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# Ensuring the traceability of measuring results to the International System of Units SI

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## 1. Purpose and area of applicability of the document

This document has been prepared by the "Calibration" Sector Committee in collaboration with the Federal Institute of Metrology METAS for the harmonisation of activities performed by calibration laboratories.

The clients of accredited bodies or certified companies expect to receive accurate measuring and test results with known measurement uncertainties. Ensuring that measuring values can be traced back to standards issued by a metrology institute and the International System of Units SI as described in this document is a major prerequisite for the correctness of measuring results and the correct determination of measurement uncertainties.

This document aims to:

- Define the traceability of measurements and related terminology,
- Provide information on how to ensure the traceability of measuring results to standards issued by a metrology institute and the International System of Units SI,
- Describe the surveillance process for the traceability of measuring and test equipment,
- Provide practical tips on implementing calibration and test measures.

This document applies to all areas where it is important that measuring results can be compared. It is therefore relevant to accredited calibration, testing, inspection and certification bodies as well as non-accredited companies in matters relating to certification, for instance.

## 2. Principles

Requirements for the management system (MS) are specified in standards ISO/IEC 17000 et seqq. and in particular, in the following international standards:

- ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*
- ISO 15189:2012 *Medical laboratories – Particular requirements for quality and competence*
- ISO 9001:2015 *Quality management systems – Requirements* (including corresponding ISO Guides)

The surveillance process for the measuring and test equipment is described in the following documents, among others:

- ISO/IEC 10012:2003 *Measurement management systems – Requirements for measurement processes and measuring equipment*
- ILAC-P10:2013 *Policy on Traceability of Measurement Results*

Please refer to the following documents for the application of certified reference materials (CRM):

- ISO Guide 30: 2015 *Reference materials - Terms and definitions*
- ISO Guide 31: 2015 *Reference materials – Contents of certificates and labels*
- ISO Guide 33: 2015 *Reference materials – Good practice in using reference materials*
- ISO 17034:2016 *General requirements for the competence of reference material producers*
- ISO Guide 35: 2017 *Reference materials – Guidance for characterization and assessment of homogeneity and stability*
- EA-04/14 *The Selection and Use of Reference Materials*
- EURACHEM/CITAC Guide *Traceability in Chemical Measurement. A guide to achieving comparable results in chemical measurement*

### 3. International agreements on the mutual recognition of certificates

#### 3.1 CIPM MRA

The CIPM MRA (*Mutual recognition arrangement for national measurement standards and for calibration and measurement certificates issued by NMIs*) is an agreement concluded between national metrology institutes for the mutual recognition of national standards as well as calibration and measurement certificates. It is based on international key comparisons of mutually assessed management systems (for METAS in accordance with ISO/IEC 17025) as well as calibration and measurement capabilities (CMC) that are subject to a strict review process. The certificates recognised within this scope carry the logo depicted on the right. The agreement, participating laboratories, results of the measurement comparisons and CMCs are documented in a database of the Bureau International des Poids et Mesures (BIPM).



<http://www.bipm.org/en/cipm-mra>

#### 3.2 EA MLA

The EA (*European Cooperation for Accreditation*) is the European network of the national accreditation bodies. The EA MLA (*Multilateral Agreement*) is an agreement amongst EA members for the mutual recognition of accreditation certificates, inspection and test reports and the calibration certificates of the bodies accredited in the European member states.

<http://www.european-accreditation.org>

#### 3.3 ILAC MRA

The ILAC (*International Laboratory Accreditation Cooperation*) is an international association of accreditation bodies for laboratories and inspection bodies. Accreditation bodies around the world that are assessed and found to be competent by their peers have signed an agreement – *ILAC recognition arrangement (ILAC MRA)* – that promotes the acceptance of products and services in foreign countries. The aim of this agreement is to create an international system that supports international trade by reducing technical trade barriers to realise the goal of free trade – "Once a product has been tested it is accepted everywhere".



<http://www.ilac.org/>

#### 3.4 Agreements in the statutory metrology sector

The OIML (*Organisation internationale de métrologie légale*) is an international organisation that aims to develop harmonised statutory measuring equipment guidelines and apply them in all countries. The OIML has introduced two systems for further developing harmonisation and free trade:

The **OIML Certificate System for Measuring Equipment** is a voluntary agreement under which the members certify measuring equipment in accordance with strictly harmonised requirements, test methods and test reports. Recognition of these certificates is voluntary and based on mutual trust. However, the certificates may be used as a basis for further binding agreements of mutual recognition, especially for the OIML MAA.

In the **OIML Mutual Acceptance Arrangement (MAA)**, a group of OIML members undertakes to mutually and bindingly recognise certificates for certain measuring equipment categories. The participating laboratories must comply with the requirements of standard ISO/IEC 17025, which are assessed by an international team. The aim of the MAA is to create mutual trust in construction type tests and to consequently make it easier to launch measuring equipment in the regulated sector.

<http://www.metrologyinfo.org/oiml-3.html>

## **4. Ensuring traceability**

### **4.1 Calibration hierarchy**

A company usually calibrates its measuring equipment on the basis of operating standards whose values can be traced back to national standards, and therefore the reference values of the International System of Units SI, through the use of reference standards. The values can be traced in several steps and the measurement uncertainty must be known for each one of them. The example of the Swiss metrological infrastructure in Annex 4 illustrates the hierarchy of the various bodies.

It generally has to be remembered that the selection of the calibration body depends greatly on the measurement uncertainty required with regard to the application of the measuring equipment. The higher up a body is positioned within the calibration hierarchy, in other words the fewer the steps that have to be taken to trace values so as to realise an SI unit, the smaller the measurement uncertainty allowed for the calibration of the measuring equipment.

### **4.2 Institutions that are able to ensure the traceability of the measuring values**

- **National metrology institutes**

In Switzerland, The Federal Institute of Metrology METAS (<http://www.metas.ch>) or corresponding foreign metrology institutes protect the national standards and pass on their values through calibrations and verifications to the industry, research sector and society. The CIPM MRA ensures that the certificates and reports are recognised internationally.

- **Accredited calibration bodies**

In Switzerland, the calibration bodies of the Swiss Calibration Service SCS (<http://www.sas.admin.ch>) or corresponding foreign accredited bodies have the recognised power to realise traceable calibration results. The EA MLA or ILAC ensures that the certificates and reports are recognised internationally.

- **Non-accredited calibration bodies**

If the measuring values are traced through a non-accredited body (e.g. with so-called company certificates), the client and/or owners or users of the measuring or test equipment must assess the professional competence of the calibration body. Such assessments almost always require an on-site visit and establish, in particular, if the non-accredited calibration body:

- Keeps its instruments and equipment in good order,
- Uses processes that are adapted to suit the planned calibration,
- Bases its reference standards on national standards,

- Has determined the measurement uncertainty for the planned calibration and ensured that it is suitable,
- Has sufficient expert knowledge,
- Maintains its own management system within the meaning of ISO/IEC 17025:2017, which ensures a constant quality of its services (including, in particular, the documentation of all processes). The effect of the management part of such management system may be regarded as identical to the effect of an ISO 9001:2015 system.

If non-accredited calibration bodies are involved to ensure traceability, the SAS assessors or auditors of the certification bodies request information on and evidence of the adequate assessment made by the user of the measuring equipment. On the other hand, the accreditation ensures that the calibration body has the required competences and that it complies with the corresponding requirements of the standards. The assessment in this regard is made by an independent body.

- **Company-internal calibration bodies**

The criteria for the assessment of the professional competences of non-accredited bodies also apply to internal, non-accredited calibration bodies. They are usually assessed as part of internal audits whose findings are also taken into consideration for the management assessment. The company's management therefore assumes full responsibility for correctly calibrating the measuring and test equipment.

### 4.3 Other ways to ensure traceability

- **Own primary standards**

Calibration laboratories that maintain their own primary standards or fundamentally and consistently base their units on SI units may only claim that their units can be traced back to SI units if the standards have been compared directly or indirectly with similar standards issued by national metrology institutes (ISO/IEC 17025:2017, Section 6.5.2 c).

- **Reference materials and interlaboratory comparisons**

(See 5.1.1, Point 4)

## 5. Monitoring of measuring and test equipment

### 5.1 Requirements of standard ISO/IEC 17025:2017

Standard ISO/IEC 17025:2017 requires in section 6.4 for all equipment used in tests and/or calibrations, including equipment used in auxiliary measurements (such as environmental conditions), with a impact on the validity of the results of the tests, calibrations or samples to be calibrated prior to use. The laboratory must have an established schedule and process for calibrating its equipment.

*Note:* Such schedule should comprise a system for selecting, applying, calibrating, testing, monitoring and maintaining standards and reference materials that are used as standards for test and calibration measuring equipment (ISO/IEC 17025:2017, Section 6.4.7).

#### 5.1.1 Requirements for calibration bodies

Calibration laboratories must develop and implement the calibration schedule for equipment so as to ensure that the calibrations and measurements performed by the laboratory can be traced back to SI units. The calibration certificates issued by these laboratories must state the measurement results, including the measurement uncertainty, or a statement on compliance with a certain metrological specification (ISO/IEC 17025:2017, Section 6.5.2).

#### **Requirements for the traceability of calibrations**

The traceability of equipment and standards must be ensured as described below: Calibration by

- 1) A national metrology institute that is able to perform the calibrations required within the scope of the CIPM MRA. Calibrations covered by the CIPM MRA are listed in Annex C of the CIPM MRA (BIPM Key Comparison Data Base KCDB, <http://kcdb.bipm.fr/>), which also states the measurement uncertainties.

**or**

- 2) An accredited calibration laboratory that is able to perform the required calibrations (the official area of application reflects the scope of calibration) and whose responsible accreditation body has signed the ILAC MRA.

*Note:* Calibration laboratories display the official accreditation mark and optionally the ILAC mark on their calibration certificates as a reference to an accredited service. This may be interpreted as a reference to full traceability.

**or**

- 3a) A national metrology institute that, despite having suitable calibration facilities, is not covered by the CIPM MRA. See Annex 1 for such cases.

**or**

- 3b) A calibration laboratory that, despite having suitable calibration facilities, is not covered by the ILAC Arrangement, i.e. which is not accredited for such calibration. See Annex 1 for such cases.

Laboratories that have ensured the traceability of their measuring results by using calibration services in accordance with 1) or 2) thus carry out expertly performed and traceable calibrations that are recognised through peer assessments or accreditations. This is not the case in 3a) and 3b). 3a) and 3b) should therefore only be applied if the measuring value to be calibrated cannot be established by 1) and 2).

In this case, the laboratory must ensure that there is sufficient evidence that the measuring results can be traced correctly and that the measurement uncertainty to be determined exists and has been documented. The accreditation body must check this; see Annex 1.

If the measurements cannot be traced strictly back to SI units, traceability to other suitable standards must be ensured. These may be certified reference materials or processes and/or standards based on mutual consent that have been clearly defined and agreed by all parties involved (ISO/IEC 17025:2017, Section 6.5.3). Participation in a suitable interlaboratory comparisons programme is encouraged, where possible. This process requires for one laboratory participating in a ring test to be nominated as a reference (pilot) laboratory and for this laboratory to assess and document the test results (see ISO/IEC 17043:2010).

As a rule, interlaboratory comparisons are unsuitable for tracing measuring values. They rather provide evidence of a body's competence to carry out the measurements.

- 4) ISO/IEC 17025, Section 6.5.3 only applies if the laboratory can prove that the requirements in 1) to 3) cannot be met. The laboratory is responsible for ensuring compliance with the requirements in Section 6.5.3 and for documenting the corresponding evidence. The accreditation body assesses the evidence and documentation.

**Note: Laboratory-internal calibrations**

The accredited laboratories may maintain a multi-tier calibration hierarchy for their own purposes (e.g. secondary chains) without stating the calibrations within this hierarchy in the area of application. The traceability and processes of this hierarchy must be documented and are assessed by the accreditation body, if necessary. The same applies to test bodies; see 5.1.2.

### 5.1.2 Requirements for test bodies

The requirements for calibration laboratories (ISO/IEC 17025:2017, Section 6.5) generally also apply for test laboratories and their measuring and test equipment with measuring functions, at least if the part of the uncertainty originating from the measuring equipment contributes to the overall measurement uncertainty contained in the test result.

#### Traceability requirements

The requirements stated in 5.1.1, 1) to 4) apply if the test laboratory's equipment that is to be calibrated contributes to the overall measurement uncertainty of the test result.

### 5.1.3 Requirements for medical laboratories specified in standards

The requirements for medical laboratories are specified in standard ISO 15189, Section 5.3.1.4:

The laboratory must have a documented equipment calibration process with a direct or indirect impact on the test. This process comprises:

- a) Compliance with the manufacturer's operating conditions and instructions,
- b) Recording the metrological traceability of the calibration standard and the traceable calibration of the equipment,
- c) Regular tests of the required measuring accuracy and functionality of the measuring system,
- d) Recording the calibration status and date,
- e) Ensuring that the previous calibration factors are updated correctly if the calibration requires the introduction of correction factors,
- f) Taking precautions to prevent adjustments or corruptions that may invalidate the test results.

The metrological traceability must refer to the reference materials or processes of an existing higher measuring level.

*Note:* Manufacturers of test systems may document the traceability of the calibration to the reference materials or processes of an existing higher measuring level. Such documentation is acceptable as long as the manufacturer's unmodified test system and calibration process is used.

If this is not possible or irrelevant, other means for building trust in the results must be used, including, but not limited to, the following:

- Use of certified reference materials,
- Tests or calibrations through other processes,
- Use of established standards or methods that have been mutually specified, signed and accepted by all participating parties.

#### Traceability requirements

The traceability requirement in Section 5.1.1, 4) applies in this case.

## 5.2 Calibration intervals

Accredited bodies and certified companies decide themselves which measuring and test equipment is to be calibrated as well as the intervals, purpose and measurement uncertainty.

Accredited bodies specify their own calibration intervals. They are checked by the accreditation body and expert during the assessment. They have a particular process for determining



suitable calibration intervals. The guidelines ILAC G24 *Guidelines for the determination of calibration intervals of measuring instruments* ([http://ilac.org/publications-and-resources/ilac-guidance-series/ilac\\_G24\\_2007.pdf](http://ilac.org/publications-and-resources/ilac-guidance-series/ilac_G24_2007.pdf)) and SAS 740d *Guidelines for the determination of calibration intervals of reference standards and reference instruments* provide appropriate guidance.

## 6. Reference materials

Reference materials help to significantly improve the quality of the results in a wide range of sectors such as analytical chemistry, foodstuff, environmental, biology and clinical chemistry.

Reference materials act like the reference standards for physical units (weights, lengths, capacities, etc.).

There are different types of reference materials:

- Pure substances: characterised by their purity and/or traces of impurities they contain,
- Standard solutions and gas mixtures: characterised by the combination of their ingredients (in the form of existing trace elements or main components),
- Physical-chemical reference materials: characterised by characteristic values such as viscosity, optical density or dew point,
- Reference items or artefacts: characterised by their functional features such as smell, taste, flash point, solidity, etc.

The ISO formally defines two material classes – "certified reference materials (CRM) and "reference materials" (RM). Both terms are defined in Annex 2 of this document.

The "Institute for Reference Materials and Measurements" (IRMM; <http://www.irmm.jrc.be>) in Europe and the "National Institute of Standards and Technology" (NIST; <http://www.nist.gov>) in the USA as well as domestic and foreign private providers of reference materials are important suppliers of reference materials. For more information on European supplies go to <http://www.erm-crm.org>.

Since autumn 2007, Swiss reference material providers may also have their competence formally verified in the form of an accreditation. The SAS assumes the internationally recognised process as specified by the ILAC in 2016, which is based on ISO 17034:2016 and standard ISO / IEC 17025:2017. The newly created accreditation type "certified reference materials provider" (SRMS; Swiss Reference Material Service) confirms to the accredited provider and its clients that its products and their characterisation meet the requirements of ISO 17034:2016 and standard ISO / IEC 17025:2017 and that the certificates of these providers contain the information required by ISO Guide 31.

*Note:* The terms "analysis certificate" or "conformity certificate" commonly used by non-accredited bodies never refer to certified reference materials.

Clients should therefore be careful when using reference materials of non-accredited providers and ensure that the information required for the intended use (such as traceability and measurement uncertainty) is available.

The depth required for validations or the continuous monitoring of processes depends on several factors such as client requirements, consequences of incorrect measurements and tighter specification limits on which a specification's conformity approval is based. The quality of the reference materials therefore has to be determined for each individual case.

The following are recommendations:

- **Validating the test process and estimating the measurement uncertainty :**  
It is recommended to use certified reference material whenever possible when validating a process or determining the measurement uncertainty of a process. Sufficiently characterised reference material may be enough for validations following the slight modification of existing processes.
- **Monitoring routine processes**

The use of reference material is sufficient when verifying the competent application of a standard process.

Accredited laboratories must be able to explain and justify why they have chosen to use certain reference materials. The required depth depends on the importance of the analysis and the impact of the reference material on the reliability of the final result and related measurement uncertainty .

*Note:* Additional information is contained in ISO Guides 30, 31, 33, 35 and document EA-4/14 (see Section 2).

## **6.1 Requirements for the traceability through reference materials and certified reference materials**

The standard ISO 17034 contains additional information on reference material producers. Reference material producers who meet the requirements of the standard ISO 17034 are considered to be competent.

Requirements for the traceability through reference materials providers:

- The characteristics attributed to certified reference material, which can be traced back to a national metrology institute and that is recorded in the BIPM KCDB or that can be traced back to reference material complying with ISO Guide 34, are recognised as valid traceability (see ILAC General Assembly resolution ILAC 8.12).
- The characteristics attributed to certified reference material recorded in the JCTML database are recognised as valid traceability.
- The majority of reference materials and certified reference materials are produced by other reference material providers. They may be regarded as consumables critical to the quality of the test or calibration and the laboratory must prove that the reference material or certified reference material is suitable for the intended use in accordance with ISO/IEC 17025, Section 6.6.1 or ISO 15189, Section 5.3.1.4.

## **Annex 1: Traceability requirements without taking into consideration CIPM MRA and ILAC MRA**

Traceability on the basis of 3a) and 3b) (5.1.1) ranges from NMI calibrations outside the area of applicability of the CIPM MRA and accredited laboratories that perform calibrations outside their scope to calibrations performed by non-accredited laboratories.

To ensure traceability in such cases, sufficient evidence of the professional competence of the calibration service provider must be available. As a minimum, the following points have to be taken into consideration (the figures refer to the sections of standard ISO/IEC 17025):

- Evidence of the calibration method validation (7.2.2)
- Process for determining measurement uncertainties (7.6)
- Documentation of the measurement's traceability (6.5)
- Documentation of the validity of calibration results (7.7)
- Documentation of employees' competences (6.2)
- Documentation of premises and environmental conditions (6.3)
- Audit of the calibration laboratory (6.6.2 and 8.8)

For non-accredited laboratories, it may be necessary to perform assessments of the laboratory that are similar to those an accreditation body would perform in accordance with standard ISO/IEC 17025 in order to prove competences.

Economic reasons should not be behind the assurance of traceability with the assistance of 3a) and 3b) (5.1.1). It should rather be regarded as a last resort when all other options are unavailable.

## Annex 2: Terminology

The following collection of the most commonly used terms has been taken from these documents:

- VIM, International vocabulary of metrology Dictionary, JCGM 200:2012, [http://www.bipm.org/utils/common/documents/jcgm/JCGM\\_200\\_2012.pdf](http://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf) or the identical ISO Guide 99:2007,
- ISO 9000:2015, Quality management – Fundamentals and vocabulary,
- [Measuring Instruments Ordinance](#) SR 941.210.

The information in brackets refers to VIM, issue 2, 1993.

### **Metrological (or technical) traceability, VIM 2.41 (6.10)**

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.

### **Calibration, VIM 2.39 (6.11)**

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.

### **Verification, Art. 4 e of the Measuring Instruments Ordinance**

Official test and confirmation that an individual measuring device meets legal requirements.

### **Validation, ISO 9000:2015, VIM 2.45**

Verification, where the specified requirements are adequate for an intended use.

### **Measurement standard, VIM 5.1 (6.1)**

Realization of the definition of a given quantity, with stated quantity value and associated measurement uncertainty, used as a reference.

### **National measurement standard, VIM 5.3 (6.3)**

Measurement standard recognized by national authority to serve in a state or economy as the basis for assigning quantity values to other measurement standards for the kind of quantity concerned.

*Note:* The national standards are periodically compared with one another in collaboration with the Bureau International des Poids et Mesures (BIPM).

### **Primary measurement standard, VIM 5.4 (6.4)**

Measurement standard established using a primary reference measurement procedure, or created as an artifact, chosen by convention.

The old definition was more understandable in this respect: *Standard that meets the highest metrological standards or that is largely recognised as such whose value is recognised without any reference to other standards of the same measuring value.*

### **Reference measurement standard, VIM 5.6 (6.6)**

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.

### **Working measurement standard, VIM 5.7 (6.7)**

Measurement standard that is used routinely to calibrate or verify measuring instruments or measuring systems.

### **Transfer measurement device, VIM 5.9 (6.8)**

Device used as an intermediary to compare measurement standards.

**Reference material, VIM 5.13 (6.13)**

Material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties.

**Certified reference material, VIM 5.14 (6.14)**

Reference material, accompanied by documentation issued by an authoritative body and providing one or more specified property values with associated uncertainties and traceabilities, using valid procedures.

**Measurement, VIM 2.1 (2.1)**

Process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity.

**Determination, (ISO 9000:2015, 3.11.1)**

Activity to find out one or more characteristics and their characteristic values.

**Material measure, VIM 3.6 (4.2)**

Measuring instrument reproducing or supplying, in a permanent manner during its use, quantities of one or more given kinds, each with an assigned quantity value.

**Measuring instrument (calibration or test), VIM 3.1 (4.1)**

Device used for making measurements, alone or in conjunction with one or more supplementary devices.

**Stability of a measuring instrument, VIM 4.19 (5.14)**

Property of a measuring instrument, whereby its metrological properties remain constant in time.

**Measurement accuracy, VIM 2.13 (3.5)**

Closeness of agreement between a measured quantity value and a true quantity value of a measurand.

**Measurement uncertainty, VIM 2.26 (3.9)**

Non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used.

**Annex 3: Abbreviations**

BIPM	International Bureau of Weights and Measures	<b>B</b> ureau <b>I</b> nternational des <b>P</b> oids et <b>M</b> esures
CGPM	General Conference on Weights and Measures	<b>C</b> onf�rence <b>G</b> �n�rale des <b>P</b> oids et <b>M</b> esures
CIPM	International Committee for Weights and Measures	<b>C</b> omit� <b>I</b> nternationale des <b>P</b> oids et <b>M</b> esures
CRM	<b>C</b> ertified <b>R</b> eference <b>M</b> aterial	
EA	<b>E</b> uropean Cooperation for <b>A</b> ccreditation	
EN	European standard	<b>E</b> urop�ische <b>N</b> orm
EU	<b>E</b> uropean <b>U</b> ion	
IEC	International <b>E</b> lectrotechnical <b>C</b> ommission	
ILAC	International <b>L</b> aboratory <b>A</b> ccreditation <b>C</b> ooperation	
ILC	Interlaboratory <b>C</b> omparison	
IRMM	Institute for <b>R</b> eference <b>M</b> aterials and <b>M</b> easurements	
ISO	International <b>O</b> rganisation for <b>S</b> tandardisation	
JCGM	<b>J</b> oint <b>C</b> ommittee for <b>G</b> uides in <b>M</b> etrology	
JCTML	<b>J</b> oint <b>C</b> ommittee for <b>T</b> raceability in <b>L</b> aboratory <b>M</b> edicine	
KCDB	<b>K</b> ey <b>C</b> omparison <b>D</b> ata <b>B</b> ase	
METAS	Federal Institute of <b>M</b> etrology	Institut f�d�ral de m�trologie
MLA	<b>M</b> ultilateral <b>A</b> greement for the <b>R</b> ecognition of <b>C</b> ertificates	
MRA	<b>M</b> utual <b>R</b> ecognition <b>A</b> rrangement	
MS	<b>M</b> anagement <b>S</b> ystem	
NIST	<b>N</b> ational Institute of <b>S</b> tandards and <b>T</b> echnology (US metrology institute)	
NMI	<b>N</b> ational <b>M</b> etrology Institute	
OIML	International Organisation for Legal Metrology	<b>O</b> rganisation <b>I</b> nternationale de <b>M</b> �trologie <b>L</b> �gale
RM	<b>R</b> eference <b>M</b> aterial	
SAS	<b>S</b> wiss <b>A</b> ccreditation <b>S</b> ervice	
SCS	<b>S</b> wiss <b>C</b> alibration <b>S</b> ervice	
SI	International System of Units	<b>S</b> yst�me international d'unit�s
SVS	<b>S</b> wiss <b>V</b> erification <b>S</b> ervice	
VIM	International Vocabulary of Metrology	<b>V</b> ocabulaire <b>I</b> nternational de <b>M</b> �trologie

## Annex 4: Metrological infrastructure in Switzerland

