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CCEM 2019 Report

from

Working Group on the SI

Barry Wood

BIPM March 28 2019

Outline

- WGSI Terms of Reference and Members
- The Revised SI
- Revised mise document and Implementation Guidelines
- Implementation Tasks
- Disbanding the WGSI

Terms of Reference

The Consultative Committee on Electricity and Magnetism formed the Working Group on the Proposed Changes to the SI (CCEM WGSI) in 2005. Since that time the working group has drafted the CCEM's recommendation EM1(2007) and its mise en pratique (2009), all in support of the proposed redefinition of the SI.

As redefinition finally approached the CCEM decided to reconstitute the WGSI focusing on the effective implementation of the revised SI and preparing for other possible changes impacting electrical metrology.

Terms of Reference

The revised Terms of Reference of the CCEM WGSI are:

- To liaise with the CIPM's SI promotion Task Group concerning the promotion and coordination of the implementation of the proposed changes to the SI,
- To liaise with the CCU, other CC's and related committees concerning the implementation of the revised SI and other changes that may occur in the future,
- To prepare guidelines for the NMIs and affected clients concerning the discontinuous change in the electrical units occurring at the time of redefinition,
- To consider and possibly revise the mise en pratique as needed,
- To continue to monitor changes in other units that may impact the electrical measurement system

WGSI Members

Chairperson:	Dr. Barry Wood	NRC
Members :	Dr. Ilya Budovsky	NMIA
	Dr. Steve Giblin	NPL
	Dr. Beat Jeckelmann	METAS
	Dr. François Piquemal	LNE
	Dr. James Olthoff	NIST
	Dr. Ian Robinson	NPL
	Dr. Uwe Siegner	PTB
	Dr. Michael Stock	CCEM Secretary
	Dr. Gert Rietveld	CEM Président

Revised Mise en Pratique

https://www.bipm.org/en/measurement-units/rev-si/

Key Documents tab

- Draft mise en pratique for the ampere and other electric units in the SI
  - Final numbers and digits

- CCEM Guidelines for Implementation of the Revised SI

Implemention Guidelines

It is advice for NMI's and clients about implementing electrical redefinition.

It considers numerical correction versus recalibration versus waiting until the next calibration cycle.

It is NOT absolutely necessary to correct all electrical values on implemention day (May 20, 2019).

Other requirements and sources of information.

This document is also guidance for QS auditors.

Implementation Guidelines 1

Update quality system and associated documents to delete references to the terms and values of the ‘1990 conventional values’.

The terms ‘von Klitzing’ constant and ‘Josephson’ constant are acceptable.

effective May 20, 2019.

Implementation Guidelines 2

Quantum standards such as Josephson voltage standards and quantum Hall resistance standards must have their reference values for $2e/h$ *and* h/e^2 *updated, i.e.*

2e/h = J_K = 483 597.848 416 984 GHz/V
h/e^2 = R_K = 25 812.807 459 3045 Ω

effective May 20, 2019.

Updating Calibration Values

Technically the values of all existing electrical calibrations will discontinuously change on May 20, 2019.

There are several acceptable options to accomplish this task.

- re-calibrate on May 20, 2019
- numerically correct existing calibration values
- continue to use the existing calibration values **if** their expanded uncertainties are sufficiently large.

Updating Calibration Values

Relative change for calibration values will be

$+1.067 \times 10^{-7}$ for voltage quantities

$+1.779 \times 10^{-8}$ for resistance quantities

-1.779×10^{-8} for capacitance quantities

$+1.956 \times 10^{-7}$ for power quantities

While all calibration values should in principal be updated effective May 20, 2019, there are some practical exceptions.

Updating Calibration Values

If the relative expanded uncertainty is greater than (2.5|d|)

2.668×10^{-7} for a voltage quantity

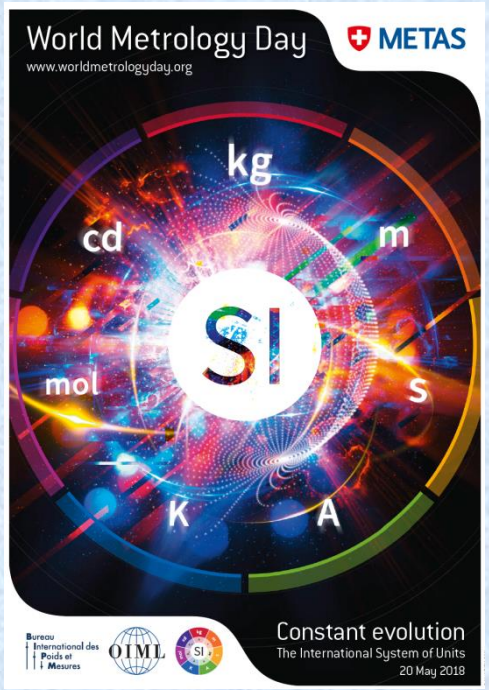
4.448×10^{-8} for a resistance quantity

4.448×10^{-8} for a capacitance quantity

4.890×10^{-7} for a power quantity

the existing calibration value can continue to be used until its next recalibration cycle.

The Revised SI Implemention Date



World Metrology Day:
May 20th, 2019

CIPM TGSI

The Task Group for the Promotion of the SI

www.bipm.org/en/measurement-units/rev-si/

BIPM are looking for images from other Laboratories for their new website. Please can you forward any to me – you will be credited for the image on the website. (Landscape in JPEG, TIF or PNG are best)

Send an email to proposal@google.com to ask them to make the google icon about measurement and the SI redefinition on the 20th May this year.

A sample email to Google

On the 20th May, the system with which we measure the world will change forever. This was agreed General Conference on Weights and Measures, in November last year, in a vote by 53 members counties. This is a truly worldwide event.

The International System of Units (SI) used worldwide structured around seven base units; the kilogram, the ampere, the metre, the second, the candela, the kelvin, and the mole.

The most significant change is the last remaining artefact – the Kilogram – is being retired and replaced by a scientific experiment based upon fundamental constants. You can find out more from the International Bureau of Weights and Measures is an intergovernmental organization who oversee matters related to measurement science and measurement standards.

The change has already received considerable publicity thought the world at the time of the vote and the 20th May – which is World Metrology Day – is the date that it comes into effect. (Metrology is the science of Measurement)

Happy to provide more detail.

Disbanding the WGSI

The Terms of reference are essentially completed.

Future re-revision of the CCEM *mise* ?

adequate for the near term

the *mise* could be expanded but it may be considered a compendium and not a *mise*

is a revision necessary in the revised SI ?

After 14 years I think that the goals of the WGSI have been achieved.

Disbanding the WGSI

To the members and contributors to the WGSI,

and with a special acknowledgement of the contributions of
Tom Witt, the original secretary of the WGSI,

Thank you!