BS EN 61672-3:2013

BSI Standards Publication

Electroacoustics — Sound level meters

Part 3: Periodic tests

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National foreword

This British Standard is the UK implementation of EN 61672-3:2013. It is identical to IEC 61672-3:2013. It supersedes BS EN 61672-3:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/29, Electroacoustics.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Electroacoustics - Sound level meters - Part 3: Periodic tests

(IEC 61672-3:2013)

Electroacoustique - Sonomètres - Partie 3: Essais périodiques (CEI 61672-3:2013)

Elektroakustik - Schallpegelmesser - Teil 3: Periodische Einzelprüfung (IEC 61672-3:2013)

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Foreword

The text of document 29/814/FDIS, future edition 2 of IEC 61672-3, prepared by IEC/TC 29 "Electroacoustics" in cooperation with the International Organization of Legal Metrology (OIML), was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61672-3:2013.

The following dates are fixed:

– latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-08-04
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-11-04

This document supersedes EN 61672-3:2003.

EN 61672-3:2013 includes the following significant technical changes with respect to EN 61672-3:2003.

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 %.

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.

Endorsement notice

The text of the International Standard IEC 61672-3:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60942	-	Electroacoustics - Sound calibrators	EN 60942	-
IEC 61094-5	-	Measurement microphones Part 5: Methods for pressure calibration of working standard microphones by comparison	EN 61094-5	-
IEC 61094-6	-	Measurement microphones Part 6: Electrostatic actuators for determination of frequency response	EN 61094-6	-
IEC 61183	-	Electroacoustics - Random-incidence and diffuse-field calibration of sound level meters	EN 61183	-
IEC 61672-1	-	Electroacoustics - Sound level meters Part 1: Specifications	EN 61672-1	-
IEC 61672-2	-	Electroacoustics - Sound level meters Part 2: Pattern evaluation tests	EN 61672-2	-
IEC 62585	-	Electroacoustics - Methods to determine corrections to obtain the free-field response of a sound level meter	EN 62585	-
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)	-	-

CONTENTS

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*

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

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.

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

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

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:

– 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,

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[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.

an adaptor of the same model shall be used when performing the acoustical signal tests of the frequency weighting.

12.10 For frequency-weighting tests using a comparison coupler, the sound pressure level in the coupler 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 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 comparison coupler, an adaptor of the same model shall be used when performing the acoustical signal tests of the frequency weighting.

12.11 For frequency-weighting tests using an electrostatic actuator, the electrostatic actuator shall be coupled to the microphone in accordance with the instructions of the manufacturer of the device and also with the instructions of the manufacturer of the microphone installed on the sound level meter, if available. The signal voltage applied to the electrostatic actuator shall be adjusted to display an indicated sound level between 70 dB and 100 dB at 1 kHz.

NOTE At frequencies less than 1 kHz, the measured frequency weighting when using an electrostatic actuator will not show the effects of defects such as holes in the diaphragm of the microphone.

12.12 The sound calibrator and microphone, comparison coupler and microphones, or electrostatic actuator and microphone shall be coupled and allowed an appropriate time to stabilize. The sound level displayed in response to the input signals shall be recorded for each test frequency. As a minimum, two repetitions of the coupling and measurements shall be performed to give a total of at least three tests.

12.13 At each test frequency, the average sound level shall be calculated as the arithmetic average of the adjusted indications of frequency-weighted sound level.

12.14 At each test frequency, for tests using a multi-frequency sound calibrator, comparison coupler, or electrostatic actuator, the average sound level from 12.13 shall be corrected to an equivalent free-field or random-incidence frequency-weighted sound level by application of the applicable correction data noted in 12.2.

12.15 The relative frequency weighting, relative to the response at 1 kHz, shall be determined from the average equivalent free-field or random-incidence sound level at a test frequency minus the average equivalent free-field or random-incidence sound level at 1 kHz.

12.16 Measured deviations of the relative frequency weighting from the corresponding design goals given in IEC 61672-1 shall not exceed the applicable acceptance limits from IEC 61672-1.

13 Electrical signal tests of frequency weightings

13.1 Frequency weightings shall be determined using steady sinusoidal electrical input signals for all frequency weightings for which design goals and acceptance limits are specified in IEC 61672-1 and which are provided in the sound level meter. The sound level meter shall be set to display F-time-weighted sound level, 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.

13.2 On the reference level range and for each frequency weighting to be tested, the level of a 1 kHz input signal shall be adjusted to yield an indication that is 45 dB less than the upper boundary stated in the Instruction Manual for the linear operating range at 1 kHz on the reference level range. The input signal level shall be recorded.

13.3 At test frequencies other than 1 kHz, the level of the input electrical signal shall be determined as the level of the input signal at 1 kHz minus the exact design-goal response, given in IEC 61672-1 for the selected frequency weighting at the test frequency. The indication on the display device shall be recorded.

13.4 The levels of the input signals and the corresponding indications on the display device shall be recorded for the following test frequencies:

- for tests of class 1 sound level meters: the nine nominal frequencies at octave intervals from 63 Hz to 16 kHz;
- for tests of class 2 sound level meters: the eight nominal frequencies at octave intervals from 63 Hz to 8 kHz.

13.5 For each frequency weighting, the relative frequency weighting shall be calculated as the sound level indicated at a test frequency minus the sound level indicated at 1 kHz.

13.6 For each frequency weighting and at each test frequency, corrections shall be applied to the relative frequency weightings determined in 13.5 to account for:

– the deviation of the free-field or random-incidence frequency response of the microphone in the reference direction from a uniform frequency response;
– the average effects of reflections from the case of the sound level meter and of diffraction of sound around the microphone and preamplifier; 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.

13.7 Corrections for the effects of reflections and diffraction and for the influence of the windscreen and windscreen accessories on the free-field or random-incidence frequency response shall be the same as used for the frequency-weighting tests with acoustical signals.

13.8 The laboratory shall determine the corrections for the deviations of the free-field or random-incidence frequency response of the microphone fitted to the sound level meter in the reference direction from a uniform frequency response. The corrections shall be determined for all the applicable test frequencies specified in 13.4. IEC 62585 describes methods for the determination of the corrections for the deviation of the free-field frequency response from a uniform frequency response.

13.9 The corrected relative frequency weightings, determined as described in 13.5 to 13.8, are the deviations from the design-goal frequency weightings given in IEC 61672-1.

13.10 At each test frequency, measured deviations from the design-goal frequency weighting shall not exceed the applicable acceptance limits from IEC 61672-1.

14 Frequency and time weightings at 1 kHz

14.1 For a steady sinusoidal electrical input signal at 1 kHz on the reference level range and with an input signal that yields an indication of the reference sound pressure level with frequency weighting A, the indications shall be recorded for frequency weightings C and Z, as available, with the sound level meter set to display F-time-weighted sound level, or time-averaged sound level, as available. In addition, the indications with frequency weighting A shall be recorded with the sound level meter set to display F-time-weighted sound level, S-time-weighted sound level, and time-averaged sound level, as available.

14.2 Measured deviations of the indicated level of a C-weighted or Z-weighted measurement quantity from the level of the corresponding A-weighted measurement quantity shall not exceed the acceptance limits given in IEC 61672-1.

14.3 The measured deviation of the indication of A-weighted sound level with S time weighting, and the measured deviation of the indication of A-weighted, time-averaged sound level, from the indication of A-weighted sound level with F time weighting shall not exceed the acceptance limits given in IEC 61672-1.

15 Long-term stability

15.1 The long-term stability of a sound level meter is evaluated from the difference between the A-weighted sound levels indicated in response to steady 1 kHz signals applied at the beginning and end of a period of operation. For each indication, the level of the input signal shall be that which is required to display the reference sound pressure level on the reference level range for the first indication.

15.2 The period of continuous operation shall be between 25 min and 35 min during which any convenient set of tests that use electrical input signals are performed.

15.3 The measured difference between the initial and final indications of A-weighted sound level shall not exceed the acceptance limits given in IEC 61672-1. The indicated sound level may be a 10-s-averaged sound level, an F-time-weighted sound level, or an S-time-weighted sound level.

16 Level linearity on the reference level range

16.1 Level linearity shall be tested with steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A. For each test of level linearity, the indications of F-time-weighted sound level or time-averaged sound level, along with the corresponding anticipated indication of sound level, shall be recorded.

16.2 Tests of level linearity shall begin with the input signal adjusted to display the starting point given in the Instruction Manual for tests of level linearity at 8 kHz on the reference level range. The calculation procedure described in IEC 61672-2 shall be used to determine level linearity deviations.

16.3 Level linearity shall be measured in 5 dB steps of increasing input signal level from the starting point up to within 5 dB of the upper boundary stated in the Instruction Manual for the linear operating range at 8 kHz, then at 1 dB steps of increasing input signal level up to, but not including, the first indication of overload. The test of level linearity shall then be continued at 5 dB steps of decreasing input signal level from the starting point down to within 5 dB of the specified lower boundary, then at 1 dB steps of decreasing input signal level down to, but not including, the first indication of an under-range condition.

16.4 At least over the extent of the linear operating range stated in the Instruction Manual for 8 kHz, measured level linearity deviations shall not exceed the applicable acceptance limits given in IEC 61672-1.

16.5 Measured level linearity deviations shall not exceed the applicable acceptance limits given in IEC 61672-1 from the specified upper boundary of the linear operating range up to, but not including, the first indication of overload and also from the specified lower boundary of the linear operating range down to, but not including, the first indication of an under-range condition.

17 Level linearity including the level range control

17.1 For sound level meters that have more than one level range, tests of level linearity deviations including deviations introduced by the level range control shall be performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter

set for frequency weighting A. For each test, signal levels shall be recorded as indications of F-time-weighted sound level or time-averaged sound level.

17.2 The level of the input signal shall be adjusted to yield an indication of the reference sound level on the reference level range. The level of the input signal and the level of the indicated signal shall be recorded.

17.3 With the input signal level kept constant, the indicated signal level shall be recorded for all level ranges where the signal level is displayed. The indicated signal levels and the corresponding anticipated indications of signal levels shall be recorded.

17.4 For each level range, the level of the input signal shall then be adjusted to yield a signal level that is expected to be 5 dB greater than the signal level that first causes an indication of under-range on a level range. The indicated signal levels and the corresponding anticipated levels shall be recorded.

17.5 Level linearity deviations shall be calculated as an indicated signal level minus the corresponding anticipated signal level. Measured level linearity deviations shall not exceed the applicable acceptance limits given in IEC 61672-1.

18 Toneburst response

18.1 The response of a sound level meter to short-duration signals shall be tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter shall be set for frequency weighting A.

18.2 For the toneburst signals, indications of the sound level meter to be recorded are: maximum F-time-weighted sound level, maximum S-time-weighted sound level, and sound exposure level, as applicable. If the capability to measure sound exposure level is not provided, then time-averaged sound level for an averaging time that includes the toneburst shall be measured, if available, and the sound exposure level calculated as specified by IEC 61672-1.

18.3 When maximum F-time-weighted sound levels of tonebursts are measured, the level of the steady 4 kHz signals from which the tonebursts are extracted shall be measured with the F time weighting. Similarly, the S-time-weighted level of the steady signal shall be measured when maximum S-time-weighted sound levels of tonebursts are measured. When sound exposure levels of the tonebursts are measured, the time-averaged sound level of the steady signal shall be measured. If the capability to measure a time-averaged sound level is not provided, then the sound exposure level of the steady signal for any convenient integration time shall be measured, if available, and the corresponding time-averaged sound level calculated as specified by IEC 61672-1.

18.4 The level of the steady input signal shall be adjusted to display an F-time-weighted, S-time-weighted, or time-averaged sound level, as appropriate, that is 3 dB less than the upper boundary stated in the Instruction Manual for the linear operating range at 4 kHz on the reference level range.

18.5 For tests with the F time weighting, the indication shall be recorded of the maximum F-time-weighted sound level in response to tonebursts having durations of 200 ms, 2 ms, and 0,25 ms.

18.6 For tests with the S time weighting, the indication shall be recorded of the maximum S-time-weighted sound level in response to tonebursts having durations of 200 ms and 2 ms.

18.7 For measurements of sound exposure level (or time-averaged sound level for an averaging time that includes the toneburst), the indications in response to tonebursts having durations of 200 ms, 2 ms, and 0,25 ms shall be recorded.

18.8 Measured deviations of the measured toneburst responses from the corresponding reference toneburst responses given in IEC 61672-1 shall not exceed the applicable acceptance limits given in IEC 61672-1.

19 C-weighted peak sound level

19.1 Indications of C-weighted peak sound level shall be tested on the least-sensitive level range. The test signals consist of (a) a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and (b) positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings.

19.2 The level of the steady sinusoidal 8 kHz electrical input signal, from which a single complete cycle is extracted, shall be adjusted to yield an indication of C-weighted, F-time-weighted sound level, or C-weighted, time-averaged sound level, that is 8 dB less than the upper boundary stated in the Instruction Manual for the peak level range at 8 kHz on the least-sensitive level range. The indication of steady sound level shall be recorded.

19.3 The indication of C-weighted peak sound level in response to a complete cycle of the 8 kHz signal shall be recorded. Application of the complete-cycle 8 kHz signal shall not cause indication of an overload condition.

19.4 The level of the steady sinusoidal 500 Hz electrical input signal, from which positive and negative half cycles are extracted, shall be adjusted to yield an indication of C-weighted, F-time-weighted sound level, or C-weighted, time-averaged sound level, that is 8 dB less than the upper boundary stated in the Instruction Manual for the peak level range on the least-sensitive level range. The indications of steady sound levels shall be recorded.

19.5 The indications of C-weighted peak sound level in response to a single positive half-cycle 500 Hz signal and to a single negative half-cycle 500 Hz signal shall be recorded and reported. Applications of the 500 Hz half-cycle signals shall not cause indications of an overload condition.

19.6 Measured deviations from the design-goal differences given in IEC 61672-1 of the measured differences between the indications of C-weighted peak sound level and the corresponding indications of the C-weighted steady signal levels shall not exceed the applicable acceptance limits given in IEC 61672-1.

20 Overload indication

20.1 The test of overload indication shall only be performed for sound level meters capable of displaying time-averaged sound level.

20.2 Overload indication shall be tested on the least-sensitive level range with the sound level meter set to display A-weighted, time-averaged sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz shall be used. The one-half-cycle signals shall be extracted from steady signals of the same signal level and shall begin and end at zero crossings.

20.3 The test shall begin at an indicated time-averaged level for the steady input signal that corresponds to 1 dB less than the upper boundary specified for the linear operating range at 4 kHz. The level of the single positive one-half-cycle input signal shall be increased to the first indication of overload, to a resolution of 0,1 dB. The process shall be repeated for the single

negative one-half-cycle signal. The levels of the single one-half-cycle input signals that produced the first indications of overload shall be recorded to a resolution of 0,1 dB.

NOTE Relative levels of the one-half-cycle input signals can be determined from the setting of an input-signal-level attenuator.

20.4 The measured difference between the levels of the positive and negative one-half-cycle input signals that first cause the displays of overload indication shall not exceed the acceptance limits of IEC 61672-1.

20.5 It shall be verified that the overload indicator latches on as specified in IEC 61672-1 when an overload condition occurs.

21 High-level stability

21.1 The ability of a sound level meter to operate continuously in response to high signal levels without significant change in sensitivity is evaluated from the difference between the A-weighted sound levels indicated in response to a steady 1 kHz electrical signal at the beginning and end of a 5 min period of continuous exposure to the signal.

21.2 The level of the steady electrical input signal shall be that which is required to display the sound level that is 1 dB less than the upper boundary of the 1 kHz linear operating range on the least-sensitive level range. The indicated sound level may be a 10 s-averaged sound level, an F-time-weighted sound level, or an S-time-weighted sound level.

21.3 The measured difference between the initial and final indications of A-weighted sound level shall not exceed the acceptance limits given in IEC 61672-1.

22 Documentation

The documentation of the periodic test shall contain at least the following information, as applicable, unless national regulations require otherwise:

a) the date(s) when the periodic tests were performed;

b) the statement: ‘Periodic tests were performed in accordance with procedures from IEC 61672-3:–';

c) a statement of the availability or non-availability of (and, if available, a reference to) evidence, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter submitted for periodic testing successfully completed the applicable pattern-evaluation tests given in IEC 61672-2;

d) the name and location of the laboratory performing the periodic tests;

e) the name of the manufacturer or supplier, model designation, serial number, and performance class of the sound level meter and, if applicable, the version of the internal operating software loaded in the sound level meter;

f) the name of the manufacturer or supplier, model designation and serial number of the microphone;

g) the name of the manufacturer or supplier, model designation and any unique identification of the microphone preamplifier, if removable from the case of the sound level meter;

h) if the sound level meter is a multi-channel device, a designation of which channels were selected for testing;

i) a unique description of the Instruction Manual relating to the sound level meter including, as applicable, the publication date and version number; for Instruction Manuals downloaded from an Internet website, the date of the download as well as any unique descriptive information;

j) the name of the manufacturer or supplier, model designation and serial number of the sound calibrator, together with details of any adaptors used and the source of any correction data used to adjust the indication at the calibration check frequency; if applicable, a statement that the sound calibrator is not of a model that is specified in the Instruction Manual of the sound level meter;

k) a description of the source of the data used to correct the sound levels indicated in response to application of a multi-frequency sound calibrator, comparison coupler, or electrostatic actuator to sound levels equivalent to those that would be indicated in response to plane, progressive sound waves incident from the reference direction or in response to random-incidence sound, as applicable; if applicable, a statement that the source of the correction data is not the Instruction Manual of the sound level meter;

l) when the uncertainties of measurement for the free-field correction data are not available, a statement as follows:

‘No information on the uncertainty of measurement, required by IEC 61672-3:–, for the correction data given in the Instruction Manual or obtained from the manufacturer or supplier of the sound level meter, or the manufacturer of the microphone, or the manufacturer of the multi-frequency sound calibrator, comparison coupler, or electrostatic actuator (delete as appropriate) was provided in the Instruction Manual or made available by the manufacturer or supplier of the sound level meter. The uncertainty of measurement of the correction data was therefore assumed to be the maximum-permitted uncertainty given in IEC 62585 for the corresponding free-field correction data and for a coverage probability of 95 %.’

m) a statement of the calibration check frequency, reference sound pressure level, and reference level range for the sound level meter;

n) a description of the configuration of the sound level meter for the tests including any connecting cables that were provided to operate the sound level meter;

o) the ranges of the static pressure, air temperature, and relative humidity measured during the testing;

p) from application of the calibrated sound calibrator, the initial and adjusted indications of the sound level meter at the calibration check frequency, and reference to the certificate for the sound calibrator, if available;

q) for information only, the level of self-generated noise measured for frequency-weighting A with the microphone installed and, for all frequency weightings available in the sound level meter, with the microphone replaced by the suitably terminated electrical input-signal device;

NOTE A report of a measured level of self-generated noise that exceeds the corresponding highest-anticipated level of self-generated noise from the Instruction Manual is not necessarily an indication of non-conformance to the specifications of IEC 61672-1:–.

r) when evidence was publicly available to show that pattern-evaluation tests had been performed in accordance with IEC 61672-2 to demonstrate that the model of sound level meter conformed to all applicable specifications of IEC 61672-1 and the results of all periodic tests according to this part of IEC 61672 were satisfactory, a statement as follows:

‘The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:–, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:–, to demonstrate that the model of sound level meter fully conformed to the class Y specifications in IEC 61672-1:–, the sound level meter submitted for testing conforms to the class Y specifications of IEC 61672-1:–.’;

s) when no evidence was publicly available to show that pattern-evaluation tests had been performed in accordance with IEC 61672-2 to demonstrate that the model of sound level meter conformed to all applicable specifications of IEC 61672-1 or if the correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and the results of all periodic tests according to this part of IEC 61672 were satisfactory, a statement as follows:

‘The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:–, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:– because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class Y specifications in IEC 61672-1:– or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:– cover only a limited subset of the specifications in IEC 61672-1:–.’

t) when the results of the periodic tests for the sound level meter are not satisfactory for the designated performance class, a statement as follows:

'The sound level meter submitted for periodic testing did not successfully complete the class Y tests of IEC 61672-3:–. The sound level meter did not conform to the class Y specifications of IEC 61672-1:–.'

In addition, the documentation shall indicate which tests were not successfully completed and the reasons therefore.

NOTE Examples of reasons why tests were not successfully completed might be "Measured level linearity deviations exceeded the applicable acceptance limits" or "Measured deviations from the design goal for indications of C-weighted peak sound levels exceeded the applicable acceptance limits." Another reason might be that the manufacturer-provided uncertainty for the free-field or random-incidence correction data was a significant part of the laboratory’s uncertainty budget and as a result the deviation from the design goal exceeded the acceptance limits for a particular test.

In the above statements, replace class Y with class 1 or class 2, as appropriate. Also, replace date '–' by the year of issue of this second edition.

u) If results of measurements of deviations from the design goals are provided by a laboratory to a customer, each test result should give the measured deviation from the design goal along with the associated maximum-permitted uncertainty of measurement. The laboratory’s actual uncertainty for each measurement result should also be provided.

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