Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

TECHNICAL COOPERATION

Expert Report

Expert Report

Quality Infrastructure Services for Renewable Energy Sources and Energy Efficiency in Latin America and the Caribbean
Project Nro 95969 / BMZ No.: 2011.2026.0

Technical Cooperation with **IAAC**
Country | region: Latin America and Caribbean
Objective: II Workshop on Traceability of Measurement Results
City | country: Santo Domingo, Dominican Republic
Duration: 03th- 04th September 2015

Reporter: Imilce Zuta
Function: Expert/No. contract 4500094549t
Date: 07th December 2015

Abbreviations | Explanation of terms used

AB	Accreditation Body
BIPM	International Bureau for Weights and Measurements
CIPM	International Committee for Weights and Measurements
CIPM MRA	Mutual Recognition Agreement of the CIPM
CMC	Calibration and Measurement Capabilities
CCs	Consultative Committees
DI	Designated Institute
GA	General Assembly
IAAC	Interamerican Accreditation Cooperation
ILAC	International Laboratory Accreditation
ISO	International Standardization Organization
IEC	International Electrotechnical Commission
KC	Key Comparison
KCDB	Key Comparison Data Base
LAC	Latin American and Caribbean Countries
LATU	Laboratorio Tecnológico del Uruguay
LSC	Laboratory SubCommittee
MWGs	Metrology (Technical) Working Group of SIM
PTB	Physikalisch-Technische Bundesanstalt
PT	Proficiency Testing
PV	Photovoltaic
QI	Quality Infrastructure
QSTF	Quality System Task Force of SIM
QMS	Quality Management System
R3E	Energy Efficiency and Renewable Energies
RM	Reference Material
RMO	Regional Metrology Organizations
SI	International System (of Units)
SIM	Sistema Interamericano de Metrología
SWH	Solar Water Heaters
TC	Technical Cooperation
WG	Working Group

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1. PRELIMINARY REMARKS

One of the elements of the project “Quality Infrastructure Services for Renewable Energy Sources and Energy Efficiency in Latin America and the Caribbean”, defined by the five partners is to strengthen elements of conformity assessment systems related to the quality assurance of solar water heaters and the energy efficiency labelling programme in household appliances. However, the conformity assessment activities are supported by measurements, which would have to be traceable.

The countries achieve the traceability in the region in different ways and in the framework of the current Traceability Policy ILAC P10 applicable for the community of Accreditation Bodies (ABs) a work-shop has been realized in 2014. In this activity some key metrological principles and the SIM approach about this Traceability Policy were presented and the different cases for fulfilling this policy by ABs was discussed in a general way.

As an output of this workshop the elaboration of a guidance for applying this policy was proposed mainly focused in key cases of the clause 5.6.2.1.1 of the ISO/IEC 17025:2005, for IAAC members taking advantage the expertise of SIM representatives which attend the workshop. So this workshop pretends to generate as a first step the discussion around the scope of the calibration laboratory and then a discussion around the fulfilment of the requirement of the ISO/IEC 17025 mentioned above, taking into account the related ILAC documents.

2. SUMMARY (IF NECESSARY, IN WORKING LANGUAGE)

Summary (if necessary, in working language)

3. OBJECTIVE

- Strengthening of the evaluation capabilities for the fulfilment of the ILAC Policy on the Traceability of Measurements Results – ILAC P10:01/2013 mainly focus in the key cases of the 5.6.2.1.1 of the ISO/IEC 17025:2005, potential guidance to be developed.
- Aim to a harmonization of the declaration of the accreditation scope for calibration laboratories.
- Present how the Quality System Task Force operates in terms of the assessment the QMS of an National Metrology Institute (NMI).
- Make known the proposals of studies and comparisons planned by some Working Groups of SIM, which includes quantities related to the traceability of energy efficiency and renewable energies to the representatives of Laboratory Accreditation Programme IAAC[1]

[1] This subject was addressed in a general which was previously coordinated with Mrs. Claudia Santo

4. IMPORTANT RESULTS OF THE EXPERT MISSION

- Capabilities strengthened in the evaluation of the fulfilment of the ILAC Policy on the Traceability of Measurements Results – ILAC P10:01/2013 mainly focus in the key cases of the 5.6.2.1.1 of the ISO/IEC 17025:2005 through the realization of some practical activities for the quantities of mass and temperature
- Task for representatives of the LSC who participate in the Workshop to develop a proposal of a draft document about how to evaluate the ILAC P10
- Discussion about the declaration of the accreditation scope for calibration laboratories, relevant information to be considered
- Explanation about how the NMIs get a new CMC.
- General knowledge about the proposals of studies and comparisons planned by some relevant Working Groups of SIM as a first information base. Potential identification of common interest and needs respect to this plan, between the NMI and the AB of each country as a first step.

4.1 GENERAL COMMENTS ON THE CURRENT SITUATION

In the workshop we had the participation of Mrs. Barbara Belzer from NIST and Mrs. Claudia Santo representative of SIM, who works in LATU as Director of Scientific and Industrial Metrology, the moderation was in charge of Mr. Warren Merkel from NIST and Mrs. Imilce Zuta from PTB. It was held in Hotel “Parque del Lago” in Santo Domingo, Dominican Republic, on 3th and 4th September 2015.

During the workshop the following blocks were addressed:

- What is happening with the SI System.
- CMC´s recognition process in the QSTF
- Declaration of the accreditation scope
- Discussion about ILAC P10-01/2013
- Next Steps

4.2 DESCRIPTION OF THE CENTRAL ACTIVITIES AND RESULTS

4.2.1 <u>What is happening with the SI System</u>

The SI System of quantities is based in seven base quantities: length, mass, time, electric current, thermodinamic temperature, amount of substance and luminous intensity.

What is happening with the international system of units?

Originally it was based on artifacts materialized units In consequence, definitions do not depend on devices, but on fundamental physical constants

Currently the “kilogram” is set by fixing the numerical value of the Planck constant to be equal exactly to 6.62606 x 10 $^{-34}$ “when it is expressed in the units $s^{-1}m^{-2}kg$, which is equal to J.s

The “kelvin” is defined in terms of an intrinsic property of water that, while being an invariant of nature, in practice depends on the purity and isotopic composition of the water used, The kelvin

would be better defined if it were liked to an exact numerical value of the Boltzmann constant "kB".

The redefinition of the mole would be linked to the value of the Avogadro Number, constant N_A would have the consequence that is no longer dependent on the definition of the current kilogram (mass of the prototype of the kilogram). Considering the new proposal for the kilogram, the mole would depend of the Planck constant "h".

4.2.2 About the CMCs recognition process for an NMI/DI (role of the QSTF)

For the recognition of a scope for an NMI they would have to have:

a) A technical peer review, which is a technical evaluation made by peer metrologists in the execution of the particular CMC they are applying.
b) Participation in a Key Comparison (KC) carried out by the CCs of the CIPM, the BIPM and the RMOs, and published and maintained in the KCDB by the BIPM. This publication validates its competence in the CMC this NMI is applying. It is also valid the NMI participates in an intercomparison with another NMI that has participated successfully in a KC as mentioned before.
c) The competence of the personnel involved in the CMC is also supported by execution of researches or technical publications related with the scope. It is also considered the participation of the personnel involved in the scope in the CCs of the BIPM or in the MWGs of SIM
d) An evaluation of the QMS of the laboratory made by qualified representatives of SIM.

About the presentation by the applicant NMI/DI in a determined scope of CMCs the content mainly address:

- General and specific structural organization for the quantities they are applying for
- Current Staff
- Adequacy of the policy and procedures
- Change of QMS (positive and negative)
- Overview of the procedures of the QMS
- Objectives defined with the corresponding goals and indicators which measure the fulfilment of the goal periodically
- Non Conformities focusing in critical findings
- Non-Conforming Work
- Customer Feedback
- Claims
- Corrective and Preventive Actions
- Improvements
- Internal Audits, it is mentioned the non-conformities and observations and the stage in which they are. Preferably it is expected they are closed.
- Peer review (QMS Peer review and Technical Peer review): What it has been assessed, results in terms of how many Major NC and Number of Recommendations.
- Vitality of CMCs. Internships, training, maintenance of technical personnel, etc.
- Significant changes about the MU and capability change
- Results of KC, Comparisons in which the NMI/DI had participated.

4.2.3. Declaration of the accreditation scope – CMC by calibration laboratories

For the declaration of the accreditation scope for a calibration laboratory (calibration activity) we could take into account the ILAC P 14, so it would include the calibration and measurement capability (CMC) expressed as:

a) Measurand or reference material
b) Calibration/measurement method
c) Calibration/measurement procedure
d) Type of instrument/material to be calibrated/measured
e) Measurement range and additional parameters where applicable
f) Measurement uncertainty

About the measurement uncertainty
The smallest measurement uncertainty that can be expected to be achieved by the laboratory which could be expressed as:

- A Single value, valid throughout the range
- A range which requires proper assumption for the interpolation to find the uncertainty at intermediate values
- An explicit function of the measurand of a parameter
- A matrix where values of the uncertainty depend on the values of the measurand and additional parameters
- A graphical form providing there is sufficient resolution on each axis to obtain at least two significant figures for the uncertainty
- No open intervals.

Note: The measurement uncertainty is expressed as the expanded uncertainty having a specific coverage probability of approximately 95% and expressed in the same unit as the measurand or in a term relative to the measurand (percent)

The laboratory would have to provide evidence that:

- The existence of the best device to be calibrated,
- The consideration of the reproducibility and repeatability, when available.

On the other hand, when reference values are provided, the uncertainty covered by the CMC should include factors related to the measurement procedure as it will be carried out on a sample, without considering the contribution from the instability and/or inhomogeneity of the material

Note:
The measurement uncertainty covered by the CMC for the reference value measurement is different from the measurement uncertainty associated to the reference material provided by a reference material producer. The expanded uncertainty of a CRM will in general be higher than the uncertainty covered by the CMC of the reference value measurement of the reference material

The related ISO/IEC 17025 requirements:

Respect to some related requirements of the ISO/IEC 17025 about the CMC are:

a) Calibrations laboratories shall report the measurement uncertainty

b) In the Calibration Report/Certificate is not intended to be used in support of further dissemination of metrological traceability
c) The calibration laboratory shall determine the measurement uncertainty and take it into account when a statement of compliance is done
d) The calibration laboratory shall retain the documentation that gives evidence of this issue.

It was given some examples in the quantities of temperature and mass.

4.2.4. ILAC P10-01/2013

The alternatives for assuring metrological traceability proposed in the policy are:

1) An NMI whose service is suitable for the intended need and is covered by the CIPM MRA. Services covered by the CIPM MRA can be viewed in Appendix C of the BIPM KCDB which includes the range and uncertainty for each listed service.
2) An accredited calibration laboratory whose service is suitable for the intended need (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 recognised by ILAC.

3a) An NMI whose service is suitable for the intended need but not covered by the CIPM MRA. In this case the accreditation body shall establish a policy to ensure that those services meet the relevant criteria for metrological traceability in ISO/IEC 17025:2005.

3b) A calibration laboratory whose service is suitable for the intended need but not covered by the ILAC Arrangement or by Regional Arrangements recognised by ILAC. In these cases the accreditation body shall establish a policy to ensure that those services meet the relevant criteria for metrological traceability in ISO/IEC 17025:2005.

As the requirement 5.6.2.1.2 of the ISO/IEC 17025: 2005 states that “there are certain calibrations that currently cannot be strictly made in SI units. In these cases calibration shall provide confidence in measurements by establishing traceability to appropriate measurement standards such as:
- the use of certified reference materials provided by a competent supplier to give a reliable physical or chemical characterization of a material;
- the use of specified methods and/or consensus standards that are clearly described and agreed by all parties concerned.
- participation in a suitable programme of inter laboratory comparisons is required where possible and its documentation shall be assessed by the accreditation body.

Other key considerations

a) Where traceability to SI units is not possible, or not relevant, then:

- Certified reference materials, agreed methods, consensus methods
- Participation in suitable inter-lab comparisons
- Examination or calibration by another procedure

- Ratio or reciprocity-type measurements
- Documentation of statements regarding reagents, procedures or examination system

b) For the traceability of the ISO 15189
In 5.6.3 of ISO 15189 it is required a programme for calibration of measuring systems and verification of trueness shall be designed and performed so as to ensure that results are traceable to SI units or by reference to a natural constant or other stated reference.

c) 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 traceability does not need to be demonstrated

Considerations for the Accreditation Body

a) When the calibration laboratory is accredited it is recommended to require the following information:
Appropriate evidence includes:
- Records of calibration method validation (5.4.5)
- Procedures for estimation of uncertainty (5.4.6)
- Documentation for traceability of measurements (5.6)
- Documentation for assuring quality of calibration results (5.9)
- Documentation for competence of staff (5.2)
- Documentation for accommodation and environmental conditions (5.3)
- Audits of the calibration laboratory (4.6.4 and 4.14)

b) When the calibration laboratory is non accredited, it may be necessary to perform a practical assessment of that lab against ISO/IEC 17025 to ensure that competent work is actually performed. For this evaluation we could take into account the criteria mentioned in a) above.

c) Learn about the economy's NMI
- Determine status with the CIPM MRA:
  (*) Signatory (Member State),
  (*) Associate (category for those States), Not yet members of the BIPM, Ability to participate in the CIPM MRA
  (*) No status
- Establish rapport
- Establish dialog with NMI technical experts

d) Provide information to the Region about:
- AB policy
- Assessor training
- Guidance/Policy documents for CABs
- Evidence of traceability pathways

e) Dissemate the Traceability Policiy to the CABs, taking into account the appropriate terminology (VIM), coordinate with the corresponding NMI

Considerations for the Evaluators

a) Read the AB traceability policy and clarify with the AB
b) Determine NMI status with the CIPM MRA

c) Use the KCDB Appendix C as guidance, take into account there could be gaps and the capabilities could have changed.
d) Look for KC, regional, intercomparisons and so on, take into account some of them could be in progress
e) Traceability pathway via another NMI / DI
f) A visit to the NMI could have sense when:
   - It is not a signatory of CIPM MRA
   - It is a signatory but CMCs not listed in the CIPM MRA, in this case, check Key and Regional Comparison status
   - It is a signatory for some but not all included
g) A visit may not be needed if traceability pathway can be established and verified and the AB provides details.

Proposals of studies and comparisons planned by some relevant Working Groups of SIM as a first information base.
The representative of SIM mentioned the Photometry and Radiometry WG is not meeting since some time ago, so there is no any planned activities about these subjects.

Potential common interest among ABs and NMIs
Despite of this, we as team have foreseen that the joint activities that could be done with the NMIs, is the organization of proficiency testing referred to the energy efficiency subjects mainly. As we had some experience in the organization of some proficiency testing in energy efficiency in refrigerators and there is a proficiency testing programme for lighting offered by NIST. See activities Number 3 and 4 of the Plan of Activities.

4.3 NEED FOR ACTION

To develop the future activities mentioned in 6.

These activities are relevant to support the specific plan of activities which is shown below. Some of these activities depends on each representative of the participant countries and those ones related to training and documentation are being coordinated with the LSC representatives in order to continue strengthening the knowledge and application of the traceability in LAC countries as support of the energy efficiency and renewable energies programmes.

Specific Plan of Activities proposed as a group among the involved people:

Nro	Activity	Responsible	When?
1	Training in ILAC P14 Note.This training could include the use of the KCDB	SIM/IAAC/PTB (I.Zuta)	2016
2	Evaluation of the Elaboration of Guidance documentation	LSC Representatives / PTB (I.Zuta)	2016

	for the evaluatos, ABs about the Traceablity subject.[2]		
3	NMIs support ABs with technical experts for perfomirng asssessments for calibration laboratories as needed	Coordination between the NMI and the AB of the economy[3]	After the workshop
4	Evaluate needs or demand for: - PT that could be organized by NMIs or - RM that could be prepared by the NMIs	Coordination between the NMI and the AB of the economy[3]	After the workshop

5. CONCLUSIONS

The discussion about the different subjects related to the ILAC P10 and the proper ILAC P10 itself facilitated and strengthened the better understanding of the implementation of the Traceability Policy in LAC countries. It is clear that its application depends on the economy and that it is relevant to take into account particular considerations for establishing an appropriate evaluation/ implementation criteria by the ABs. And in consequence it lets to the LAC countries to have a more clear view about how to evaluate this issue during the peer evaluations.

We continue working in the activities shown in the plan.

6. RECOMMENDATIONS (FUTURE ACTIVITIES, NETWORKING POTENTIAL ETC.)

What	Name	When
1.Plan of activities proposed - Training	LSC/ TSC/ I.Zuta	2016
2.Plan of activities proposed – Technical Activities	LSC[4]	2018
Coordination with IAAC about the presentation of the peer evaluation process in SIM GA and QSTF Meeting.	IAAC (V. Gandy)	November 2015 - 2016

[2] related subjects could be considered.

[3] I.Zuta, will ask about these activities to the IAAC LSC Chair and Vice-Chair,

[4] In coordination of I.Zuta

7. APPENDIX TO THE EXPERT REPORT

7.1 AGENDA

"II Workshop on Traceability of Measurement Results"

AGENDA

Thursday 3th September 2015		
Hour	**Subject**	**Lecturer / Facilitator**
09:00	Welcome	ODAC Representative
	Introduction	W. Merkel / I.Zuta
09:30	Traceability: a continuous and challenging work of all NMIs…. New SI definition. Rol of the NMIs in this process Importance of CIPM MRA. How it works at national, regional and international level. Relevant actors	C. Santo
10:30	How CIPM and SIM are working in order to improve the effectiveness of the Agreement Discussion, questions	C. Santo
11:15	Coffee break	
11:45	How are the scopes of calibration laboratories presented? Discussion in groups: How is currently being done? Is the harmonization need?	B. Belzer C. Santo
13:00	Lunch	
14:30	How is the evaluation of an NMI about the QMS and fulfillment of the ISO/IEC 17025 at regional level? Examples, questions	C. Santo
15:35	Coffee break	
16:00	Activities of some WGs of SIM Discussion. Possible areas of joint work.	C. Santo
16:30	End	

Friday 4th September 2015		
Hour	**Subject**	**Lecturer / Facilitator**
09:00	Study of the ILAC Policy on the Traceability of Measurements Results – ILAC P10:01/2013 mainly focus in the key cases of the 5.6.2.1.1 of the ISO/IEC 17025:20051 - elaboration of key elements for a corresponding guiding document; develop ideas and proposals for a possible joint action by IAAC Development of cases	B. Belzer
11:00	Coffee Break	
	Study of the ILAC Policy on the Traceability of Measurements Results – ILAC P10:01/2013 mainly focus in the key cases of the 5.6.2.1.1 of the ISO/IEC 17025:20051 - elaboration of key elements for a corresponding guiding document; develop ideas and proposals for a possible joint action by IAAC. Development of cases	B. Belzer
13:00	Lunch	
14:30	Study of the ILAC Policy on the Traceability of Measurements Results – ILAC P10:01/2013 mainly focus in the key cases of the 5.6.2.1.1 of the ISO/IEC 17025:20051 - elaboration of key elements for a corresponding guiding document; develop ideas and proposals for a possible joint action by IAAC. Presentation of cases developed and discussion	B. Belzer
15:30	Coffee break	
16:00	Outcomes Next steps	W. Merkel / I. Zuta
16:45	End	

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7.2 CONTACTS

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7.3 UPDATE OF THE OPERATIONAL PLAN (OPTIONAL)

Update of the operational plan (optional)

7.4 UPDATE OF RESULTS-BASED MONITORING (OPTIONAL)

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