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Edition 2.0 2013-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electroacoustics – Sound level meters – Part 3: Periodic tests

Electroacoustique – Sonomètres – Partie 3: Essais périodiques

IEC 61672-3:2013

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ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 3: Periodic tests

FOREWORD

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International Standard IEC 61672-3 has been prepared by IEC technical committee 29: Electroacoustics, in cooperation with the International Organization of Legal Metrology (OIML).

This second edition cancels and replaces the first edition published in 2006. This second edition constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

In this second edition, conformance to specifications is demonstrated when:

a) measured deviations from design goals do not exceed the applicable acceptance limits, and
b) the uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty, with both uncertainties determined for a coverage probability of 95 %.

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The text of this second edition is based on that of the first edition and the following documents:

FDIS	Report on voting
29/814/FDIS	29/825/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61672 series, published under the general title *Electroacoustics – Sound level meters*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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- amended.

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ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 3: Periodic tests

1 Scope

This second edition of IEC 61672-3 describes procedures for periodic testing of time-weighting, integrating-averaging, and integrating sound level meters that were designed to conform to the class 1 or class 2 specifications of the second edition of IEC 61672-1. The aim of the standard is to ensure that periodic testing is performed in a consistent manner by all laboratories.

NOTE 1 In this document, references to IEC 61672-1, IEC 61672-2, and IEC 61672-3 refer to the second editions unless stated otherwise.

NOTE 2 Procedures for the periodic testing of sound level meters designed to conform to the specifications of IEC 61672-1:2002 were given in IEC 61672-3:2006.

The purpose of periodic testing is to assure the user that the performance of a sound level meter conforms to the applicable specifications of IEC 61672-1 for a limited set of key tests and for the environmental conditions under which the tests were performed.

The extent of the tests in this part of IEC 61672 is deliberately restricted to the minimum considered necessary for periodic tests.

Periodic tests described in this edition of IEC 61672-3 apply to sound level meters for which the manufacturer claims conformance to the specifications of the second edition of IEC 61672-1. Periodic tests described in this part of IEC 61672 apply to sound level meters for which the model has been, or has not been, pattern approved by an independent testing organization responsible for pattern approvals in accordance with the test procedures of the second edition of IEC 61672-2.

Because of the limited extent of the periodic tests, if evidence of pattern approval is not publicly available, no general conclusion about conformance to the specifications of IEC 61672-1 can be made, even if the results of the periodic tests conform to all applicable requirements of this edition of IEC 61672-3.

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.

IEC 60942, *Electroacoustics – Sound calibrators*

IEC 61094-5, *Measurement microphones – Part 5: Methods for pressure calibration of working standard microphones by comparison*

IEC 61094-6, *Measurement microphones – Part 6: Electrostatic actuators for determination of frequency response*

IEC 61183, *Electroacoustics – Random-incidence and diffuse-field calibration of sound level meters*

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IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 61672-2, *Electroacoustics – Sound level meters – Part 2: Pattern evaluation tests*

IEC 62585, *Electroacoustics – Methods to determine corrections to obtain the free-field response of a sound level meter*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

3 Submission for testing

3.1 An instruction manual applicable to the model and version of the sound level meter shall be available in order to perform periodic tests of a sound level meter. If an applicable Instruction Manual is not submitted along with the sound level meter, nor available at the laboratory, nor publicly accessible from the Internet web site of the manufacturer or supplier of the sound level meter, then no periodic tests shall be performed.

3.2 The source for the instruction manual shall be described in the documentation for the periodic tests.

3.3 All items or accessories for the sound level meter that are necessary for periodic testing shall accompany the sound level meter when it is submitted for testing. A device specified in the instruction manual for inserting electrical signals equivalent to signals from the microphone shall also be submitted if requested by the laboratory.

3.4 Periodic tests as described in this part of IEC 61672 shall not be performed unless the markings on the sound level meter are as required by IEC 61672-1 or there is evidence that the sound level meter was originally so marked. The serial number and the model designation shall be visible on the sound level meter.

3.5 Data required to perform the periodic tests shall be available and the source of the data shall be recorded and reported by the laboratory. The data shall include all relevant information required by IEC 61672-1 and IEC 62585.

3.6 A sound calibrator shall be available. The sound calibrator shall be supplied with the sound level meter, if required by the user or if requested by the laboratory, or shall be supplied by the laboratory. If a suitable sound calibrator is supplied by the user, it shall be used by the laboratory to establish the acoustical sensitivity of the sound level meter.

4 Conformance

4.1 Conformance to a performance specification is demonstrated when the following criteria are both satisfied: (a) a measured deviation from a design goal does not exceed the applicable acceptance limit and (b) the corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in IEC 61672-1 for the same coverage probability of 95 %. IEC 61672-1 gives example assessments of conformance using these criteria.

4.2 For laboratories performing periodic tests, the uncertainties associated with all measurements shall be determined in accordance with the procedures of ISO/IEC Guide 98-3. Metrological terms shall be as defined in ISO/IEC Guide 99. Actual measurement uncertainties shall be calculated for a coverage probability of 95 %. Calculation of the uncertainty of

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measurement for a particular test should consider at least the following components, as applicable. Other uncertainty components are noted in Clauses 7, 12, and 13.

– The uncertainty attributed to calibration of the individual instruments and equipment used to perform the test, including the sound calibrator and any free-field facility;
– The uncertainty resulting from environmental effects or adjustments;
– The uncertainty resulting from small errors that may be present in the applied signals;
– The uncertainty attributed to effects associated with the repeatability of the results of the measurements. When a laboratory is only required to make a single measurement, it is necessary for the laboratory to make an estimate of the contribution of random effects to the total uncertainty. The estimate should be determined from an evaluation of several measurement results previously obtained for a similar sound level meter;
– The uncertainty associated with the resolution of the display device of the sound level meter under test. For digital display devices that indicate signal levels with a resolution of 0,1 dB, the uncertainty component should be taken as a rectangular distribution with semi-range of 0,05 dB;
– The uncertainty associated with the device used to mount the sound level meter in the free-field test facility;
– The uncertainty resulting from the deviation of the sound field in the free-field test facility from an ideal free sound field; and
– The uncertainty associated with each correction applied to the measurement data.

4.3 If an actual uncertainty of measurement for a test performed by the laboratory exceeds the corresponding maximum-permitted uncertainty, the result of the test shall not be used to evaluate conformance to this part of IEC 61672 for periodic testing.

4.4 A laboratory's actual uncertainty, without inclusion of the uncertainty of the manufacturer's free-field or random-incidence correction data, shall not exceed the corresponding maximum-permitted uncertainty from IEC 61672-1. However, when the uncertainty of the manufacturer's correction data is included it is possible that an actual uncertainty of measurement may exceed the corresponding maximum-permitted uncertainty only because the uncertainty of the manufacturer's correction data was a significant part of the laboratory's uncertainty budget. In this event, testing may proceed, but the documentation for the periodic tests shall include a statement to explain the reasons that the results of a test did not conform to a specification of IEC 61672-1.

5 Preliminary inspection

Prior to any measurements, the sound level meter and all accessories shall be visually inspected, paying particular attention to damage to, or accumulation of foreign material on, the protection grid or diaphragm of the microphone. All relevant controls shall be operated to ensure that they are in working order. If the controls, display, and other essential elements are not in proper working order, no periodic tests shall be performed.

6 Power supply

For all tests, the sound level meter shall be powered from its preferred supply or a suitable alternative. Before and after conducting the set of tests with acoustical signals and before and after conducting the set of tests with electrical signals, the power supply for the sound level meter shall be checked by the method stated in the Instruction Manual to ensure that it is within the specified operating limits. If the voltage or the equivalent indication of the status of the power supply is not within the operating limits and the reason cannot be attributed to partially discharged batteries or an incorrect selection of the voltage of the public power supply, then no periodic tests shall be performed as a malfunction is indicated.

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NOTE Changes to the output of the power supply can be determined as changes to the percentage of the voltage from fully-charged batteries, or by an equivalent procedure.

7 Environmental conditions

7.1 Periodic tests shall be performed within the following ranges of environmental conditions: 80 kPa to 105 kPa for static air pressure, 20 °C to 26 °C for air temperature, and 25 % to 70 % for relative humidity.

7.2 As a minimum, the static air pressure, air temperature, and relative humidity shall be measured and recorded at the start and end of periodic testing.

7.3 Unless data are available for the influence on the model of a sound level meter of the deviations in the prevailing environmental conditions from the reference environmental conditions, for periodic tests of frequency weightings conducted at a static pressure less than 97 kPa, the laboratory shall assign a standard uncertainty of 0,09 dB for measurements at frequencies less than or equal to 3 kHz and a standard uncertainty of 0,14 dB for measurements at frequencies greater than 3 kHz.

NOTE The two standard uncertainties are for use when values for the standard uncertainties are not available from the potential sources listed in 12.6. The two values were determined from estimates of 0,15 dB and 0,25 dB respectively for the maximum influence of static pressure on frequency response for models of microphones that have the greatest air stiffness in the back cavity.

8 General test requirements

8.1 Periodic tests described in subsequent clauses apply only for those design features that are required by IEC 61672-1 and that are available in the sound level meter submitted for test. All such features shall be tested.

8.2 For all periodic tests, the configuration of the sound level meter shall be as requested by the user and shall be as specified in the Instruction Manual for one of the normal modes of operation, including all required accessories. For a sound level meter that provides selectable settings for corrections to the relative frequency response for the influence of any accessories or for other configurations of the sound level meter, the tests shall be performed using the settings that are appropriate for the configuration of the sound level meter in its normal mode of operation. Any such settings shall remain unchanged throughout the testing.

8.3 Electrical signals shall be inserted into the sound level meter through the input device or by the means specified in the Instruction Manual. The deviation of the frequency of an input signal from a specified frequency shall not exceed ±0,25 % of the specified frequency.

8.4 For a sound level meter that has an electrical output that is to be used for periodic tests, the indications obtained from the electrical output and the corresponding indications on the display device of the sound level meter shall be confirmed to be identical within the acceptance limits given in IEC 61672-1. Where multiple outputs are present, if an output is specified in the Instruction Manual for testing, that output shall be used for periodic testing.

8.5 The laboratory shall use instruments that have been calibrated for the appropriate quantities at appropriate intervals. As required, the calibrations shall be traceable to national standards.

9 Sound calibrator

9.1 General

The sound calibrator shall preferably be a model specified in the Instruction Manual for use with the sound level meter, or alternatively a sound calibrator producing the same nominal

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sound pressure level and frequency as a model specified in the Instruction Manual. In the latter case, any adjustments to be applied when that model of calibrator is coupled to the model of microphone supplied on the sound level meter shall use publicly available data from either the manufacturer of the sound level meter or the manufacturer of the sound calibrator.

NOTE It is possible that publicly available data for a model of sound calibrator that is not specified in the Instruction Manual has not been verified according to IEC 61672-2.

9.2 Information for operation

Any adaptor required to couple the microphone of the sound level meter to the sound calibrator shall be available. An Instruction Manual for the sound calibrator also shall be available. If an appropriate sound calibrator, any necessary adaptor, or the Instruction Manual are not available, no periodic tests shall be performed.

9.3 Information for testing

For periodic testing of a sound level meter, the sound calibrator shall be shown to conform to the periodic-testing requirements for the applicable performance class of IEC 60942. Conformance shall be demonstrated for sound pressure level, frequency, and total distortion using the methods given in the applicable edition of IEC 60942. Evidence that the sound calibrator conforms to the applicable requirements of IEC 60942 may be provided by documentation from a periodic test performed in accordance with the procedures given in IEC 60942. The laboratory may offer to perform a calibration for the sound calibrator.

9.4 Calibration of the sound calibrator

Calibration of the sound calibrator shall be performed using equipment for which calibration of the appropriate quantities is traceable to national standards. The calibration of the sound calibrator shall use the model of microphone supplied with the sound level meter, or an equivalent model of microphone, or a suitable microphone along with correction data appropriate to the model of microphone supplied with the sound level meter. When correction data are used, the source of the data shall be the manufacturer of the sound calibrator, microphone, or sound level meter, and shall be stated in the documentation for the periodic tests. A calibration certificate for the sound calibrator showing the results of the calibration shall be supplied.

10 Indication at the calibration check frequency

10.1 The indication of the sound level meter at the calibration check frequency shall be checked by application of the sound calibrator described in Clause 9. The sound level meter shall be adjusted, if necessary, to indicate the required sound level for the environmental conditions under which the tests are performed. For multi-channel sound level meter systems, the indication shall be checked for as many of the channels as are required to be tested. The indications of the sound level meter before and after adjustment shall be recorded. If the adjustment value was determined using a particular model of adaptor with the sound calibrator, an adaptor of the same model shall be used when checking the indication of the sound level meter.

10.2 The effect of the prevailing environmental conditions on the sound pressure level produced in the coupler of the sound calibrator, relative to the sound pressure level produced under the reference environmental conditions of IEC 61672-1, shall be accounted for in accordance with the procedure and data from the Instruction Manual for the sound calibrator.

11 Self-generated noise

11.1 Microphone installed

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11.1.1 Measurements of the level of self-generated noise shall be made in a location that is available to the testing laboratory and where the level of background noise is minimized. Any supplied windscreen and windscreen accessory need not be installed around the microphone for measurement of the level of self-generated noise. The sound level meter shall be in the configuration submitted for periodic testing and with the most-sensitive level range and frequency-weighting A selected.

11.1.2 The indicated level of the A-weighted self-generated noise on the most-sensitive level range shall be recorded and reported. The level of self-generated noise is preferably measured as a time-averaged sound level with an averaging time of at least 30 s. Time-averaged sound level may be measured directly or calculated from an indication of sound exposure level and integration time. If time-averaged sound level cannot be determined, the time-weighted sound level from the average of ten observations taken at random over a 60 s interval shall be measured. If the time-weighted sound level is recorded, the S time weighting shall be used if available; otherwise the F time weighting shall be used.

NOTE 1 The indication of sound level is influenced by background noise as well as the self-generated noise.

NOTE 2 The A-weighted level of self-generated noise is reported for information only and is not used to assess conformance to a requirement. The level of self-generated noise is reported without an associated uncertainty.

11.2 Microphone replaced by the electrical input-signal device

With the microphone replaced by the electrical input-signal device (or using the specified means of inserting electrical signals), and with the device terminated in the manner specified in the Instruction Manual for measurements of the level of self-generated noise, the indicated level of the time-averaged or time-weighted self-generated noise, measured by the same procedure as with the microphone installed, shall be recorded and reported for all frequency weightings and for the most-sensitive level range.

NOTE The level of self-generated noise is reported for information only and is not used to assess conformance to a requirement. The level of self-generated noise is reported without an associated uncertainty.

12 Acoustical signal tests of a frequency weighting

12.1 The sound level meter shall be in the configuration submitted for periodic testing. The sound level meter shall be set for frequency-weighting C, if available, otherwise for frequency-weighting A. The frequency weighting shall be tested using a calibrated multi-frequency sound calibrator, comparison coupler, electrostatic actuator, or a free-field facility. In the latter case, the appropriate test procedure given in IEC 61672-2 shall be followed, but only for the test frequencies specified in this clause. Evidence shall be available to demonstrate that the multi-frequency sound calibrator conforms to the requirements of IEC 60942 for class 1 performance; a class 1/C multi-frequency sound calibrator may be used if appropriate for the prevailing environmental conditions. The working standard microphone used with the comparison coupler shall conform to the requirements of IEC 61094-4. The electrostatic actuator shall conform to the applicable requirements of IEC 61094-6.

NOTE 1 Tests using a multi-frequency sound calibrator, comparison coupler, or electrostatic actuator, if the appropriate free-field or random-incidence correction data are available, are likely to take less time than tests using a free-field facility.

NOTE 2 A measurement microphone that conforms to the requirements of IEC 61094-1 for laboratory standard microphones also conforms to the requirements of IEC 61094-4 for working standard microphones.

12.2 At each test frequency, data to correct the sound levels indicated by a sound level meter to equivalent free-field or random-incidence sound levels determined in accordance with a procedure given in IEC 62585 or IEC 61183, as applicable, shall be available. Correction data shall account for:

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– the equivalent free-field or random-incidence frequency response of the sound level meter if the source of sound or simulated sound is the pressure field in a multi-frequency sound calibrator, in a comparison coupler, or from an electrostatic actuator;[1] and,

– if applicable, the average influence on the frequency response of a typical microphone of a windscreen and any accessories that are part of the configuration of the sound level meter for normal use.

12.3 Correction data shall be obtained from tables in the Instruction Manual for the sound level meter.

12.4 If the necessary correction data are not available from the Instruction Manual, data from the manufacturer of the microphone, multi-frequency sound calibrator, comparison coupler, or electrostatic actuator may then be used. This data shall be publicly available.

NOTE It is possible that publicly available data that is not specified in the Instruction Manual has not been verified according to IEC 61672-2.

12.5 The source for the free-field or random-incidence correction data shall be stated in the documentation for the results of the periodic tests. The source for the associated uncertainties of measurement shall be the same as the source for the corresponding correction data. If the uncertainties of the corresponding free-field correction data are not available, the applicable maximum-permitted uncertainties given in IEC 62585 shall be used in the calculation of the laboratory's total uncertainty budget.

12.6 If an accessory is part of the configuration for the normal use of the sound level meter submitted for test but the relevant data on the influence of the accessory on the frequency response of a typical microphone of the specified model are not available from the Instruction Manual nor from the Internet website of the manufacturer or supplier of the sound level meter, then periodic testing of the sound level meter cannot be performed in accordance with this part of IEC 61672, except in a free-field facility.

12.7 The frequency weighting for tests with acoustical signals shall be determined at 125 Hz, 1 kHz, and 8 kHz.

12.8 At the discretion of the laboratory, the sound level meter shall be set to measure F-time-weighted sound level or S-time-weighted sound level, or time-averaged sound level, or sound exposure level. If sound exposure level is measured, the corresponding time-averaged sound level shall be calculated as specified by IEC 61672-1 for the integration time. Averaging time or integration time shall be at least 10 s and shall be recorded. The sound level meter shall be set for the reference level range or the level range closest to the reference level range that will permit displays of the signals from the multi-frequency sound calibrator, comparison coupler, or electrostatic actuator. If necessary, the frequency weightings with acoustical signals shall be tested in accordance with the free-field or random-incidence test procedure of IEC 61672-2, as applicable.

12.9 For frequency-weighting tests using a multi-frequency sound calibrator, the sound pressure level in the coupler of the sound calibrator shall preferably be set to the reference sound pressure level at 1 kHz, but shall be in the range from 70 dB to 125 dB at all frequencies. The sound pressure level produced in the coupler of the sound calibrator, when coupled to the microphone of the sound level meter, shall be known by calibration at each test frequency. If the correction data were determined with the protection grid of the microphone of the sound level meter replaced with an adaptor ring, an adaptor ring of the same model shall be used when performing the acoustical signal tests of the frequency weighting. If the correction data were determined using a particular model of adaptor with the sound calibrator,

[1] This correction term includes the correction to equivalent free-field or random-incidence level for the source of sound or simulated sound and the corrections for the typical effects of reflections from the case of the sound level meter and for the effect of diffraction of sound around the microphone mounted on the sound level meter, as applicable.

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