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Electroacoustics - Sound level meters - Part 1: Specifications

Elektroakustik - Schallpegelmesser - Teil 1: Anforderungen

Electroacoustique - Sonomètres - Partie 1: Spécifications

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17.140.50	Elektroakustika	Electroacoustics

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Electroacoustics - Sound level meters - Part 1: Specifications
(IEC 61672-1:2013)

Electroacoustique - Sonomètres - Partie 1: Spécifications (CEI 61672-1:2013)

Elektroakustik - Schallpegelmesser - Teil 1: Anforderungen (IEC 61672-1:2013)

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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

The text of document 29/812/FDIS, future edition 2 of IEC 61672-1, 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 61672-1:2013.

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)	2013-08-04
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-11-04

This document supersedes EN 61672-1:2003.

EN 61672-1:2013 includes the following significant technical changes with respect to EN 61672-1:2003.

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 %.

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The text of the International Standard IEC 61672-1:2013 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 61000-4-2	2008	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-6-2	2005	Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2 + corr. September	2005 2005
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 62585	-	Electroacoustics - Methods to determine corrections to obtain the free-field response of a sound level meter	EN 62585	-
ISO/IEC Guide 98-4	2012	Uncertainty of measurement Part 4: Role of measurement uncertainty in conformity assessment	-	-
ISO/IEC Guide 99		International vocabulary of metrology - Basic and general concepts and associated terms (VIM)	-	-
CISPR 16-1-1 + corr. October + corr. October + A1	2010 2010 2011 2010	Specification for radio disturbance and immunity measuring apparatus and methods Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus	EN 55016-1-1 - - + A1	2010 - - 2010

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electroacoustics – Sound level meters – Part 1: Specifications

Electroacoustique – Sonomètres – Partie 1: Spécifications

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 1: Specifications

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61672-1 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 2002. This second edition constitutes a technical revision.

The main technical changes with respect 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 %.

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

FDIS	Report on voting
29/812/FDIS	29/823/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 of 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,
- replaced by a revised edition, or
- amended.

INTRODUCTION

For assessments of conformance to performance specifications, this second edition of IEC 61672-1 uses different criteria than were used for the 2002 first edition.

In the period from 1961 to 1985, International Standards for sound level meters did not provide any requirements or recommendations to account for the uncertainty of measurement in assessments of conformance to specifications.

This absence of requirements or recommendations to account for uncertainty of measurement created ambiguity in determinations of conformance to specifications for situations where a measured deviation from a design goal was close to a limit of the allowed deviation. If conformance was determined based on whether a measured deviation did or did not exceed the limits, the end-user of the sound level meter incurred the risk that the true deviation from a design goal exceeded the limits.

To remove this ambiguity, IEC Technical Committee 29, at its meeting in 1996, adopted a policy to account for measurement uncertainty in assessments of conformance in International Standards that it prepares.

The first edition (2002) of IEC 61672-1 accounted for measurement uncertainty by giving two explicit criteria for determining conformance to the specifications. The two criteria were (a) that measured deviations from design goals, extended by the expanded uncertainty of measurement, do not exceed the applicable tolerance limits and (b) that the expanded uncertainty of measurement does not exceed agreed-upon maximum values. For most performance specifications, the tolerance limits were calculated essentially by extending the allowances for design and manufacturing from the 1979 and 1985 International Standards for sound level meters by the applicable maximum-permitted expanded uncertainties of measurement. Tolerance limits were intended to represent the limits for true deviations from design goals with a coverage probability of 95 %.

This second edition of IEC 61672-1 uses an amended criterion for assessing conformance to a specification. Conformance 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. Acceptance limits are analogous to the allowances for design and manufacturing implied in the first edition (2002) of IEC 61672-1. Actual and maximum-permitted uncertainties are determined for a coverage probability of 95 %. The amended criterion for assessing conformance does not necessitate any change to the design of a sound level meter in order to conform to the specifications of this International Standard.

The maximum-permitted uncertainties of measurement are not equivalent to the uncertainties associated with the measurement of a sound level. The uncertainty of a measured sound level is evaluated from the anticipated deviations of the electroacoustical performance of the sound level meter from the relevant design goals as well as estimates of the uncertainties associated with the specific measurement situation. Unless more-specific information is available, the evaluation of the contribution of a specific sound level meter to a total measurement uncertainty can be based on the acceptance limits and maximum-permitted uncertainties specified in this standard.

ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 1: Specifications

1 Scope

This part of IEC 61672 gives electroacoustical performance specifications for three kinds of sound measuring instruments:

- a time-weighting sound level meter that measures exponential-time-weighted, frequency-weighted sound levels;
- an integrating-averaging sound level meter that measures time-averaged, frequency-weighted sound levels; and
- an integrating sound level meter that measures frequency-weighted sound exposure levels.

Sound level meters conforming to the requirements of this standard have a specified frequency response for sound incident on the microphone from one principal direction in an acoustic free field or successively from random directions.

Sound level meters specified in this standard are intended to measure sounds generally in the range of human hearing.

NOTE The AU frequency weighting specified in IEC 61012 can be applied for measurements of A-weighted sound levels of audible sound in the presence of a source that contains spectral components at frequencies greater than 20 kHz.[1]

Two performance categories, class 1 and class 2, are specified in this standard. In general, specifications for class 1 and class 2 sound level meters have the same design goals and differ mainly in the acceptance limits and the range of operational temperature. Acceptance limits for class 2 are greater than, or equal to, those for class 1.

This standard is applicable to a range of designs for sound level meters. A sound level meter may be a self-contained hand-held instrument with an attached microphone and a built-in display device. A sound level meter may be comprised of separate components in one or more enclosures and may be capable of displaying a variety of acoustical signal levels. Sound level meters may include extensive analogue or digital signal processing, separately or in combination, with multiple analogue and digital outputs. Sound level meters may include general-purpose computers, recorders, printers, and other devices that form a necessary part of the complete instrument.

Sound level meters may be designed for use with an operator present or for automatic and continuous measurements of sound level without an operator present. Specifications in this standard for the response to sound waves apply without an operator present in the sound field.

1 IEC 61012, *Filters for the measurement of audible sound in the presence of ultrasound.*

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 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

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

ISO/IEC Guide 98-4:2012, *Evaluation of measurement data – The role of measurement uncertainty in conformance assessment*

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

CISPR 16-1-1:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*[2]
Amendment 1:2010

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 98-4, ISO/IEC Guide 99, and IEC 61000-6-2, as well as the following apply.

NOTE All quantities are expressed in SI units.

3.1
sound pressure
difference between an instantaneous total pressure and the corresponding static pressure

Note 1 to entry: Sound pressure is expressed in pascals (Pa).

3.2
sound pressure level
ten times the logarithm to the base 10 of the ratio of the time-mean-square of a sound-pressure signal to the square of the reference value

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2 CISPR = *International Special Committee on Radio Interference*.

Note 1 to entry: Sound pressure level is expressed in decibels (dB).

Note 2 to entry: The reference value is 20 µPa.

3.3
frequency weighting
difference, as a specified function of frequency, between the level of the frequency-weighted signal indicated on the display device and the corresponding level of a constant-amplitude sinusoidal input signal

Note 1 to entry: Level difference is expressed in decibels (dB).

3.4
time weighting
exponential function of time, of a specified time constant, that weights the square of a sound-pressure signal

3.5
sound level
frequency-weighted sound pressure level
level with time weighting or time averaging of the square of a frequency-weighted sound-pressure signal

Note 1 to entry: Sound level is expressed in decibels (dB).

3.6
time-weighted sound level
ten times the logarithm to the base 10 of the ratio of the running time average of the time-weighted square of a frequency-weighted sound-pressure signal to the square of the reference value

Note 1 to entry: Time-weighted sound level is expressed in decibels (dB).

Note 2 to entry: For time-weighted sound level, example letter symbols are L_{AF}, L_{AS}, L_{CF}, and L_{CS} for frequency weightings A and C and time weightings F and S.

Note 3 to entry: In symbols and as an example, A-weighted and F-time-weighted sound level $L_{AF}(t)$ at observation time t can be represented by

$$L_{AF}(t) = 10 \lg \left[\frac{(1/\tau_F) \int_{-\infty}^{t} p_A^2(\xi) e^{-(t-\xi)/\tau_F} d\xi}{p_0^2} \right] \quad \text{dB} \qquad (1)$$

where

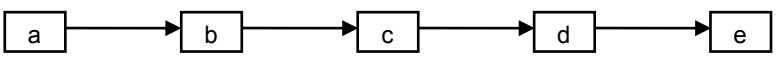
– τ_F is the exponential time constant in seconds for the F time weighting;

– ξ is a dummy variable of time integration from some time in the past, as indicated by -∞ for the lower limit of the integral, to the time of observation t;

– $p_A(\xi)$ is the A-weighted instantaneous sound-pressure signal; and

– p_0 is the reference value of 20 µPa.

Note 4 to entry: The sketch in Figure 1 illustrates the process indicated by Equation (1).



IEC 2243/13

Key

a Start with a frequency-weighted electrical input signal

b Square the input signal

c Apply a low-pass filter with one real pole at -1/τ (exponential time weighting)

d Take the base-10 logarithm

e Display the result in decibels with the square of a reference value of 20 µPa