughout the world. ILAC facilitates trade and supports regulators by operating a worldwide mutual recognition arrangement – the ILAC Arrangement - among Accreditation Bodies (ABs) that are subject to regular peer reviews. The signatory status of the ABs that are signatories to the ILAC Arrangement is available from www.ilac.org and the data, calibration and test results issued by accredited laboratories and inspection bodies are accepted globally via the ILAC Arrangement.

Accredited laboratories and inspection bodies are required to comply with appropriate international standards including requirements for metrological traceability and measurement uncertainty.

The **International Organization for Standardization (ISO),** ISO is an independent, non-governmental international organization with a membership of national standards bodies.

Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges.

ISO publishes a range of standards that apply to manufacture and testing of various products, and the provision of services. In many cases, calibration and testing form an integral part of the requirements of the standards. ISO harmonizes its terminology with the VIM and frequently incorporates measurement-related clauses in these standards. As ISO is responsible, together with the International Electrotechnical Commission, (IEC), for ISO/IEC 17025 it endorses the principle of traceable measurement to the SI. ISO works closely with the IEC, which has general responsibility for electrical standards, and the International Telecommunication Union (ITU), which has general responsibility for telecommunication standards. ISO, IEC and ITU work cooperatively through the World Standards Cooperation (WSC).

LIST OF ACRONYMS

ABs	Accreditation Bodies
BIPM	International Bureau of Weights and Measures
CABs	Conformity Assessment Bodies
CGPM	General Conference on Weights and Measures
CIPM	International Committee for Weights and Measures
CIPM MRA	CIPM Mutual recognition of national measurement standards and of calibration and measurement certificates issued by national metrology institutes
CMCs	Calibration and Measurement Capabilities
GUM	Evaluation of measurement data - Guide to the expression of uncertainty in measurement - published as: - JCGM 100 - OIML G1-100 - ISO/IEC Guide 98-3
IEC	International Electrotechnical Commission
ILAC	International Laboratory Accreditation Cooperation
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JCGM	Joint Committee for Guides in Metrology
JCTLM	Joint Committee for Traceability in Laboratory Medicine
KCDB	BIPM's key comparison database
OIML	International Organization of Legal Metrology
OIML MAA	OIML Mutual Acceptance Arrangement
OIML-CS	OIML Certification System
NMI	National Metrology Institute
SI	International System of Units
TBTs	Technical barriers to trade
VIM	International vocabulary of metrology – Basic and general concepts and associated terms – published as - JCGM 200 - OIML V 2-200 - ISO/IEC Guide 99
WSC	World Standards Cooperation