
Electroacoustics - Sound calibrators (IEC 60942:2003)

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EUROPEAN STANDARD

EN 60942

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2003

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English version

**Electroacoustics –
Sound calibrators**
(IEC 60942:2003)

Electroacoustique –
Calibreurs acoustiques
(CEI 60942:2003)

Elektroakustik –
Schallkalibratoren
(IEC 60942:2003)

This European Standard was approved by CENELEC on 2003-04-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 29/528/FDIS, future edition 3 of IEC 60942, 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 was approved by CENELEC as EN 60942 on 2003-04-01.

This European Standard supersedes EN 60942:1998 + A1:2001.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-04-01

Annexes designated "normative" are part of the body of the standard.

In this standard, annexes A, B, C and ZA are normative.

Annex ZA has been added by CENELEC.

The most significant changes from the previous edition are: the inclusion of maximum permitted uncertainties of measurement within the tolerance limits; the inclusion of a normative annex giving the format for reporting results of pattern evaluation tests; changes to the class designations; specification of the type designation of the microphone to be used to determine the class; harmonization of the range of operating environmental conditions with those for sound level meters. Specifications for equivalent free-field and diffuse-field levels have been removed.

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Endorsement notice

The text of the International Standard IEC 60942:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61000-6-2 NOTE Harmonized as EN 61000-6-2:2001 (modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-801	1994	International Electrotechnical Vocabulary (IEV) Chapter 801: Acoustics and electroacoustics	-	-
IEC 61000-4-2	1995	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	1995
IEC 61000-4-3	2002	Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2002
IEC 61000-6-1 (mod)	1997	Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments	EN 61000-6-1	2001
IEC 61094-1	2000	Measurement microphones Part 1: Specifications for laboratory standard microphones	EN 61094-1	2000
IEC 61094-2	1992	Part 2: Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique	EN 61094-2	1993
IEC 61094-4	1995	Part 4: Specifications for working standard microphones	EN 61094-4	1995
IEC 61094-5	2001	Part 5: Methods for pressure calibration of working standard microphones by comparison	EN 61094-5	2001
IEC 61672-1	2002	Electroacoustics - Sound level meters Part 1: Specifications	EN 61672-1	2003
CISPR 22 (mod)	1997	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022 + corr. July	1998 2001

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR/IEC 61000-6-3 (mod)	1996	Electromagnetic compatibility (EMC) Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments	EN 61000-6-3	2001
ISO/IEC Guide Expres	1995	Guide to the expression of uncertainty in measurement	-	-
ISO 266	1997	Acoustics - Preferred frequencies	-	-
ISO Publication ISBN 92-67-01075-1	1993	International vocabulary of basic and general terms in metrology	-	-
OIML R 97	1990	Barometers	-	-

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROACOUSTICS –
SOUND CALIBRATORS**
FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60942 has been prepared by IEC technical committee 29: Electroacoustics, in cooperation with the International Organization of Legal Metrology (OIML).

This third edition cancels and replaces the second edition published in 1997, and its amendment 1 (2000), of which it constitutes a technical revision.

The most significant changes from the previous edition are: the inclusion of maximum permitted uncertainties of measurement within the tolerance limits; the inclusion of a normative annex giving the format for reporting results of pattern evaluation tests; changes to the class designations; specification of the type designation of microphone to be used to determine the class; harmonization of the range of operating environmental conditions with those for sound level meters. Specifications for equivalent free-field and diffuse-field levels have been removed.

The text of this standard is based on the following documents:

FDIS	Report on voting
29/528/FDIS	29/533/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.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Sound calibrators are designed to produce one or more known sound pressure levels at one or more specified frequencies when coupled to specified models of microphone in specified configurations, for example, with or without protective grid. The sound pressure level generated by a sound calibrator may depend on environmental conditions such as static pressure, air temperature and relative humidity.

Sound calibrators have two principal applications:

- a) the determination of the electroacoustical pressure sensitivity of specified models of microphone in specified configurations;
- b) checking or adjusting the overall sensitivity of acoustical measuring devices or systems.

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ELECTROACOUSTICS – SOUND CALIBRATORS

1 Scope

This International Standard specifies the performance requirements for three classes of sound calibrator: laboratory standard (class LS), class 1 and class 2. Tolerance limits are smallest for class LS and greatest for class 2 instruments. Class LS sound calibrators are normally used only in the laboratory; class 1 and class 2 are considered as sound calibrators for field use. A class 1 sound calibrator is primarily intended for use with a class 1 sound level meter and a class 2 sound calibrator primarily with a class 2 sound level meter, as specified in IEC 61672-1.

The tolerance limits for class LS sound calibrators are based on the use of a laboratory standard microphone, as specified in IEC 61094-1, for demonstrations of conformance to the requirements of this standard. The tolerance limits for class 1 and class 2 sound calibrators are based on the use of a working standard microphone, as specified in IEC 61094-4, for demonstrations of conformance to the requirements of this standard.

A multi-level and multi-frequency sound calibrator has the same class designation for all sound pressure level and frequency combinations for which the instruction manual states that the instrument conforms to the requirements of this standard.

This standard does not include requirements for equivalent free-field or random-incidence sound pressure levels, such as may be used in the overall sensitivity adjustment of a sound level meter.

A sound calibrator may provide other functions, for example, tonebursts. Requirements for these other functions are not included in this standard.

2 Normative references

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

IEC 60050(801):1994, *International Electrotechnical Vocabulary (IEV) – Chapter 801: Acoustics and electroacoustics*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*. Basic EMC Publication

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*. Basic EMC Publication

IEC 61000-6-1:1997, *Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 1: Immunity for residential, commercial and light-industrial environments*

IEC 61094-1:2000, *Measurement microphones – Part 1: Specifications for laboratory standard microphones*

IEC 61094-2:1992, *Measurement microphones – Part 2: Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique*

IEC 61094-4:1995, *Measurement microphones – Part 4: Specifications for working standard microphones*

IEC 61094-5:2001, *Measurement microphones – Part 5: Methods for pressure calibration of working standard microphones by comparison*

IEC 61672-1:2002, *Electroacoustics – Sound level meters – Part 1: Specifications*

CISPR 22:1997, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR/IEC 61000-6-3:1996, *Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 3: Emission standard for residential, commercial and light-industrial environments*

ISO/IEC Guide :1995, *Guide to the expression of uncertainty in measurement*

ISO 266:1997, *Acoustics – Preferred frequencies*

ISO Publication:1993, ISBN 92-67-01075-1, *International vocabulary of basic and general terms in metrology*

OIML International Recommendation R 97:1990, *Barometers*

3 Terms and definitions

For the purposes of this International Standard, the definitions contained in IEC 60050(801) and the ISO Publication *International Vocabulary of Basic and General Terms in Metrology*, as well as the following definitions, apply. Definitions for other relevant quantities are given in the documents referenced in Clause 2.

3.1

sound calibrator

device that generates a sinusoidal sound pressure of specified sound pressure level and frequency when coupled to specified models of microphone in specified configurations

3.2

specified sound pressure level

sound pressure level(s) generated under reference environmental conditions for use with a particular microphone model and configuration, valid for either an individual sound calibrator (in the case of a class LS calibrator) or all sound calibrators of the same model (in the case of a class 1 or class 2 calibrator)

3.3

nominal sound pressure level

close approximation to the specified sound pressure level(s), valid for all sound calibrators of the same model, rounded to the nearest decibel (intended for marking)

3.4

specified frequency

frequency(ies) of the sound generated by the sound calibrator under reference environmental conditions, valid for either an individual sound calibrator (in the case of a class LS calibrator) or all sound calibrators of the same model (in the case of a class 1 or class 2 calibrator)

3.5

nominal frequency

close approximation to the specified frequency, often rounded according to ISO 266 (intended for marking)

3.6

principal sound pressure level

sound pressure level specified in the instruction manual as principal

NOTE Principal sound pressure level is used during demonstration of conformance of the sound calibrator to the requirements of this standard.

3.7

principal frequency

frequency specified in the instruction manual as principal

NOTE Principal frequency is used during demonstration of conformance of the sound calibrator to the requirements of this standard.

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3.8

replication

repeat of a measurement involving coupling the microphone to the sound calibrator and then completely removing the microphone from the sound calibrator

3.9

total distortion

ratio in per cent of the root-mean-square of the total distortion components to the root-mean-square of the entire signal

3.10

reference orientation

orientation of a sound calibrator such that the principal axis of the opening of the cavity (the axis along which the microphone is inserted into the cavity) coincides with the principal direction of an emitter or receiver of radiofrequency fields. The opening of the cavity faces away from the emitter or receiver

3.11

reference plane

plane of contact between the microphone and the sound calibrator

3.12

effective load volume of a microphone

volume of air at reference environmental conditions that has the same acoustic compliance as the cavity bounded by the reference plane, the microphone diaphragm and the outer cylindrical surface of the microphone at the reference plane, including the equivalent volume of the microphone (see IEC 61094-1)

NOTE Effective load volume is generally expressed in cubic millimetres.

4 Reference environmental conditions

Reference environmental conditions for specifying the performance of a sound calibrator are:

- air temperature: 23 °C
- static pressure: 101,325 kPa
- relative humidity: 50 %

5 Requirements

5.1 General

5.1.1 A sound calibrator conforming to the requirements of this standard shall have the characteristics described in this clause. Adaptors may be provided to accommodate more than one model of microphone. For the purpose of this standard, any such adaptor is an integral part of the sound calibrator.

5.1.2 The sound calibrator shall conform to the requirements of this standard for one or more of the sound pressure level and frequency combinations available. All the combinations conforming to the requirements given in this standard shall conform to the same class designation. Conformance to the requirements of this standard shall not be stated for sound pressure level and frequency settings for which this standard provides no tolerance limits.

5.1.3 Class LS sound calibrators shall be supplied with an individual calibration chart containing the information required by 6.2. For class 1 and class 2 sound calibrators, the specified sound pressure level(s) and specified frequency(ies) shall be given in the instruction manual.

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5.1.4 Class LS and class 1 sound calibrators that require corrections for the influence of static pressure to conform to the specifications for the appropriate class shall have the letter 'C' added to their class designation. Class LS and class 1 sound calibrators shall not require corrections for any of the other environmental conditions to achieve the requirements specified for the appropriate class. Class 2 sound calibrators that require corrections for any of the environmental conditions to conform to the specified requirements shall have the letter 'C' added to their class designation. Where appropriate, the class designation shall be described as class LS/C, class 1/C, class 2/C. Where corrections are permitted, and are necessary to conform to the specified requirements as an environmental condition varies, these corrections shall be stated in the instruction manual.

5.1.5 Class 1 sound calibrators that require a correction for the influence of static pressure to conform to the specifications of this standard shall be supplied with a barometer. The barometer shall enable the static pressure to be measured so that the ability of a sound calibrator to conform to the requirements for the class is not affected. Class 2 sound calibrators that require a correction for the influence of static pressure to conform to the specifications of this standard shall be supplied with a barometer (which shall enable the static pressure to be measured in such a way that the ability of a sound calibrator to conform to the requirements for the class is not affected), unless the corrections are sufficiently small that for any change in static pressure of $\pm 6,0$ kPa the uncorrected measured sound pressure levels conform to the specifications of this standard. In this case, the corrections to be applied for the influence of variations in static pressure shall be stated in the instruction manual, together with information on how to calculate the relevant correction when operating the sound calibrator at different heights above sea-level.