

	COOMET Recommendation	COOMET R/GM/11:2010
	REGULATIONS for comparison of measurement standards from the national metrological institutes of COOMET	
<p><i>Approved at the 3rd meeting of Joint Committee on measurement standards Minsk, Belarus, 13 of May 2005</i></p> <p><i>Approved at the 15th COOMET Committee Meeting (Vilnius, Lithuania, September 8–9, 2005)</i></p> <p><i>Updated and amended at the 17th COOMET Committee Meeting (Minsk, Belarus, April 24-25, 2007)</i></p> <p><i>and at the 20th COOMET Committee Meeting (Astana, Kazakhstan, on April 21–22, 2010)</i></p>		

The present Regulations set the goals for comparison of measurement standards from the national metrology institutes (NMI's) of COOMET in the context of realization of the *Arrangement on Mutual Recognition of National Measurement Standards and of Calibration and Measurement Certificates Issued by National Metrology Institutes* (hereinafter referred to as Arrangement), as well as the order of their planning, organization and execution. The Regulations are based on the principles discussed in the *Guidelines for CIPM Key Comparisons* (hereinafter referred to as the CIPM Guidelines, see Appendix 1).

Alterations and additions can be made to the present Regulations at the meetings of the Joint Committee on Measurement Standards (JCMS).

1. The main terminology and definitions

National metrology institute (NMI): An NMI signatory to the Agreement.

National metrology institute of COOMET: An NMI, which has been designated by the appropriate national governmental or other official authority as that responsible for establishment, conservation and application of national measurement standards.

Comparison of measurement standards (comparison): Comparison of the unit sizes reproduced and/or maintained by two and more measurement standards.

Notes:

1. The measurement standards reproducing and/or maintaining the base SI units, derived units, multiple and submultiple units are subject to comparison.
2. Comparisons of two measurement standards are called “bilateral comparisons”.

Key comparison: One of the set of comparisons selected by a Consultative Committee to test the principal techniques and methods in the field.

CIPM key comparison: A key comparison executed by a Consultative Committee or the BIPM leading to a key comparison reference value and degrees of equivalence determination

Note:

Only the key comparisons executed by a Consultative Committee or the BIPM, result in a key comparison reference value.

Key comparison reference value: The reference value accompanied by its uncertainty resulting from a key comparison executed by the CIPM.

Degree of equivalence of a national measurement standard: The degree to which the value of a national measurement standard is consistent with the key comparison reference value. This is expressed quantitatively by the deviation from the key comparison reference value and the uncertainty of this deviation.

Note:

The degree of equivalence between two national measurement standards is expressed as the difference between their respective deviations from the key comparison reference value and the uncertainty of this difference.

COOMET key comparison: A key comparison of national measurement standards from the NMI's of COOMET resulting in the their degree of equivalence determination.

COOMET key comparison reference value: The reference value accompanied by its uncertainty resulting from a key comparison of the NMI's national measurement standards executed by COOMET.

Note:

In the COOMET key comparison the link between the COOMET and CIPM key comparison reference values is obtained by referring to the results of those NMI's that have taken part also in the CIPM key comparison.

Supplementary comparisons of COOMET: Comparisons of national measurement standards of the COOMET NMI's that are executed alongside with the key comparisons.

Note:

The aim of a supplementary comparison consists, as a rule, in supporting confidence in calibration and measurement certificates issued by some NMI's of the given RMO.

COOMET supplementary comparison reference value: The reference value accompanied by its uncertainty resulting from a supplementary comparison of the NMI national measurement standards executed by COOMET.

COOMET pilot comparison: A comparison of the NMI national measurement standards in COOMET executed before a COOMET key comparison with the purpose of preliminary estimation of possible deviations of measurement results in the COOMET key comparison.

COOMET pilot comparison reference value: The reference value accompanied by its uncertainty resulting from a pilot comparison of the NMI national measurement standards executed by COOMET.

Transfer standard: A measurement standard used for comparison of the other measurement standards that, on some reason, cannot be compared directly.

Pilot NMI: An NMI responsible for organization and performance of a comparison, as well as processing of its results.

Comparison coordinator: A member of the pilot NMI, who coordinates a comparison directly.

Calibration and measurement capabilities (CMC's): Estimation of the accuracy of calibration or measurement guaranteed by an NMI to the clients of its measurement services in the form of an expanded uncertainty of the NMI measurement results with a confidence level of 0,95. The CMC's characterize the quality of measurement services rendered to the clients on the permanent basis. The CMC data are published in the database at the BIPM web-site. (See Appendix C of the Arrangement)

2. Underlying principles

The national measurement standards of COOMET NMI's are compared in order to:

- establish the degree of equivalence of the national measurement standards;
- estimate the NMI's calibration and measurement capabilities.

Notes:

1. The participation in COOMET key comparisons is open to all COOMET NMI's, as well as the other institutes conforming to the COOMET rules (including those invited from the outside the region) and having the technical competence in a particular comparison.
2. In establishing the COOMET key comparison reference value and the degree of equivalence of the national measurement standards from the COOMET NMI's, one should take into account a possible correlation between the measurement results submitted by the COOMET NMI's, which can be explained by borrowing the unit size, similar measurement procedures and measuring equipment.
3. The comparison of the national measurement standards of the COOMET NMI's does not replace or substitute calibration of those.

2.2. The comparisons of the national measurement standards of the COOMET NMI's are subdivided into key, supplementary and pilot comparisons. The comparisons can be multilateral or bilateral.

2.3. The guidance and coordination of the COOMET comparisons, as well as composition of Appendix C to the Arrangement (NMI's calibration and measurement capabilities) on the basis of their results, are entrusted to the COOMET Technical Committees (TC's) according to the fields of measurement.

2.4. The JCMS draws up the COOMET Program of Comparisons that brings together the Programs of Comparisons according to the fields of measurement drawn up by the respective TC's.

2.5. The COOMET Program of Comparisons is to be approved by the COOMET Committee.

3. Planning of comparisons

3.1. The COOMET NMI's propose to execute comparisons according to the following order stipulated by the rules and procedures of COOMET. An NMI initiating a comparison sends a form of the respective project to a member of the COOMET Committee from its country that is to be submitted to the COOMET Secretariat (Appendix 2). The COOMET Secretariat records this proposal and sends the format to all NMIs of the COOMET member-states, as well as to the Chairman of the TC in the given field of measurement, the Working Group on comparisons and the JCMS.

3.2. The TC Chairman puts on the agenda of the next TC meeting the question about including the proposed comparison into the COOMET Program of Comparisons and its organization. By this time the TC members have to determine the opportunity and extent of participation of the NMIs from their countries in the given comparison.

3.3. At the TC meeting they discuss the urgency and possibility of executing the proposed comparison, as well as the CMC positions (according to the international classificatory) supported by its execution.

After discussion the TC:

- coordinates the COOMET theme on executing the comparison;
- takes a decision about organizing the comparison;
- gives its classification (a key, supplementary or pilot comparison);
- determines the CMC range provided by the comparison;
- establishes the list of prospective participants;
- nominates a pilot NMI from among the NMI's participating in the given comparison to draw up the technical protocol and circulation scheme of the comparison;
- nominates a coordinator of the comparison (from among the members of the pilot NMI).

3.4. Organisational and financial matters of the comparison are managed by structural and working bodies individually taking into account collateral subordination of COOMET bodies

3.5. The TC Chairman informs the JCMS Chairman, the Chairman of TC 1.1 "General Metrology" and the COOMET Secretariat about the taken decisions.

4. Registration of comparisons

4.1. A pilot NMI sends the form of the project approved by the TC to ~~a member of the COOMET Committee from its country for submission to~~ the COOMET Secretariat (See Appendix 2). The information in Box 6 in the form of the Agreed Project shall contain the following data in addition: comparison type, supported CMC, piloting NMI of the comparison, registration in the KCDB (except for the pilot ones).

4.2. The TC Chairman sends the completed form of comparison to the JCMS Chairman for introduction into the Program of Comparisons. (See Appendix 3).

4.3. The pilot NMI (coordinator) registers the key comparison in Appendix B of the Arrangement by means of interactive forms on the BIPM web-site “JCRB/Open-access documents/guideline for comparisons” at the address:

<http://www1.bipm.org/en/committees/jc/jcrb/documents.html>. Direct access is possible (see Appendixes 4, 5a) for key comparisons:

http://www1.bipm.org/utills/common/documents/jcrb/key_comp_flowchart.pdf

- for subsequent bilateral (see Appendixes 4, 5B)

http://www1.bipm.org/utills/common/documents/jcrb/subsequent_bilaterals.pdf

4.4 The TC Chairman registers the supplementary comparison in Appendix B of the Arrangement by means of interactive forms on the BIPM web-site “JCRB/Open-access documents/guideline for comparisons” at the address:

<http://www1.bipm.org/en/committees/jc/jcrb/documents.html>.

Direct access is possible (see Appendixes 4,5b) for supplementary comparisons:

http://www1.bipm.org/utills/common/documents/jcrb/suppl_comp_flowchart.pdf.

4.5 The Stages of comparisons must be registered in proper time in Appendix B and the COOMET Program of Comparisons.

5. Organization of comparisons

5.1. A pilot NMI has to take decisions on all the cases listed in clause 5 of the CIPM Guidelines, namely:

- to make a list of participants in a comparison, including the full information about their mailing addresses and e-mails;
- to select a transfer standard (standards);
- to determine the urgency of a pilot comparison or preliminary study of the transfer standard characteristics;
- to choose the scheme of the comparison* ;
- to set a date for beginning the comparison, a detailed schedule of work, conveying equipment and traffic roads for transporting each transfer standard;
- to determine the necessary actions in case of a breakdown of the transfer standard, or if one of the participating NMI’s fails to do the work in the due course.

5.2. The NMI’s participating in a comparison are responsible for transporting a transfer standard to the next participant in accordance with the accepted outline of the comparison within the terms specified in the schedule of comparisons. In these terms are frustrated, the pilot NMI responsible for circulation of the transfer standard, has to revise the schedule of comparisons and to inform the participants of the comparison about that.

5.3. The pilot NMI sends the technical protocol and circulation scheme of comparisons directly to the participating NMI’s and the COOMET Secretariat.

5.4. The coordinator of the comparison has to inform periodically (once in a half a year) the Chairmen of the TC and JCMS about the progress in the comparison. The JCMS Chairman enters the current information in the database of the Program of Comparisons.

5.5. In the case of the unfounded stopping of the comparison the TC Chairman includes suggestion to exclude the comparison form the COOMET Program of Comparisons and KCDB BIPM. The COOMET Committee Member of the country which represents the pilot NMI should be informed via the COOMET Secretary.

6. Technical protocol of a comparison

* The outline of the comparison can be of different character: circulation of one transfer standard to all participating NMI’s; sending an individual measurement standard from a pilot NMI to each participating NMI, or vice versa; some combination of these variants; etc.

6.1. The technical protocol of comparisons must contain a detailed description of the comparison procedure. It includes:

- detailed description of measuring instruments: model, type, serial number, dimensions, mass, packing, etc., as well as specifications required for their operation;
- recommendations for handling a transfer standard, including its unpacking, subsequent packing and sending to the next participant (including the full list of the packed content, mass and size of the package, instructions, etc.);
- procedure of unpacking of the transfer standard at the NMI;
- testing to be performed before measurement;
- service conditions of the transfer standard during measurement;
- presentation form of measurement results;
- measurement procedure (for the measurement standards realizing the dependent reproduction, it is necessary to indicate the country which national measurement standard has provided the size of the unit, and the link between this measurement standard and that of the participant in the comparison);
- list of the main components of a measurement uncertainty that are to be evaluated by each participant in the comparison (the participating NMI's can add here some other components, which they think to be significant), recommendations for evaluation of the uncertainty, as well as covariance matrix of measurement results;
- measurement results must be submitted to the pilot NMI not later than one month after completing the measurements in the laboratory.

6.2. The technical protocol of the comparison is worked out by the pilot NMI. An opportunity is envisaged to consult on this matter with the Chairmen of the COOMET TC and the CIPM CC in this field of measurement or its working group.

The technical protocol of the key comparison is coordinated with the respective CIPM CC. (See clause 4 and Appendix 4, Appendix 5a, 5b.) The approved technical protocol is sent out to the Chairmen of the respective TC and TC 1.1.

6.3 Recommended template of the technical protocol is given in the Appendix 6.

7. Preparation of the report of comparisons

7.1. A pilot NMI has the prime responsibility for preparation of the report of comparisons.

7.2. Measurement results submitted to the pilot NMI are not divulged until all participants send their measurement results. The measurement result is not considered to be full without indicating the uncertainty and all its components.

7.3. The pilot NMI analyzes the comparison results. If the data of some participating NMI diverge essentially, the pilot NMI informs it about that and suggests the results should be checked for the presence of statistical treatment errors. If this check does not detect the error, the measurement results of this participant are left unchanged.

7.4. The pilot NMI (or the working group if it has been organized) prepares a preliminary report (Report A) of comparisons and sends it out to the participants of the comparisons and TC 1.1 for discussion and comments. The Report A contains the results of the participants and their total standard uncertainties. The Report A can be drawn up, if necessary, together with the respective CIPM CC. (See clause 4 and Appendix 4, Appendix 5a and 5 b). The Report A is confidential for the participants of the comparisons.

7.5. The pilot NMI draws up and sends out the final report (Report B) to the participants of the comparisons taking into consideration their comments and suggestions.

7.6. The report must contain an algorithm for treatment of the data submitted by the participants of the comparisons. In addition, the report of key comparisons presents an algorithm of the link with the CIPM key comparison reference value, sets the degree of equivalence for each measurement standard of the participant of the comparison, as well as the way of approval of the claimed CMC's.

The report of supplementary comparisons gives a data treatment algorithm and the way of approval of the claimed CMC's. And finally, the report of pilot comparisons analyzes the claimed estimates of uncertainty components and the actual level of reproducibility of the measurement results in the NMI's participating in the comparisons.

7.7. The Report B could be undergone an expertise in TC 1.1(if it is necessary), whereupon it is approved at the meeting of a TC on the respective field of measurement taking into account the conclusion of TC 1.1.

7.8. On approving the Report B, the TC Chairman sends it to the BIPM. The BIPM Committees that receive the given report (Their addresses are found using the interactive forms presented at the page JCRB/Open-access documents/guideline for comparisons of the BIPM web-site by the e-mail: <http://www.bipm.org/en/committees/jc/jcrb/documents.html> (Appendix 5a, 5b, 5c)). The report is also forwarded to the JCMS Chairman to be included in the database of the COOMET Program of Comparisons.

The pilot NMI sends a brief form of the final report (see Appendix 2) to the COOMET Secretariat.

7.9. On approving the final report and its approbation by the working group of the CIPM CC, the comparison results are published in the corresponding journals. After the publication they can be used in other articles or oral contributions.

7.8. Final report of the comparisons from KCDB is automatically published in the Metrologia Technical Supplement

7.9 In accordance with KCDB and the Metrologia Technical Supplement rules the final report should be in pdf format and contain a short abstract

7.10 Recommended template of the report is given in the Appendix 7

Appendices:

1. Guidelines for CIPM key comparisons;
2. Extract from the COOMET Rules and Procedures "Guidelines for filling in the forms";
3. Form of comparison registration in the COOMET Program of comparisons and calibrations (It is going to be presented later by VNIIFTRI.);
4. Form of comparison registration at the BIPM;
- 5a. Process of execution and registration of RMO supplementary comparisons;
- 5b. Process of execution and registration of key comparisons.
- 5.c Process for subsequent bilateral key comparisons
6. Recommended template of the Technical Protocol
7. Recommended template of the report

Appendix 7

RECOMMENDED TEMPLATE OF THE COMPARISON REPORT (examples of fonts are given, use double space)

TYPE OF REPORT (A,B or FINAL)

KCDB BIPM ID No (COOMET PROJECT No)

NAME

Author list ^{a, b, c....)}

*a) Full name of institution (акроним), state, town - corresponding author e-mail
(coordinator of the comparison)*

b) Full name of institution (акроним), state, town (participants of the comparison)

.....

Abstract.

Text

1 .Inroduction

2. Partisipants

№	NMI	Mail address for the traveling standard sending	NMI acronym	Contact person	e-mail, phone fax
1					
2					
3					

3. Comparison fulfillment

Scheme of the comparison

The item should describe:

- Comparison technique (circulation of one transfer standard to all participating NMI's; sending an individual measurement standard from a pilot NMI to each participating NMI, or vice versa; some combination of these variants; etc;

- timetable;

Transfer standard

The item should describe:

- Name of the measuring device
- Type
- Model
- Serial number
- Dimension
- Weight
- Packing description
- Technical details unnecessary for usage
- Photo (if necessary)

Packing and unpacking

The item should describe:

- The list of the package content;
- Weight and dimensions of package;
- Description of the unpacking procedure;
- Description of the packing procedure for sending to the next participant

3. Measurement procedure

The item should describe:

- Descriptions of the mesurand, measurement conditions, devices;
- Requirements to the measuring procedure which should be accounted in the participants reports;
- testing to be performed before measurement;
- service conditions of the transfer standard during measurement;.
- Agreed equation of the measurement (if necessary)y;
- In the case of the applying own measurement procedures by the participants, they description should be done

4. Results of the comparison

The item should describe:

- Results of the participants measurements results and their total standard uncertainties
- Uncertainties budgets of the participants measurements results:

Standard uncertainty, Bq/g	A	B
Contribution due to		
Combined uncertainty (Quadratic summation)		
Total combined standard uncertainty		
Expanded uncertainty (k=2)		
Level of confidence		

5. Data evaluation

4. Evaluation of the results of comparisons

The item should contain the next information:

- Algorithm of the evaluation of the data sent by the participants
- For the key comparisons the next points should be given:
 - Linking technique to the KCRV,
 - The equivalences degrees for each participated standard,
 - The method of CMCs supporting;
- For the supplementary comparisons the next points should be given:
 - Algorithm of the data evaluation,
 - The method of CMCs supporting
- For the pilot studies the next points should be given:
 - Algorithm of the data evaluation,
 - Analysis of the declared uncertainty budget components;
 - The data consistency