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BSI Standards Publication

Guidance on how to conduct Round Robin Tests

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Guidance on how to conduct Round Robin Tests

Guide de conduite des essais Round Robin

Leitfaden zur Durchführung von Ringversuchen

This Technical Report was approved by CENELEC on 2014-01-24.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (CLC/TR 50619:2014) has been prepared by CLC/TC TC59X "Performance of household and similar electrical appliances".

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Introduction

It is the responsibility of each standardisation committee under TC 59X to establish the repeatability and reproducibility of the measurement standards developed.

Results from inter-laboratory comparisons are important for

a) identification of interlaboratory differences;

b) establishment of the effectiveness and comparability of test or measurement methods;

c) validation of uncertainties;

d) evaluation of the performance of laboratories for specific tests or measurements and monitoring laboratories' continuing performance;

e) identification of problems in laboratories and initiation of actions for improvement which, for example, may be related to inadequate test or measurement procedures, effectiveness of staff training and supervision, or calibration of equipment; and

f) education of participating laboratories based on the outcomes of such comparisons.

The need for ongoing confidence in laboratory performance is not only essential for laboratories and their contractors but also for other interested parties, such as regulators, laboratory accreditation bodies and other organisations that specify requirements for laboratories. EN ISO/IEC 17011 requires accreditation bodies to take account of laboratories' participation and performance in proficiency testing.

With this respect round robin testing was widely made in the past by TC59X for development of measurement procedures on purpose of EU regulatory measures on Labeling and Ecodesign. Round robin test results have been widely taken into account in the establishment of regulations, in defining tolerance levels for verification of declared values and/or limits.

This Technical Report is intended to provide a consistent basis for performing round robin testing. It gives guidance to all interested parties to determine the competence among each other. It provides common ground for reliable statistical data (repeatability and reproducibility levels, etc.) as needed for regulation purposes (like for Labeling and Ecodesign).

1 Scope

This Technical Report provides guidance for carrying out round robin tests (RRT) and hence for the determination of levels of repeatability (intra-laboratory variability) and reproducibility (inter-laboratory variability).

This Technical Report can also be used to verify the measurement methods, to improve the measurement method, and to qualify laboratories.

It is not applicable for the determination of production variation for a particular product.

General advice on proficiency testing of laboratories is given in EN 17043. This Technical Report can be used in addition to this document.

NOTE The repeatability and reproducibility levels are important factors for the establishment of uncertainty margins of the measurement methods and for the definition of tolerances levels in verification schemes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies..

EN ISO/IEC 17043:2010, *Conformity assessment — General requirements for proficiency testing (ISO/IEC 17043)*

IEC/TR 61923, *Household electrical appliances — Method of measuring performance — Assessment of repeatability and reproducibility*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO/IEC 17043:2010 and the following apply.

3.1
contracting body
organisation or individual for which a round robin testing is provided through a contractual arrangement

[SOURCE: EN ISO/IEC 17043:2010, definition 3.3, modified]

3.2
repeatability
precision under repeatability conditions

Note1 to entry: Repeatability includes the variability of the appliance under test.

[SOURCE: ISO 3534-1, definition 3.15]

3.3
reproducibility
precision under reproducibility conditions

Note 1 to entry: Reproducibility includes repeatability

[SOURCE: ISO 3534-1, definition 3.20]

3.4
round robin testing
process in which one or more items is tested according to a specific protocol by a number of different laboratories

Note 1 to entry: It is the intention to derive levels of repeatability and reproducibility and hence making classifications of laboratories.

Note 2 to entry: An alternative term is “ring testing”. The term “proficiency testing” is more general as covers other aspects than derivation of repeatability and reproducibility values [SOURCE: EN ISO/IEC 17043:2010, definition 3.7].

Note 3 to entry: It may be used for the evaluation of laboratory performance against pre-established criteria.

4 Process and responsibilities

4.1 Process

4.1.1 Product to be tested

The product category to be tested should be clearly specified and one or more representative products should be selected. If only one product is selected, it should be representative in the sense that it reflects the typical behaviour and performance of the defined product category. It is recommended that two or more products be tested in order to get an indication on the measurement uncertainty across the range of performance that is likely to be encountered in the market. (For example, one product with high and one with low energy/water consumption or performance).

The products to be used for the RRT can be selected either by pre-testing, pre-selection or special production.

Additional sample(s) should be put aside as replacements in case any RRT samples are damaged.

NOTE It may be appropriate to circulate key items of test equipment or other test objects together with the RRT samples.

4.1.2 Parameters to be tested

The parameters to be tested should be clearly defined.

Usually the full parameter set of a measurement procedure should be covered (e.g. parameters as set out in EN 60456 washing machine like washing performance, consumption values, time, rinsing efficiency. Noise may be seen as a different measurement procedure).

If repeatability and reproducibility of the measurement standard are to be assessed, all additional materials used for the testing should be as defined in the measurement procedure, and should not be specially selected. (Examples of such materials in the case of washing machine tests would include test swatches, soils and detergent).

If it is considered likely that the reproducibility of results could be affected by batch-to-batch variability within given tolerances of the test material this can form part of the RRT. In this case, different batches of material would need to be included in the test design of the RRT.

4.1.3 Measurement procedure

The measurement procedure(s) to be used for testing should be clearly defined. Preferably RRTs should be based on published EN standards. For RRTs supporting standardisation work it may be necessary to use working papers like prEN or even DC documents as the measurement procedure. Alternatively, national, international and/or industrial standards may be used and where necessary, combinations of more than one measurement method can be used. It is essential therefore that clear instructions are given on which version of a measurement standard the RRT is based. If deviations between the standard used for the RRT and a later published standard exist, care shall be taken in interpretation of the results of the RRT in relation to the final published standard.

4.1.4 RRT procedure

The RRT procedure is based on sending one or more products to different laboratories to be tested according to the defined measurement procedure(s). Therefore, the same sample of the product(s) shall be forwarded from laboratory to laboratory (serial procedure).

Care should be taken to ensure no damage or change (e.g. aging) occurs to the product during this process. Damage can be limited by ensuring the sample is properly packaged and that it is transported from laboratory to laboratory by a carrier with a proven track record of transporting delicate items.

The aging effect may be reduced using the parallel procedure described below but in any case, the extent of any aging should wherever possible be determined by re-testing the same product again in the first laboratory after it has gone through all the testing in the other laboratories.

As a second best alternative, more than one sample of the product selected is sent in parallel to the laboratories (parallel procedure). In this case, before the RRT begins, it should be demonstrated that all samples show similar behaviour under test. Again, the samples should wherever possible, be re-tested by the same laboratory at the end of the RRT to check for any change in behaviour under test.

For calculating reliable figures of the repeatability and reproducibility, a minimum of five laboratories should participate in an RRT. If more than 10 laboratories take part in an RRT, a parallel procedure combined with a serial procedure may be advisable for time reasons (e.g. samples showing similar behaviour are each sent to five laboratories).

4.2 Responsibilities

4.2.1 Contracting body

The body(ies) which is (are) running and/or financing the RRT should operate in a transparent manner towards all involved parties.

The contracting body should appoint an individual or a team to coordinate the RRT.

4.2.2 Coordinator

The coordinator should be on call throughout the testing phase.

If only one person is coordinating the RRT he/she should be neutral and independent. For example, they should not be employed by a product manufacturer or a test house involved in the RRT.

NOTE Deviations from this rule may be necessary in individual cases.

Any deviations from the recommendations of this document should be documented by the coordinator and included in the final internal report.

4.2.3 Subcontractor

Subcontractors (collaborators) in RRT should inform the coordinator regularly about the progress. The coordinator should be informed about unforeseeable proceedings without any delay.

4.2.4 Financing of RRT

The coordinator should establish and agree with the contracting body the financing of the RRT. All costs (e.g. coordinator, subcontractor, product samples to be tested, logistics, test materials, testing) for the RRT are to be defined and agreed before recruiting participant laboratories.

5 Testing laboratories

5.1 Potential laboratories

A list of potential laboratories should be prepared by the coordinator, in consultation with the contractor and relevant standardisation bodies.

5.2 Announcement

5.2.1 General

The round robin test should be announced publically together with the qualification criteria as defined in document “Qualification of laboratories for verification procedures” (e.g. tender procedure, TC59X-working group procedure) so that all laboratories that might be interested have the chance to apply to take part in the RRT.

NOTE Potential laboratories may be contacted directly.

5.2.2 Questionnaire

The announcement should be accompanied by a questionnaire where the general qualification of the laboratory (equipment, experience, certification, qualification) should be assessed. The laboratories are asked to answer within a fixed time frame.

If there are minimum qualification criteria given to take part in the RRT interested labs have to confirm fulfilling these qualification criteria as well as their agreement to the financial conditions. (See also Clause 8)

5.2.3 Assessment of selection of laboratories

An assessment scheme for selecting the laboratories including a defined scoring and minimum requirements for selecting a laboratory should be defined by the organisers before the announcement is sent out.

5.3 Selection of laboratories

All laboratories which comply with the minimum requirements and which have confirmed their interest should be allowed to take part in the RRT. If, for practical reasons, participation has to be limited, those laboratories should be chosen which have got the highest ranking according to the replies on their questionnaire. If laboratories express their interest to participate, but do not fulfil some minimum requirements, they may take part in the RRT as a learning exercise, but their test results should not be included in the final evaluation. They may be also excluded from any financial benefits.

5.4 Final list of laboratories

Based on the result of the assessment, the coordinator prepares a list of laboratories which are to participate in the RRT. In consultation with the laboratories the coordinator establishes a sequence of testing and a timescale so that each laboratory knows when it will receive the RRT samples and when it will have to forward the samples to the next participating laboratory.

6 Transportation of the product

6.1 Logistics

The coordinator may contract a specialist company to transport the RRT samples from laboratory to laboratory.

Alternatively once a laboratory has concluded the test, the product will be sent to the next one by this laboratory.

Whatever logistical system is used, it should be emphasised that special care in handling the samples is essential to avoid compromising their performance**.**

6.2 Packaging

Special care shall be taken with packaging in order to reduce the chance of damage during the transportation. At least the same protection level as given by the packaging of normal production shall be ensured, e.g. by using the same packaging material.

It is recommended to make use of robust wooden boxes. The appliances could be fixed inside the box by the use of soft corner elements (e.g. polystyrene).

7 Test

7.1 Execution of test

Laboratories should execute the test in accordance with the measurement procedure. They should inform the coordinator immediately if any problems arise.

The coordinator should provide a format in which the test results should be reported.

7.2 Laboratory visit

The coordinator should visit each laboratory while RRT testing is in progress. During the visit the following should be checked or verified:

- data given in the questionnaire, especially regarding the test equipment;
- calibration procedure documents relating to the test equipment;
- personal qualifications of persons involved in testing;
- compliance with the measurement procedure as specified for the RRT; and
- laboratory qualification or accreditation.

7.3 Transmission of result

Once a laboratory has concluded their tests, they send their measurement results to the coordinator. The coordinator stores the results in an anonymous form. At this stage, the coordinator should conduct a preliminary analysis of the results to assess the consistency of the data. If inconsistencies are encountered these may be resolved through discussion with the laboratory concerned. The other participants should not be informed about the results at this stage.

8 Analysis, report and termination

8.1 Analysis

The coordinator or a subcontractor analyses the results following IEC/TR 61923.

Special care should be taken on handling of outliers. Obvious outliers may be corrected (e.g. typing errors) after consultation with the laboratory concerned. When no clear reason can be assigned to an outlier result, it should be kept in the data files. Final evaluation should be done with and without outlying results.

8.2 Report

8.2.1 Draft report

A draft internal report should be prepared by the coordinator. The draft internal report should include the items described in 8.2.2. This report should be disseminated to all participating laboratories. The laboratories should be given the opportunity to respond to the draft report.

After this, the coordinator prepares the final internal report incorporating the feedback from the laboratories and disseminates it to all participating laboratories.

8.2.2 Content of the internal report

The report should include:

- results from individual laboratories (made anonymous if appropriate);
- discussion of outliers (if needed);
- standard deviations for each parameter (with and without outliers);
- repeatability and reproducibility levels for each parameter (with and without outliers);
- learning on possible or necessary improvements of standard.

8.3 Termination and publication of final external report

The coordinator should submit a statement to all participants informing them that the RRT has been completed.

Elementary results should be made available for third party scrutiny at least in an anonymous way at least within CLC/TC59X. RRT data should not be made available to other non-participating parties without the agreement of all participating parties. It is helpful if the coordinator obtains agreement from the participants for this kind of disclosure before starting the RRT.

The final external report should be made public with only general results included so that competitive and sensitive information is not disclosed. The coordinator should report the results to the relevant technical committee of CLC/TC59X.

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