BRITISH STANDARD

BS EN
60942:2003

Electroacoustics — Sound calibrators

The European Standard EN 60942:2003 has the status of a British Standard

ICS 17.140.50

National foreword

This British Standard is the official English language version of EN 60942:2003. It is identical with IEC 60942:2003. It supersedes BS EN 60942:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/29, Electroacoustics, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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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
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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.

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).

CONTENTS

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.

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.

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.

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 ±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.

NOTE 1 A class LS sound calibrator is normally used only in the laboratory where a suitable device should be available for measuring static pressure if the sound calibrator has a class 'C' designation. Hence, there is no requirement to supply a barometer for this class.

NOTE 2 The barometer may provide the data directly in the form to be used to correct measured sound pressure levels to the reference static pressure.

5.1.6 Where a class 2 sound calibrator, that requires a correction for the influence of temperature or relative humidity to conform to the specifications of this standard, is supplied with the means to measure the relevant environmental condition, the supplied means shall enable the condition 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.

NOTE The 'supplied means' may provide the data directly in the form to be used to correct measured sound pressure levels to the reference environmental conditions.

5.1.7 The design of the sound calibrator and the materials used in the construction should be such as to provide long-term stability for the operation of the sound calibrator.

5.1.8 If a specific orientation of the sound calibrator is to be used to conform to the requirements of this standard, this orientation shall either be indicated on the sound calibrator, or the indication on the sound calibrator shall refer to the instruction manual, which shall state the required orientation.

5.1.9 All performance requirements relate to the operation of the sound calibrator following stabilizing of the coupling of the microphone and sound calibrator, and after the sound pressure level and frequency have stabilized. The elapsed time necessary for stabilization of the sound pressure level and frequency, which begins once the sound calibrator is switched on with the microphone coupled to it, shall be stated in the instruction manual, and shall not exceed 30 s for any applicable combination of environmental conditions specified in 5.4. The sound calibrator and microphone shall be allowed to reach equilibrium with the prevailing environmental conditions before coupling.

NOTE The stabilization time required following the coupling of the microphone to the sound calibrator may vary considerably depending on the model of microphone and sound calibrator in use.

5.1.10 Those components of a sound calibrator that are not intended to be accessible to the user shall be protected by seals or marks.

5.1.11 The tolerance limits in this standard include the associated expanded uncertainty of measurement calculated for a coverage factor of 2 corresponding to a level of confidence of approximately 95 %, in accordance with the guidelines given in the ISO/IEC *Guide to the expression of uncertainty in measurement*. For testing laboratories the maximum permitted expanded uncertainties of measurement are stated in Annexes A and B of this document. Sound calibrator manufacturers may calculate the proportion of the tolerance limits available for design and manufacturing purposes by subtracting the maximum permitted expanded uncertainties of measurement from the appropriate tolerance limit.

5.1.12 Conformance to the requirements of this standard is demonstrated when the result of a measurement or the absolute value of the difference between the result and the design goal, as appropriate, extended by the actual expanded uncertainty of measurement of the testing laboratory, lies fully within the specified tolerance limits for the appropriate class. For legal metrology purposes, the tolerance limits stated in this standard are considered to be the maximum permissible errors for pattern evaluation, initial verification and subsequent verification.

5.1.13 If the actual expanded uncertainty of a measurement performed by the test laboratory exceeds the maximum permitted value given in Annexes A and B, the measurement shall not be used to demonstrate conformance to the requirements of this standard.

5.2 Sound pressure level

5.2.1 General

5.2.1.1 All specified sound pressure level(s) generated shall be stated in the instruction manual with a resolution better than, or equal to, 0,1 dB.

5.2.1.2 All the requirements and tolerance limits specified in this standard relate to the level of the sound pressure produced at the diaphragm of the inserted microphone.

5.2.1.3 The principal sound pressure level of the sound calibrator shall be at least 90 dB (re 20 μPa) when the sound calibrator is applied to the models of microphone in the configurations specified in the instruction manual.

5.2.2 Generated sound pressure level

The sound pressure level generated by the sound calibrator shall be measured as an average over 20 s of operation. For sound calibrators with letter 'C' designation the measured level shall be corrected, if necessary, to the reference environmental conditions given in Clause 4. The absolute value of the difference between the measured sound pressure level and the corresponding specified sound pressure level, extended by the expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1 for the class of sound calibrator. These tolerance limits apply to measurements made at and around reference environmental conditions within the following ranges: 97 kPa to 105 kPa, 20 °C to 26 °C and 40 % relative humidity to 65 % relative humidity.

5.2.3 Short-term level fluctuation

Fluctuation in the sound pressure level shall be measured with time-weighting F (nominal time constant of 125 ms as specified in IEC 61672-1), by making a minimum of 10 measurements at regular intervals during a period of 20 s of operation of the sound calibrator. One-half of the difference between the maximum and minimum levels measured, extended by the expanded uncertainty of measurement, shall not exceed the short-term level fluctuation limits given in Table 1 for the class of sound calibrator. These short-term level fluctuation limits apply to measurements made at and around reference environmental conditions within the following ranges: 97 kPa to 105 kPa, 20 °C to 26 °C and 40 % relative humidity to 65 % relative humidity.

Table 1 – Tolerance limits for sound pressure level and short-term level fluctuation, at and around reference environmental conditions

Range of nominal frequencies Hz	Sound pressure level tolerance limits dB			Short-term level fluctuation limits dB		
	Class LS	Class 1	Class 2	Class LS	Class 1	Class 2
31,5 to <160	–	0,50	–	–	0,20	–
160 to 1 250	0,20	0,40	0,75	0,05	0,10	0,20
>1 250 to 4 000	–	0,60	–	–	0,10	–
>4 000 to 8 000	–	0,80	–	–	0,10	–
>8 000 to 16 000	–	1,00	–	–	0,10	–

NOTE 1 Sound pressure level tolerance limits are for the absolute value of the difference between the sound pressure level generated by the sound calibrator and the specified sound pressure level, extended by the expanded uncertainty of measurement.

NOTE 2 Short-term level fluctuation limits are for the corresponding measured short-term level fluctuation, extended by the expanded uncertainty of measurement.

NOTE 3 For a class LS or class 2 sound calibrator the '–' symbols in the table indicate ranges of nominal frequency for which this standard provides no tolerance limits.

5.2.4 Sound pressure level over range of supply voltage

The absolute value of the difference between the sound pressure level generated by the sound calibrator, determined according to 5.2.2 over the range of supply voltages specified in the instruction manual, and the sound pressure level measured at the nominal supply voltage under reference environmental conditions, extended by the expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 2 for the class of sound calibrator. Also, the tolerance limits given in Table 1 for the absolute value of the difference between the measured sound pressure level and the specified sound pressure level shall not be exceeded for any supply voltage within the range.

Table 2 – Tolerance limits for the effect of supply voltage on sound pressure level, under reference environmental conditions

Tolerance limits dB		
Class LS	Class 1	Class 2
0,05	0,10	0,20

NOTE Tolerance limits are for the absolute value of the difference between the sound pressure level generated by the sound calibrator over the range of operating voltage, and the sound pressure level measured at the nominal supply voltage, extended by the expanded uncertainty of measurement.

5.3 Frequency

5.3.1 General

5.3.1.1 The principal frequency of the sound generated by the sound calibrator shall be in the range from 160 Hz to 1 250 Hz. Specified frequencies shall be calculated from the equation for exact frequency given in 3.1 of ISO 266, or taken from Table 1 of ISO 266 which gives the calculated frequency.

5.3.1.2 The principal sound pressure level shall be available at the principal frequency.

5.3.2 Frequency of sound generated by the sound calibrator

The absolute value of the difference in per cent between the frequency of the sound generated by the sound calibrator and the corresponding specified frequency, extended by the expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 3 for the class of sound calibrator. These tolerance limits apply to measurements made at and around reference environmental conditions within the following ranges: 97 kPa to 105 kPa, 20 °C to 26 °C and 40 % relative humidity to 65 % relative humidity.

Table 3 – Tolerance limits for frequency, at and around reference environmental conditions

Tolerance limits %		
Class LS	**Class 1**	**Class 2**
1,0	1,0	2,0
NOTE 1 Tolerance limits are for the absolute value of the difference in per cent between the frequency of the sound generated by the sound calibrator and the specified frequency, extended by the expanded uncertainty of measurement.		
NOTE 2 Tolerance limits are expressed as a percentage of the specified frequency.		

5.4 Influence of static pressure, air temperature and humidity

5.4.1 For environmental conditions outside the range of 97 kPa to 105 kPa, 20 °C to 26 °C and 40 % relative humidity to 65 % relative humidity, sound calibrators shall operate within the tolerance limits given in Tables 4 and 5 relative to the values measured under reference environmental conditions, and shall not exceed the tolerance limits for Table 6, for the class of sound calibrator, over any combination of the range of environmental conditions given below.

Class LS	static pressure:	65 kPa to 108 kPa
	air temperature:	+16 °C to +30 °C
	relative humidity:	25 % to 90 %
Class 1	static pressure:	65 kPa to 108 kPa
	air temperature:	–10 °C to +50 °C
	relative humidity:	25 % to 90 %

Combinations of air temperature and relative humidity that would yield a dewpoint greater than +39 °C are excluded from the tests of conformance with these specifications.

Class 2	static pressure:	65 kPa to 108 kPa
	air temperature:	0 °C to +40 °C
	relative humidity:	25 % to 90 %

NOTE The range of environmental conditions for class 1 and class 2 sound calibrators is the same as specified in IEC 61672-1 for class 1 and class 2 sound level meters.

5.4.2 Class LS and class 1 sound calibrators that conform to the requirements of Tables 4, 5 and 6 for the given class of sound calibrator, over the appropriate range of environmental conditions specified in 5.4.1, but which require corrections for the influence of static pressure to achieve conformance to the requirements specified in Table 4 and Table 5, shall be designated class LS/C or class 1/C sound calibrator, as appropriate. Similarly, class 2 sound calibrators that conform to the requirements of Tables 4, 5 and 6 for the class of sound calibrator, over the appropriate range of environmental conditions specified in 5.4.1, but which require corrections for any of the environmental conditions to achieve conformance to the requirements specified in Tables 4 and 5, shall be designated class 2/C sound calibrators. All relevant corrections, together with their associated expanded uncertainties of measurement corresponding to a confidence level of approximately 95 %, shall be given in the instruction manual. A statement shall be included in the instruction manual giving the maximum expanded uncertainty of the measurement of environmental conditions required so that the ability of a sound calibrator to conform to the requirements for the relevant class is not affected.

Table 4 – Tolerance limits for sound pressure level, over the specified range of environmental conditions

Range of nominal frequencies Hz	**Tolerance limits** dB		
	Class LS	**Class 1**	**Class 2**
31,5 to <160	–	0,50	–
160 to 1 250	0,20	0,40	0,60
>1 250 to 4 000	–	0,60	–
>4 000 to 8 000	–	0,80	–
>8 000 to 16 000	–	1,00	–

NOTE 1 Tolerance limits are for the absolute value of the difference between the sound pressure level generated by the sound calibrator over the specified range of environmental conditions (excluding the conditions covered by Table 1) and the sound pressure level measured under reference environmental conditions, extended by the expanded uncertainty of measurement.

NOTE 2 For a class LS or class 2 sound calibrator the '–' symbols in the table indicate ranges of nominal frequency for which this standard provides no tolerance limits.

Table 5 – Tolerance limits for frequency, over the specified range of environmental conditions

Tolerance limits %		
Class LS	**Class 1**	**Class 2**
1,0	1,0	2,0

NOTE 1 Tolerance limits are for the absolute value of the difference in per cent between the frequency of the sound generated by the sound calibrator over the specified range of environmental conditions (excluding the conditions covered by Table 3) and the frequency measured under reference environmental conditions, extended by the expanded uncertainty of measurement.

NOTE 2 Tolerance limits are expressed as a percentage of the specified frequency.

5.5 Total distortion

The total distortion, measured over the frequency range from at least 22,5 Hz to 20 kHz, extended by the expanded uncertainty of measurement, shall not exceed the maximum values given in Table 6, for the applicable range of environmental conditions specified in 5.4.1.

NOTE A distortion meter may indicate the ratio of the magnitude of the unwanted components to the magnitude of the fundamental component of the signal. For the maximum distortion limits specified in this standard, the difference between distortion measured as a ratio of the root-mean-square of the total distortion components to the root-mean-square of the entire signal, or to the root-mean-square of the fundamental, is insignificant compared with the uncertainty of measurement.

Table 6 – Maximum total distortion

Range of nominal frequencies Hz	**Total distortion** %		
	Class LS	**Class 1**	**Class 2**
31,5 to <160	–	4,0	–
160 to 1 250	2,5	3,0	4,0
>1 250 to 16 000	–	4,0	–

NOTE 1 Tolerance limits are for the maximum total distortion generated by the sound calibrator, extended by the expanded uncertainty of measurement.

NOTE 2 For a class LS or class 2 sound calibrator the '–' symbols in the table indicate ranges of nominal frequency for which this standard provides no tolerance limits.

5.6 Power supply requirements

The sound calibrator shall include as an integral part some means of checking that the supply voltage is sufficient to operate the sound calibrator in accordance with the requirements of this standard, or shall ensure that the sound calibrator ceases to produce any sound output when the supply voltage falls below that required to operate the sound calibrator in accordance with the requirements of this standard.

5.7 Specification and calibration of microphones

5.7.1 Microphone models and adaptors

5.7.1.1 The instruction manual for the sound calibrator shall state the microphone configuration as designated in IEC 61094-1 or IEC 61094-4, or alternatively (and in addition if desired), the name of the manufacturer or supplier, model designation and configurations (for example, with or without protective grid) of those microphones with which the sound calibrator is specified to operate in conformity with the requirements of this standard. In each case, the instruction manual shall state the required adaptor configuration (if any).

5.7.1.2 For class LS sound calibrators, at least one of the microphone configurations or models specified shall be a laboratory standard microphone as specified in IEC 61094-1.

5.7.1.3 For class 1 and class 2 sound calibrators, at least one of the microphone models specified shall be a working standard microphone as specified in IEC 61094-4.

NOTE 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.

5.7.2 Microphone sensitivity level

For the microphone models specified, it shall be possible to determine the pressure sensitivity level of the microphone by at least one of the following:

a) a method specified in IEC 61094-2, or

b) a method specified in IEC 61094-5, or by an alternative comparison method.

5.8 Electromagnetic compatibility

5.8.1 General

Sound calibrators shall conform to the requirements of this standard for radiofrequency emissions, and immunity to electrostatic discharges and power- and radiofrequency fields.

5.8.2 Radiofrequency emissions

5.8.2.1 The upper limits for the electromagnetic field strength of radiofrequency emissions from the sound calibrator are 30 dB (re 1 µV/m) quasi-peak, measured at 10 m, for frequencies in the range from 30 MHz to 230 MHz, and 37 dB (re 1 µV/m) quasi-peak, measured at 10 m, for frequencies in the range from 230 MHz to 1 GHz.

NOTE 1 The upper limits are defined for compatibility with many different standards. The limits given in Table 1 of CISPR/IEC 61000-6-3 form the basic requirements for sound calibrators.

NOTE 2 The characteristics of a quasi-peak receiver are specified in 4.1.2 of CISPR 16-1.

5.8.2.2 The instruction manual shall state the mode of operation of the sound calibrator that produces the greatest radiofrequency emissions.

5.8.3 Electrostatic discharges

5.8.3.1 Sound calibrators shall withstand contact discharges up to 4 kV and air discharges up to 8 kV, for both positive and negative voltages relative to earth ground.

NOTE The requirements are as specified in 1.4 of Table 1 in IEC 61000-6-1.

5.8.3.2 Performance criterion B as specified in IEC 61000-6-1 applies during and after these electrostatic discharge tests.

5.8.3.3 Following the completion of the electrostatic discharge tests, the sound calibrator shall be fully operational and in a configuration identical to that set before the start of the tests.

5.8.4 Immunity to power- and radiofrequency fields

5.8.4.1 Sound calibrators shall exhibit, as a minimum, immunity over the following ranges of power- and radiofrequencies and field strengths:

- root-mean-square electromagnetic field strength up to 10 V/m (unmodulated) with 80 % sinusoidal amplitude modulation at 900 Hz; frequency range from 26 MHz to 1 GHz;
- uniform root-mean-square alternating magnetic field strength of 80 A/m; frequency 50 Hz and 60 Hz.

NOTE 1 The requirements are those specified in 1.1 of Table 1 in IEC 61000-6-1 and 1.2 of Table 1 in IEC 61000-6-2 with minor amendments. These amendments extend the range of radiofrequency fields to cover from 26 MHz to 1 GHz, change the modulation frequency from 1 kHz to 900 Hz, increase the field strength for the power-frequency field to 80 A/m, and exclude the reduced field strength requirements listed in Table 1, Note 3 of IEC 61000-6-2.

NOTE 2 A sound calibrator may conform to the specifications of this standard at an unmodulated root-mean-square electromagnetic field strength greater than 10 V/m. If so, the applicable field strength should be stated in the instruction manual.

5.8.4.2 With the sound calibrator in the reference orientation and with the opening of the cavity where the microphone is inserted facing away from the emitter of the power or radio-frequency field, when the field is applied no change in operating state shall occur. The absolute value of the difference between the measured sound pressure level generated by the sound calibrator in the presence of the field, and in the absence of the field, shall not exceed 0,15 dB for a class LS sound calibrator, 0,3 dB for a class 1 sound calibrator, and 0,5 dB for a class 2 sound calibrator. For multi-level or multi-frequency sound calibrators, or both, the requirements apply for each combination of frequency and sound pressure level for which the instruction manual states that the sound calibrator conforms to the requirements of this standard.

5.8.4.3 The instruction manual for the sound calibrator shall state the configuration and the connecting devices (if any) that produce the minimum immunity (maximum susceptibility) to power- and radiofrequency fields.

6 Instrument marking and documentation

6.1 Marking of the sound calibrator

A space shall be allowed for marking on the sound calibrator, and sound calibrators conforming to the requirements of this standard shall be supplied with the following minimum information. Items a) and b) shall be marked on the sound calibrator. The remaining items shall be marked on, or displayed during operation of, the sound calibrator:

a) manufacturer’s or supplier’s name or trade mark;

b) model designation and serial number;

c) reference to this standard by number and year of publication;

d) the class of instrument, including the letter ‘C’ designation where applicable and the environmental condition(s) for which corrections need to be applied, for example, for static pressure;

e) a clear indication of all available combinations of sound pressure level and frequency that conform to the requirements of the class;

f) the nominal sound pressure level or sound pressure levels;

g) the nominal frequency or frequencies;

h) where possible, and if required for the sound calibrator, an indication of the orientation required for installation on a microphone;

i) if the sound calibrator is battery operated, the preferred battery type;

j) model designations marked on adaptors, where provided.

6.2 Individual calibration chart for a class LS sound calibrator

A class LS sound calibrator shall be supplied with an individual calibration chart from the manufacturer or supplier. The chart shall state the specified sound pressure level(s) and frequency(ies) for the models and configuration of microphone for which the sound calibrator conforms to the requirements of this standard.

6.3 Instruction manual

The sound calibrator shall be supplied with an instruction manual which shall contain the information required by Clause 5 and by 6.1. It shall also contain the following information:

a) identification of the microphone models (and of the configurations in which they are used) and of the relevant adaptors required, together with detailed instructions which need to be followed to ensure that the sound calibrator functions as intended when used as described in the instruction manual;

b) for class LS sound calibrators at least the nominal sound pressure level(s) and frequency(ies), and for class 1 and class 2 sound calibrators the specified sound pressure level(s) and frequency(ies) of the output signal when the sound calibrator is coupled to the specified microphone models and configurations;

c) if a specific orientation of the sound calibrator is to be used to conform to the requirements of this standard, this orientation shall be stated;

d) the elapsed time before the specified sound pressure level and frequency stabilize, for any available combination of sound pressure level and frequency, once the sound calibrator is switched on with the microphone coupled to it. In addition, the instruction manual shall give information on the elapsed time necessary to stabilize the microphone and sound calibrator combination, after they are coupled together;

e) the principal sound pressure level. For a sound calibrator with only one available sound pressure level, this is the principal sound pressure level;

f) the principal frequency. For a sound calibrator with only one available frequency, this is the principal frequency;

g) the range of environmental conditions over which the sound calibrator is specified to operate, and the correction data, if applicable, specified in 5.4, together with the expanded uncertainties of measurement corresponding to a confidence level of approximately 95 % associated with the correction data; for class 2 sound calibrators with letter ‘C’ designation that are not required to be supplied with a barometer, information on how to calculate the correction when operating the calibrator at different heights above sea-level;

h) identification of the available combinations of sound pressure level and frequency that conform to the requirements of this standard for the class;

i) a recommended procedure to ensure that the ambient sound level is sufficiently low during operation of the sound calibrator so that the calibrator operates as intended at each level setting;

j) for class LS sound calibrators, including those with letter designation ‘C’, the typical change in sound pressure level produced by the sound calibrator with changes in the effective load volume of the inserted microphone;

k) types of battery which may be used, if applicable, together with the typical operation lifetime, details of any battery status indicator and its operation, and the nominal, maximum and minimum supply voltages; method of connection to an external power supply, where applicable;

l) for sound calibrators with letter ‘C’ designation, a statement giving the maximum expanded uncertainty of the measurement of environmental conditions so that the ability of a sound calibrator to conform to the requirements of the relevant class is not affected; where a barometer is supplied with the sound calibrator, the expanded uncertainty of measurement of the static pressure when using the barometer;

m) for class LS sound calibrators where a barometer is required but not supplied, details of a suitable device to measure static pressure;

n) a statement of the configuration for the normal mode of operation;

o) the cables and accessories, if any, for use with the sound calibrator with which the calibrator conforms to the electromagnetic compatibility requirements of 5.8;

p) a description of the reference orientation for testing the effects of exposure to radio-frequency fields;

q) if applicable, the unmodulated root-mean-square electromagnetic field strength greater than 10 V/m for which the sound calibrator conforms to the specifications of this standard;

r) the configuration, sound pressure level and frequency settings for greatest radiofrequency emissions;

s) the configuration and connecting devices, if any, that produce minimum immunity (maximum susceptibility) to power- and radiofrequency fields;

t) details of the combinations of sound pressure level and frequency that do not conform to the requirements for the class, together with a description of their acoustical characteristics, and a statement of the nominal tolerance limits maintained about the design goals.

NOTE Where a sound calibrator has additional features not specified in this standard, the instruction manual should include a statement to this effect together with a description of the manufacturer’s design goals for the additional features and a statement of the corresponding nominal tolerance limits, including the expanded uncertainties of measurement.

Annex A
(normative)

Pattern evaluation tests

A.0 Introduction

A.0.1 This annex gives details of the tests necessary to demonstrate conformance to all the requirements specified in this standard for a model of sound calibrator. The tests are applicable to class LS, class 1 and class 2 sound calibrators, and aim to ensure that pattern evaluation tests are performed in a consistent manner at all testing laboratories. All applicable tests described in this annex shall be performed.

A.0.2 Conformance to the requirements of this standard is demonstrated when the result of a measurement or the absolute value of the difference between the result and the design goal, as appropriate, extended by the actual expanded uncertainty of measurement of the testing laboratory, does not exceed the specified tolerance limit. Laboratories performing these tests shall calculate the uncertainties associated with all the measurements in accordance with the guidelines given in the ISO/IEC *Guide to the expression of uncertainty in measurement*. Actual expanded uncertainties shall be calculated for a level of confidence of 95 %, using the necessary coverage factor. Where a testing laboratory is only required to make a single measurement, it is necessary for the laboratory to make an estimate of the random contribution to the total uncertainty, using an earlier evaluation based on several measurements for a similar sound calibrator.

NOTE Generally, a coverage factor of 2 approximates to a level of confidence of 95 %, unless the contributions are such that is necessary to use a different coverage factor to maintain the 95 % level of confidence.

A.0.3 The expanded uncertainties of measurement given in this annex are the maximum permitted for demonstration of conformance, under this annex, to the requirements of this standard. If the actual expanded uncertainty of a measurement performed by the test laboratory exceeds the maximum permitted value, the measurement shall not be used to demonstrate conformance to the requirements of this standard.

A.0.4 In this annex, tables are given for the maximum permitted expanded uncertainties of measurement. For sound calibrators at and around reference environmental conditions, Table A.1 gives the data for the generated sound pressure level and short-term level fluctuation and Table A.2 gives the data for the frequency of the sound generated. Table A.3 gives the data for the total distortion in the output signal over the specified range of environmental conditions. For sound calibrators over the specified range of environmental conditions, Table A.4 gives the data for the generated sound pressure level and Table A.5 gives the data for the frequency of the sound generated.

A.0.5 The test laboratory shall use instruments with current calibrations for the appropriate quantities. The calibrations shall be traceable to national standards, as required.

A.1 Submission for test

A.1.1 Five specimens of the same pattern of sound calibrator shall be submitted for pattern evaluation testing. As a minimum, the testing laboratory shall select two of the five specimens for testing. At least one of these two specimens shall then be tested fully according to the procedures given in this annex. The testing laboratory shall decide whether the full tests shall also be performed on the second specimen, or whether limited testing is adequate to provide approval of the pattern.

NOTE Depending on the number of specimens tested, the pattern approval may be limited to two years so that further experience with the pattern may be gained.

A.1.2 Each sound calibrator, together with all relevant accessories (such as adaptors or barometer), shall be submitted for test together with a copy of the instruction manual. Each class LS sound calibrator shall also be supplied with an individual calibration chart.

A.2 Principal values

A.2.1 It shall be confirmed that the principal sound pressure level of the sound calibrator conforms to the requirement of 5.2.1.3.

A.2.2 It shall be confirmed that the principal frequency of the sound calibrator conforms to the requirement of 5.3.1.1.

A.3 Marking of the sound calibrator and supplied documentation

It shall be verified that the markings on the sound calibrator and the information in the instruction manual supplied conform to the requirements and contain all the information specified in 6.1 and 6.3. For class LS sound calibrators, it shall be verified that the individual calibration chart contains all the information required by 6.2.

A.4 Performance tests at and around reference environmental conditions

A.4.1 General

A.4.1.1 All tests in Clause A.4 shall be performed within the ranges of environmental conditions specified in 5.2.2.

A.4.1.2 For class LS and class 1 sound calibrators with a letter designation ‘C’, where appropriate, data supplied in the instruction manual shall be applied for the influence of static pressure, to correct measured sound pressure levels to reference environmental conditions. If a barometer is supplied with the sound calibrator, it shall be used to measure the static pressure and then the data supplied in the instruction manual shall be applied, where appropriate, to correct measured sound pressure levels to the reference environmental conditions.

A.4.1.3 For class 2 sound calibrators with a letter designation ‘C’, data supplied in the instruction manual, for the influence of static pressure, temperature and relative humidity, shall be applied, where appropriate, to correct measured sound pressure levels to the reference environmental conditions. If a means of measuring the relevant environmental condition is supplied with the sound calibrator, the means shall be used to measure the relevant

environmental condition and then the data supplied in the instruction manual shall be applied, where appropriate, to correct measured sound pressure levels to the reference environmental conditions.

A.4.1.4 Except for the tests described in A.4.3.7, A.4.3.8, A.4.5.2, A.4.5.4 and A.4.6.2, all measurements shall be performed at an operating voltage within 20 % of the nominal operating voltage and without exceeding the specified maximum or minimum operating voltage.

A.4.2 Orientation

If a specific orientation for application of the sound calibrator is stated in the instruction manual, this orientation shall be used for testing. If no specific orientation is prescribed, at least 3 different orientations shall be used for the measurements of sound pressure level described in A.4.3.3.

A.4.3 Sound pressure level

A.4.3.1 The sound pressure level generated by the sound calibrator shall be measured, as an average over 20 s of operation, at the principal sound pressure level specified in the instruction manual at each of the frequency settings for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.4.3.2 For class LS sound calibrators the microphone shall be a laboratory standard microphone as specified in IEC 61094-1. For class 1 and class 2 sound calibrators the microphone shall be a working standard microphone as specified in IEC 61094-4.

NOTE 1 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.

NOTE 2 It is recommended that the sound pressure levels be measured using the insert voltage technique (see 5.3 of IEC 61094-2) or by an equivalent method to measure the open-circuit voltage from the microphone.

NOTE 3 Where a choice of microphone model is available, a microphone model should be used for which the electroacoustical characteristic is designated by the letter P in IEC 61094-1 or IEC 61094-4.

A.4.3.3 The measurement of sound pressure level shall be replicated twice to give a total of three tests. The absolute value of the difference between the mean measured sound pressure level and the corresponding specified sound pressure level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.1 for the class of sound calibrator.

A.4.3.4 Measurements of sound pressure level as described in A.4.3.3 shall be repeated for at least one other specimen of the same model of laboratory standard or working standard microphone as applicable, for each frequency setting of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.4.3.5 For multi-level sound calibrators, the sound pressure level generated by the sound calibrator shall also be measured as described in A.4.3.3, at each level setting at each of the frequency settings for which the instruction manual states that the instrument conforms to the requirements of this standard, using one specimen of the model of microphone.

A.4.3.6 The procedure given in the instruction manual shall be followed to ensure that the level of ambient sound reaching the microphone during testing is sufficiently low that the sound calibrator operates as intended.

A.4.3.7 The measurement(s) of the sound pressure level shall be repeated (excluding replications) within 5 % of the minimum operating voltage of the power supply consistent with operation of any battery condition indicator or acoustic signal cut-off facility supplied as an integral part of the sound calibrator, using one specimen of microphone. Measurements shall be made for the following combinations of sound pressure level and frequency:

– the principal sound pressure level and principal frequency;
– the maximum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum frequency and the minimum and maximum sound pressure levels available at that frequency;
– the maximum frequency and the minimum and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.4.3.8 The measurements shall be performed in terms of the variation of the level of the output voltage from the microphone at the reduced operating voltage for the sound calibrator, relative to the level of the output voltage from the microphone at the nominal supply voltage for the sound calibrator under reference environmental conditions. For each combination, the absolute value of the difference between the sound pressure level generated at the reduced operating voltage and the sound pressure level generated by the sound calibrator at the nominal supply voltage at reference environmental conditions, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 2. The actual expanded uncertainty of measurement of the difference shall not exceed 0,04 dB. Also, the absolute value of the difference between the measured sound pressure level and the specified level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1.

NOTE The uncertainty specified in this subclause is included in the maximum permitted expanded uncertainty given in Table A.1.

A.4.3.9 Where the sound calibrator is designed to be connected to an external power supply, the measurement(s) of sound pressure level shall be repeated (excluding replications) at the principal sound pressure level and principal frequency at the maximum permitted supply voltage. The measurements shall be performed in terms of the variation of the level of the output voltage from the microphone at the maximum permitted supply voltage for the sound calibrator, relative to the level of the output voltage from the microphone at the nominal supply voltage for the sound calibrator under reference environmental conditions. The absolute value of the difference between the sound pressure level generated at the maximum permitted supply voltage and the sound pressure level generated by the sound calibrator at the nominal supply voltage at reference environmental conditions, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 2. The actual expanded uncertainty of measurement of the difference shall not exceed 0,04 dB. Also, the absolute value of the difference between the measured sound pressure level and the specified level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1.

NOTE The uncertainty specified in this subclause is included in the maximum permitted expanded uncertainty given in Table A.1.

A.4.3.10 Where the instruction manual states that the sound calibrator conforms to the requirements of this standard for the same class when used with microphone models or microphone configurations other than that used in A.4.3.2, the measurements described in A.4.3 shall be repeated for those microphone models or configurations, unless the testing laboratory is satisfied that it has reliable, justifiable evidence of the equivalence of various models of microphone, or of corrections to be applied. In these cases, it may not be necessary for the laboratory to perform measurements using all models and configurations of microphones, but to use a representative sample of these equivalent models.

A.4.4 Sound pressure level stability – short-term level fluctuation

A.4.4.1 Short-term fluctuation of the sound pressure level in the cavity of the sound calibrator shall be determined at the principal sound pressure level and principal frequency, with the microphone used in A.4.3.2. A minimum of ten measurements at regular intervals using time weighting F (specified in IEC 61672-1) shall be made over a period of 20 s of operation of the sound calibrator, to find the maximum and minimum output sound pressure level. One-half of the difference between the maximum and minimum measured sound pressure levels, extended by the actual expanded uncertainty of measurement, shall not exceed the applicable tolerance limits given in Table 1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.1 for the class of sound calibrator.

A.4.4.2 Short-term level fluctuation shall be measured with one microphone only.

A.4.4.3 For multi-level sound calibrators, the measurement of short-term level fluctuation as described in A.4.4.1 and A.4.4.2, shall be repeated at the principal frequency and at the minimum sound pressure level setting for which the instruction manual states that the instrument conforms to the requirements of this standard.

Table A.1 – Maximum permitted expanded uncertainty of measurement for sound pressure level and short-term level fluctuation, at and around reference environmental conditions

Range of nominal frequencies Hz	Uncertainty of measurement for generated sound pressure level dB			Uncertainty of measurement for short-term level fluctuation dB		
	Class LS	Class 1	Class 2	Class LS	Class 1	Class 2
31,5 to <160	–	0,20	–	–	0,10	–
160 to 1 250	0,10	0,15	0,35	0,02	0,03	0,05
>1 250 to 4 000	–	0,25	–	–	0,03	–
>4 000 to 8 000	–	0,35	–	–	0,03	–
>8 000 to 16 000	–	0,50	–	–	0,03	–
NOTE For a class LS or class 2 sound calibrator the '–' symbols in the table indicate ranges of nominal frequency for which this standard provides no tolerance limits.						

A.4.5 Frequency

A.4.5.1 The frequency of the sound generated by the sound calibrator shall be measured with the microphone used in A.4.3.2, at the principal sound pressure level, for each frequency setting of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard. The absolute value of the difference in per cent between each measured frequency and the corresponding specified frequency, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 3 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.2 for the class of sound calibrator.

A.4.5.2 Measurements of frequency shall be repeated within 5 % of the minimum operating voltage of the power supply consistent with operation of any battery condition indicator or acoustic signal cut-off facility supplied as an integral part of the sound calibrator. The measurements shall be for the following combinations of sound pressure level and frequency:

– the principal sound pressure level and principal frequency;
– the maximum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum frequency and the minimum and maximum sound pressure levels available at that frequency;
– the maximum frequency and the minimum and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.4.5.3 The absolute value of the difference in per cent between each measured frequency and the corresponding specified frequency, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 3 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.2 for the class of sound calibrator.

A.4.5.4 Where the sound calibrator is designed to be connected to an external power supply, the measurement of frequency shall be repeated at the principal sound pressure level and principal frequency at the maximum permitted supply voltage. The absolute value of the difference in per cent between each measured frequency and the corresponding specified frequency, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 3 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.2 for the class of sound calibrator.

Table A.2 – Maximum permitted expanded uncertainty of measurement for frequency, at and around reference environmental conditions

Uncertainty of measurement for frequency %		
Class LS	**Class 1**	**Class 2**
0,3	0,3	0,3
NOTE Expanded uncertainties of measurement are expressed as a percentage of the specified frequency.		

A.4.6 Total distortion

A.4.6.1 Total distortion of the sound pressure signal generated by the sound calibrator shall be measured, over the frequency range from at least 22,5 Hz to 20 kHz, with the microphone used in A.4.3.2 at each frequency setting, at the maximum and minimum sound pressure level setting for which the instruction manual states that the instrument conforms to the requirements of this standard. The measured total distortion, extended by the actual expanded uncertainty of measurement, shall not exceed the limit given in Table 6 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.3 for the class of sound calibrator.

A.4.6.2 Distortion measurements shall be repeated within 5 % of the minimum operating voltage of the power supply consistent with operation of any battery condition indicator or acoustic signal cut-off facility supplied as an integral part of the sound calibrator. The measurements shall be for the following combinations of sound pressure level and frequency:

– the maximum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum frequency and the minimum and maximum sound pressure levels available at that frequency;
– the maximum frequency and the minimum and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

The measured total distortion, extended by the actual expanded uncertainty of measurement, shall not exceed the limit given in Table 6 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.3 for the class of sound calibrator.

NOTE 1 The total distortion may be measured using a rejection filter device (distortion factor meter) or an appropriate analyser.

NOTE 2 Where a choice of microphone model is available, a microphone model should be used for which the electroacoustical characteristic is designated by the letter P in IEC 61094-1 or IEC 61094-4.

Table A.3 – Maximum permitted expanded uncertainty of measurement for total distortion, over the appropriate range of environmental conditions

Range of nominal frequencies Hz	**Uncertainty of measurement for total distortion** %		
	Class LS	**Class 1**	**Class 2**
31,5 to <160	–	1,0	–
160 to 1 250	0,5	0,5	1,0
>1 250 to 16 000	–	1,0	–

NOTE 1 The above uncertainties are expressed in percentage distortion.

NOTE 2 For a class LS or class 2 sound calibrator the '–' symbols in the table indicate nominal frequency ranges for which this standard provides no tolerance limits.

A.5 Environmental tests

A.5.1 General

A.5.1.1 If the instruction manual specifies a battery of particular model and type, such a battery shall be fitted to the sound calibrator for the tests of the influence of variation in environmental conditions.

A.5.1.2 In order to reduce the time for testing the influence of temperature and humidity on the sound pressure level output of the sound calibrator, Subclause A.5.4 describes a set of abbreviated tests shorter than the full tests given in A.5.5, A.5.6 and A.5.7. These abbreviated tests measure the influence on the output of the sound calibrator of temperature and humidity combined. For the abbreviated tests, conformance to the requirements of this standard shall be demonstrated within tolerance limits smaller than those given in Tables 4 and 5. If a sound calibrator conforms to these reduced tolerance limits (see A.5.4.7) at all the test conditions then it shall be deemed to conform to the requirements of this standard, and the tests described in A.5.5, A.5.6 and A.5.7 shall not be performed. If the sound calibrator fails to conform within the reduced tolerance limits for any of the tests described in A.5.4 then the full tests of A.5.5, A.5.6 and A.5.7 shall be performed to determine whether the sound calibrator conforms to the requirements of this standard within the tolerance limits given in Tables 4 and 5.

A.5.1.3 For class LS and class 1 sound calibrators with a letter designation ‘C’, where appropriate, data supplied in the instruction manual shall be applied for the influence of static pressure, to correct measured sound pressure levels to reference environmental conditions. If a barometer is supplied with the sound calibrator, it shall be used to measure the static pressure.

NOTE The barometer may provide the data directly in the form to be used to correct measured sound pressure levels to the reference static pressure.

A.5.1.4 For class 2 sound calibrators with a letter designation ‘C’, data supplied in the instruction manual, for the influence of static pressure, temperature and relative humidity, shall be applied, where appropriate, to correct measured sound pressure levels to the reference environmental conditions. If a means of measuring the relevant environmental condition is supplied with the sound calibrator, the means shall be used to measure the relevant environmental condition.

NOTE The ‘supplied means’ may provide the data directly in the form to be used to correct measured sound pressure levels to the reference environmental conditions.

A.5.2 Influence of static pressure

A.5.2.1 The sound pressure level generated by the sound calibrator shall be measured over the applicable range of static pressure at the principal sound pressure level and at the principal frequency and all higher frequencies for which the instruction manual states that the instrument conforms to the requirements of this standard. Sound pressure levels shall be measured using one specified model and configuration of microphone for which the pressure and temperature coefficients over the required range are known. During the measurements, the temperature shall be kept constant as far as possible, preferably within ±2 °C of the reference temperature. The relative humidity at the reference static pressure shall be within ±20 % relative humidity of the reference relative humidity.

NOTE In a given volume of humid air, when the static pressure of the air in the volume is reduced by removing, or increased by adding, a quantity of humid air, the amount of water vapour in the volume will be reduced or increased in proportion. The relative humidity will therefore decrease or increase from the initial relative humidity. For practical reasons, this test for the influence of static pressure does not compensate for variations in relative humidity caused by removal, or addition, of quantities of air from the initial volume.

A.5.2.2 Sound pressure levels shall be measured at a minimum of 5 static pressures, in terms of the variation of the level of the output voltage from the microphone as the static pressure is changed, relative to the level of the output voltage from the microphone under reference environmental conditions. These static pressures shall include the reference static pressure and the minimum and maximum static pressure applicable for the class of sound calibrator. The sound calibrator shall be left to acclimatize for at least 10 min at each static pressure prior to performing a measurement. The static pressure shall be measured using a device for which the calibration is traceable to national standards, which shall enable the static pressure to be measured with an actual expanded uncertainty not exceeding 0,2 kPa for a confidence level of 95 %.

A.5.2.3 The measured sound pressure levels shall be corrected to reference environmental conditions, using the method described in A.5.1.3 or A.5.1.4 as appropriate, for the class of sound calibrator. Where applicable, a correction shall be applied to the microphone sensitivity level to take account of the variation in microphone sensitivity level with changing pressure, temperature and relative humidity.

A.5.2.4 The range of static pressure over which the absolute value of the difference between the measured sound pressure level (corrected where applicable if the sound calibrator has a letter 'C' designation) and the sound pressure level determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, does not exceed the tolerance limits given in Table 1 or Table 4, as appropriate for the static pressure and for the class of sound calibrator, shall be at least as wide as that stated in the instruction manual. This range of static pressure shall include that specified in 5.4.1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.4 for the class of sound calibrator.

Table A.4 – Maximum permitted expanded uncertainty of measurement for sound pressure level, over the specified range of environmental conditions

Range of nominal frequencies Hz	**Uncertainty of measurement for sound pressure level** dB		
	Class LS	**Class 1**	**Class 2**
31,5 to <160	–	0,25	–
160 to 1 250	0,10	0,15	0,20
>1 250 to 4 000	–	0,30	–
>4 000 to 8 000	–	0,35	–
>8 000 to 16 000	–	0,40	–

NOTE 1 These uncertainties of measurement are for the difference between the measured sound pressure level over the specified range of environmental conditions and the measurement of sound pressure level under reference environmental conditions

NOTE 2 These uncertainties include the uncertainty in manufacturer-supplied corrections, where applicable.

NOTE 3 These uncertainties do not include the uncertainty of measurement at reference environmental conditions, given in Table A.1.

NOTE 4 For a class LS or class 2 sound calibrator the '–' symbols in the table indicate ranges of nominal frequency for which this standard provides no tolerance limits.

A.5.2.5 The total distortion of the sound pressure signal generated by the sound calibrator shall be measured, according to A.4.6.1, at the lowest static pressure, for the principal frequency and the maximum sound pressure level setting for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.5.3 Acclimatization requirements for tests of the influence of variations in air temperature and relative humidity

A.5.3.1 The sound calibrator and measurement microphone shall be placed in an environmental chamber to test the influence of variations in air temperature and relative humidity on the sound pressure level, frequency and total distortion generated by the sound calibrator.

A.5.3.2 For tests of the influence of variations in air temperature and relative humidity the measurement microphone shall not be coupled to the sound calibrator and the power to the sound calibrator shall be switched off during all acclimatization periods.

A.5.3.3 Prior to any measurements, the sound calibrator shall be left, switched off, to stabilize at approximately reference conditions for 12 h.

A.5.3.4 Following this stabilization, for tests of the effects of temperature and humidity combined and for tests of the effect of relative humidity alone, at each measurement condition the sound calibrator and microphone shall be left to acclimatize for at least an additional 7 h prior to measurements. For tests of the effect of air temperature alone, this additional acclimatization period shall be at least 3 h.

A.5.3.5 Where the testing laboratory has the facility to couple the microphone to the sound calibrator without affecting the relative humidity, measurements may be performed following the time required for pressure equalization due to coupling of the microphone and calibrator. If this capability is not available, a further acclimatization period of 3 h shall be allowed before commencing measurements.

A.5.4 Abbreviated test of influence of temperature and humidity combined

A.5.4.1 The sound pressure level and frequency of sound generated by the sound calibrator at the principal sound pressure level and the principal frequency shall be measured for the following combinations of temperature and relative humidity, applicable to the class of sound calibrator:

Class LS reference temperature and relative humidity

– a temperature of 16 °C and relative humidity of 25 %

– a temperature of 30 °C and a relative humidity of 90 %

Class 1 reference temperature and relative humidity

– a temperature of −10 °C and relative humidity of 65 %

– a temperature of 5 °C and relative humidity of 25 %

– a temperature of 40 °C and relative humidity of 90 %

– a temperature of 50 °C and a relative humidity of 50 %

Class 2 reference temperature and relative humidity

– a temperature of 0 °C and relative humidity of 30 %

– a temperature of 40 °C and a relative humidity of 90 %

During the measurements, the static pressure shall be kept constant as far as possible, preferably within +2,0 kPa to −4,0 kPa of the reference static pressure.

The tolerance limits on the specified test conditions are ±2,5 °C and ±10 % relative humidity. Sound pressure levels and frequencies shall be measured using one specified model and configuration of microphone for which the pressure, temperature and relative humidity coefficients over the required range are known. The temperature and relative humidity shall be measured using devices for which the calibrations are traceable to national standards. These devices shall enable the relevant environmental condition to be measured in such a way that the ability of a sound calibrator to conform to the requirements for the relevant class is not affected. The actual expanded uncertainties of measurement shall not exceed 0,5 °C and 5 % relative humidity respectively.

NOTE The tolerance limits on the specified test conditions include the actual expanded uncertainties of measurement.

Following an initial measurement of sound pressure level and frequency at the reference temperature and relative humidity, measurements shall be performed in decreasing order of the specified temperatures. A final measurement shall then be made at the reference temperature and relative humidity.

NOTE The indicated combinations of temperature and relative humidity were chosen in consideration of the dewpoints that were obtainable within available environmental test facilities. The combinations also reflect the range of environmental conditions for general applications of class LS, class 1 and class 2 sound calibrators.

A.5.4.2 Changes in sound pressure level and frequency of the sound generated by the sound calibrator shall be measured in terms of the variation of the output voltage and frequency of the signal from the microphone as the temperature and relative humidity are changed, relative to the output voltage and frequency of the signal from the microphone for the first measurement at the reference temperature and relative humidity.

A.5.4.3 The measured sound pressure levels shall be corrected to reference environmental conditions, using the method described in A.5.1.3 or A.5.1.4 as appropriate, for the class of sound calibrator. Where applicable, a correction shall be applied to the microphone sensitivity level to take account of the variation in microphone sensitivity level with changing temperature, relative humidity and static pressure.

A.5.4.4 For multi-level or multi-frequency sound calibrators, or both, additional measurements of sound pressure level and frequency shall be performed at the reference temperature and relative humidity for the following combinations of sound pressure level and frequency:

– the maximum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum frequency and the minimum and maximum sound pressure levels available at that frequency;
– the maximum frequency and the minimum and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.5.4.5 For multi-level or multi-frequency sound calibrators, or both, further measurements shall be performed at the maximum and minimum temperature and associated relative humidity given in A.5.4.1 for the appropriate class. The following combinations of sound pressure level and frequency shall be used:

– the principal sound pressure level and principal frequency;
– the maximum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum sound pressure level and the minimum and maximum frequencies available at that sound pressure level;
– the minimum frequency and the minimum and maximum sound pressure levels available at that frequency;
– the maximum frequency and the minimum and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

A.5.4.6 Changes in sound pressure level and frequency of the sound generated by the sound calibrator shall be measured in terms of the variation of the output voltage and frequency of the signal from the microphone as the temperature and relative humidity are changed, relative to the output voltage and frequency of the signal from the microphone for the measurement at reference temperature and relative humidity.

A.5.4.7 The absolute value of the difference between the measured sound pressure levels (corrected where applicable if the sound calibrator has a letter 'C' designation) and the first measurement of the corresponding sound pressure level at the appropriate sound pressure level and frequency at reference temperature and relative humidity, extended by the actual expanded uncertainty of measurement, shall not exceed the reduced tolerance limits derived from those given in Table 4 as follows: for class LS and class 1 sound calibrators the applicable tolerance limits are those given in Table 4 reduced by 0,05 dB, and for class 2 sound calibrators are those given in Table 4 reduced by 0,10 dB. The absolute value of the difference in per cent between the measured frequencies and the first measurement of the corresponding frequency at reference temperature and relative humidity, extended by the actual expanded uncertainty of measurement, shall not exceed the reduced tolerance limits derived from those in Table 5 as follows: for class LS, class 1 and class 2 sound calibrators the applicable tolerance limits are 0,8 %, 0,8 % and 1,6 % respectively. Actual expanded uncertainties of measurement shall not exceed those given in Table A.4 and Table A.5 for the class of sound calibrator.

Table A.5 – Maximum permitted expanded uncertainty of measurement for frequency, over the specified range of environmental conditions

Uncertainty of measurement for frequency %		
Class LS	**Class 1**	**Class 2**
0,3	0,3	0,3
NOTE Expanded uncertainties of measurement are expressed as a percentage of the specified frequency.		

A.5.5 Influence of air temperature

A.5.5.1 If required by the results of the tests described in A.5.4, the sound pressure level and frequency of the sound generated by the sound calibrator shall be measured over the applicable range of air temperature at the principal sound pressure level and principal frequency. Where the sound calibrator is a multi-level or multi-frequency sound calibrator, or both, measurements shall be repeated at

– the maximum sound pressure level and the minimum, principal and maximum frequencies available at that sound pressure level;

– the minimum sound pressure level and the minimum, principal and maximum frequencies available at that sound pressure level;

– the minimum frequency and the minimum, principal and maximum sound pressure levels available at that frequency;

– the maximum frequency and the minimum, principal and maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

Measurements of sound pressure level and frequency shall be performed using one specified model and configuration of microphone for which the temperature, pressure and relative humidity coefficients over the required range are known. During the measurements, the static pressure shall be kept constant as far as possible, preferably within +2,0 kPa to −4,0 kPa of the reference static pressure, and the relative humidity shall be kept constant as far as possible at a stated humidity within ±20 % relative humidity of the reference relative humidity.

A.5.5.2 Changes in sound pressure level and frequency of the sound generated by the sound calibrator shall be measured in terms of the variation of the output voltage and frequency of the signal from the microphone as the temperature is changed, relative to the output voltage and frequency of the signal from the microphone under reference environmental conditions. Measurements shall be performed at a minimum of five temperatures. These shall include the reference temperature and the minimum and maximum temperature applicable for the class of sound calibrator, and two other temperatures outside the range from 20 °C to 26 °C. The temperature shall be measured using a device for which the calibration is traceable to national standards. This device shall enable the temperature to be measured such that the ability of a sound calibrator to conform to the requirements for the relevant class is not affected. Actual expanded uncertainty of measurement for this device shall not exceed 0,5 °C.

NOTE 1 It is important to monitor the relative humidity each time the air temperature is changed to ensure that it remains within the tolerance limits specified in A.5.5.1.

NOTE 2 Rapid changes of temperature in the chamber should be avoided.

NOTE 3 Care should be taken to avoid condensation as the temperature of the air in the environmental chamber is changed.

NOTE 4 If the testing laboratory considers that the 3 h acclimatization time is inadequate, this time may be increased.

A.5.5.3 The measured sound pressure levels shall be corrected to reference environmental conditions, using the method described in A.5.1.3 or A.5.1.4 as appropriate, for the class of sound calibrator. Where applicable, a correction shall be applied to the microphone sensitivity level to take account of the variation in the microphone sensitivity level with changing temperature, pressure and relative humidity.

A.5.5.4 The range of air temperature over which

– the absolute value of the difference between the measured sound pressure level (corrected where applicable if the sound calibrator has a letter 'C' designation) and the corresponding sound pressure level determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, does not exceed the tolerance limits given in Table 4, and

– the absolute value of the difference in per cent between the measured frequency and the frequency determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, does not exceed the tolerance limits given in Table 5

shall be at least as wide as that specified in the instruction manual, which shall include the range given in 5.4.1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Tables A.4 and A.5 respectively for the class of sound calibrator.

A.5.6 Influence of relative humidity

A.5.6.1 If required by the results of the tests described in A.5.4, the sound pressure level generated by the sound calibrator at the principal sound pressure level and the principal frequency shall be measured over the applicable range of relative humidity. Where the sound calibrator is a multi-level or multi-frequency sound calibrator, or both, measurements shall be repeated at

– the maximum sound pressure level and the minimum, principal and maximum frequencies available at that sound pressure level;

– the minimum frequency and the maximum sound pressure level available at that frequency;

– the maximum frequency and the maximum sound pressure levels available at that frequency

for which the instruction manual states that the instrument conforms to the requirements of this standard.

Measurements of sound pressure level and frequency shall be performed using one specified model and configuration of microphone for which the pressure, temperature and humidity coefficients over the required range are known. During the measurements, the static pressure and temperature shall be kept constant as far as possible, preferably within +2,0 kPa to −4,0 kPa of the reference static pressure, and within ±2 °C of the reference temperature.

A.5.6.2 Changes in sound pressure level and frequency of the sound generated by the sound calibrator shall be measured in terms of the variation of the level of the output voltage and frequency of the signal from the microphone as the relative humidity is changed, relative to the level of the output voltage and frequency of the signal from the microphone under reference environmental conditions, at a minimum of five relative humidities. These shall include the reference relative humidity and the minimum and maximum relative humidity applicable for the class of sound calibrator as specified in 5.4.1, and two other relative humidities outside the range from 40 % to 65 %. The relative humidity shall be measured using a device for which the calibration is traceable to national standards. This device shall enable the relative humidity to be measured such that the ability of a sound calibrator to conform to the requirements for the relevant class is not affected. Actual expanded uncertainty of measurement for this device shall not exceed 5 % relative humidity.

A.5.6.3 The measured sound pressure levels shall be corrected to reference environmental conditions, using the method described in A.5.1.3 or A.5.1.4 as appropriate, for the class of sound calibrator. Where applicable, a correction shall be applied to the microphone sensitivity level to take account of the variation in microphone sensitivity level with changing relative humidity, pressure and temperature.

A.5.6.4 The range of relative humidity over which

– the absolute value of the difference between the measured sound pressure level (corrected where applicable if the sound calibrator has a letter 'C' designation) and the corresponding sound pressure level determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, does not exceed the tolerance limits given in Table 4, and
– the absolute value of the difference in per cent between the measured frequency and the frequency determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, does not exceed the tolerance limits given in Table 5

shall be at least as wide as that specified in the instruction manual, which shall include the range given in 5.4.1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Tables A.4 and A.5 respectively for the class of sound calibrator.

A.5.7 Influence of temperature and humidity combined

A.5.7.1 If required by the results of the tests described in A.5.4, the sound pressure level and frequency of the sound generated by the sound calibrator at the principal sound pressure level and the principal frequency shall be measured at the following combinations of temperature and relative humidity, applicable to the class of sound calibrator.

For class LS sound calibrators:

– the reference temperature and relative humidity
– a temperature of 16 °C and relative humidity of 25 %
– a temperature of 30 °C and a relative humidity of 90 %

For class 1 sound calibrators:

– the reference temperature and relative humidity
– a temperature of −10 °C and relative humidity of 65 %
– a temperature of 40 °C and a relative humidity of 90 %

For class 2 sound calibrators:

– the reference temperature and relative humidity
– a temperature of 0 °C and relative humidity of 30 %
– a temperature of 40 °C and a relative humidity of 90 %

The tolerance limits on the nominal temperatures are ±2,5 °C and on nominal relative humidity are ±10 % relative humidity.

A.5.7.2 Measurements of sound pressure level and frequency shall be performed using one specified model and configuration of microphone for which the pressure, temperature and humidity coefficients over the required range are known. During the measurements the static pressure shall be kept constant as far as possible, preferably within +2,0 kPa to −4,0 kPa

of the reference static pressure. The actual expanded uncertainties of the devices used to measure temperature and relative humidity shall not exceed 0,5 °C and 5 % relative humidity respectively.

NOTE The tolerance limits on the specified test conditions include the actual expanded uncertainties of measurement.

A.5.7.3 Changes in sound pressure level and frequency of the sound generated by the sound calibrator shall be measured in terms of the variation of the output voltage and frequency of the signal from the microphone as the temperature and relative humidity are changed, relative to the output voltage and frequency of the signal from the microphone under reference environmental conditions. The temperature and relative humidity shall be measured using devices for which the calibrations are traceable to national standards. These devices shall enable the relevant environmental conditions to be measured adequately so that the ability of a sound calibrator to conform to the specifications for the relevant class is not affected.

A.5.7.4 The measured sound pressure levels shall be corrected to reference environmental conditions, using the method described in A.5.1.3 or A.5.1.4 as appropriate for the class of sound calibrator. Where applicable, a correction shall be applied to the microphone sensitivity level to take account of the variation in microphone sensitivity level with changing temperature, relative humidity and pressure.

A.5.7.5 The absolute value of the difference between each measured sound pressure level (corrected where applicable if the sound calibrator has a letter 'C' designation) and the corresponding sound pressure level determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 4 for the class of sound calibrator. The absolute value of the difference in per cent between each measured frequency and the corresponding frequency determined under reference environmental conditions, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 5 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.4 and Table A.5 for the class of sound calibrator.

A.6 Electromagnetic compatibility

A.6.1 General

A.6.1.1 The tests described in this clause shall be performed unless the particular configuration of the sound calibrator renders them inappropriate, in which case equivalent tests shall be substituted.

A.6.1.2 During testing, the sound calibrator shall be set to the mode of operation specified in the instruction manual as appropriate for the test being performed. It shall be operating and powered by the preferred power supply specified in the instruction manual.

A.6.1.3 Full details of the equipment necessary to perform the tests and the detailed test methods are mostly contained in other standards, with additional requirements given in this clause. These other standards, listed in Clause 2, shall be referred to for all relevant tests.

A.6.1.4 Uncertainties of measurement of the electromagnetic and electrostatic characteristics shall be as specified in the appropriate standards. The actual expanded uncertainties of measurement of the testing laboratory for the sound calibrator shall not exceed those given in this clause.

A.6.2 Radiofrequency emissions

A.6.2.1 The sound calibrator shall be configured and set as specified in the instruction manual to produce the greatest radiofrequency emissions in the frequency range being investigated.

A.6.2.2 Radiofrequency emissions shall be measured as described in Clauses 6 and 10 of CISPR 22:1997. All measured emissions shall conform to the requirements for enclosure ports in Table 1 of CISPR/IEC 61000-6-3.

A.6.2.3 The sound calibrator shall initially be tested in the reference orientation stated in the instruction manual. A microphone of a model specified in the instruction manual for use with the sound calibrator shall be inserted into the cavity of the sound calibrator.

A.6.2.4 Maintaining the configuration of A.6.2.1 and A.6.2.3, the sound calibrator shall be tested for radiofrequency emissions in at least one other plane approximately orthogonal to the reference orientation, within the limits of suitable positioning for the radiofrequency measuring system employed.

A.6.2.5 Any fixtures and fittings used to maintain the position of the sound calibrator (including the microphone and cable, if appropriate) shall be such as to have no significant influence on the measurement of any radiofrequency emissions from the sound calibrator.

A.6.2.6 If the sound calibrator is fitted with any connection device that allows interface or interconnection cables to be attached to it, then all tests of radiofrequency emissions shall be performed with cables connected to all available connection devices. All cables shall be left unterminated and shall be arranged as described in Clause 8 of CISPR 22:1997, unless the manufacturer of the sound calibrator also supplies the device connected to the sound calibrator by this cable, in which case all items shall be tested when connected together.

A.6.3 Electrostatic discharges

A.6.3.1 The equipment required and methods of testing for electrostatic discharges shall be as described in IEC 61000-4-2.

A.6.3.2 If the sound calibrator is fitted with connection devices that are not required as part of the configuration for the normal mode of operation, then no cables shall be fitted during the electrostatic-discharge tests. Discharges shall not be made to pins on connectors that are recessed behind the exterior surface of either the connector or the sound calibrator.

A.6.3.3 Any supports or other items used to maintain the position of the sound calibrator during testing shall not obscure any part of the sound calibrator required for access for electrostatic discharge testing, nor shall they influence the testing of the sound calibrator. A microphone of a model specified for use with the sound calibrator shall be inserted into the cavity of the sound calibrator. The sound calibrator shall be set in accordance with the instruction manual for normal usage at the principal frequency and principal sound pressure level.

A.6.3.4 Contact and air discharges at the maximum voltage of both polarities shall each be applied 10 times to all appropriate parts of the sound calibrator.

NOTE Care should be taken to ensure that the sound calibrator is fully discharged from any effects of each test before repeating the application of a discharge.

A.6.3.5 After a discharge, the sound calibrator shall return to the same operating state as before the discharge. During the test, unquantified changes in performance are permitted.

A.6.3.6 If the instruction manual specifies a performance degradation or loss of function after the discharge tests, this degradation or loss of function shall not result in any permanent reduced operation or change of configuration.

A.6.4 Immunity to power- and radio-frequency fields

A.6.4.1 The equipment required and methods of testing for radiofrequency fields shall be as described in IEC 61000-4-3.

A.6.4.2 Testing shall first be performed for the reference orientation stated in the instruction manual with a microphone or ‘remote-microphone’ adaptor inserted into the cavity of the sound calibrator. The sound calibrator shall be set to operate at the principal sound pressure level and principal frequency. The sound pressure level generated in the absence of the electromagnetic field shall be recorded.

NOTE In order to avoid possible effects of electromagnetic fields on the microphone, a ‘remote-microphone’ adaptor including a non-metallic tube may be used between the sound calibrator cavity and a microphone located in an area where the electric field strength is less than that to which the sound calibrator is subjected.

A.6.4.3 Tests for immunity to radiofrequency fields shall be performed either as a continuous frequency sweep or at discrete frequencies in accordance with IEC 61000-4-3, Clause 8, except that increments of up to 4 % for frequencies less than 500 MHz and up to 2 % for all other frequencies may be substituted for the 1 % specified in IEC 61000-4-3. Dwell time at each frequency shall be appropriate to the sound calibrator under test. Testing at a limited number of discrete frequencies does not remove the need for the sound calibrator to conform to the requirements of this standard at all frequencies within the specified range.

NOTE The 1 % frequency increments specified in IEC 61000-4-3 may be required for demonstrating conformance with other standards or requirements.

A.6.4.4 If the sound calibrator is fitted with any connection device that allows interface or interconnection cables to be attached to it, then all tests for immunity to power- and radio-frequency fields shall be performed with cables connected to all available connection devices. All cables shall be left unterminated and shall be arranged as described in Clause 8 of CISPR 22:1997, unless the manufacturer of the sound calibrator also supplies the device connected to the sound calibrator by this cable, in which case all items shall be tested when connected together.

A.6.4.5 Power-frequency fields shall be as specified in 5.8.4.1. Tests of susceptibility to power-frequency fields shall be performed with the sound calibrator applied to a microphone in a manner that has no influence on the power-frequency field. The microphone shall be of a model stated in the instruction manual for use with the sound calibrator.

A.6.4.6 Maintaining the configuration of A.6.4.2 and A.6.4.4, the sound calibrator shall be tested in at least one other plane, approximately orthogonal to the plane containing the principal axis of the reference orientation, within the limits of suitable positioning for the radio-frequency transmitting system employed.

A.6.4.7 The procedure given in the instruction manual shall be followed to ensure that the level of ambient sound reaching the microphone during testing is sufficiently low that the sound calibrator operates as intended. During testing, the sound calibrator shall remain fully operational and in the same configuration as it was before testing commenced.

The absolute value of the difference between the measured sound pressure level and the sound pressure level measured in the absence of the power-frequency or radiofrequency field, extended by the actual expanded uncertainty of measurement, shall not exceed the requirements of 5.8.4.2. Actual expanded uncertainties of measurement shall not exceed 0,05 dB for all classes of sound calibrator. This uncertainty does not include any contribution from measurement of the electromagnetic field.

A.6.4.8 If the instruction manual states that the sound calibrator conforms to the requirements of this standard at any other combinations of sound pressure level and frequency, in addition to the principal sound pressure level and principal frequency, the tests for immunity to power- and radiofrequency fields shall be repeated as follows:

– for multi-level single-frequency sound calibrators, all sound pressure levels for which the instruction manual states that the instrument conforms to the requirements of this standard shall be tested;

– for multi-frequency single-level sound calibrators, all frequencies for which the instruction manual states that the instrument conforms to the requirements of this standard shall be tested;

– for multi-level, multi-frequency sound calibrators all frequencies for which the instruction manual states that the instrument conforms to the requirements of this standard shall be tested at the minimum sound pressure level for which conformance with this standard is stated;

– for multi-level, multi-frequency sound calibrators all sound pressure levels for which the instruction manual states that the instrument conforms to the requirements of this standard shall be tested at the principal frequency.

A.6.4.9 In each case the absolute value of the difference between the measured sound pressure level and the sound pressure level measured in the absence of the power-frequency or radiofrequency field, extended by the actual expanded uncertainty of measurement, shall not exceed the requirements of 5.8.4.2. Actual expanded uncertainties of measurement shall not exceed 0,05 dB for all classes of sound calibrator. This uncertainty does not include any contribution from measurement of the electromagnetic field.

Annex B
(normative)

Periodic tests

B.0 Introduction

B.0.1 This annex gives details of the periodic tests applicable to class LS, class 1 and class 2 sound calibrators. It aims at ensuring that testing is performed in a consistent manner at all testing laboratories. All applicable tests described in this annex shall be performed.

B.0.2 Conformance to the requirements of this annex is demonstrated when the result of a measurement or the absolute value of the difference between the result and the design goal, as appropriate, extended by the actual expanded uncertainty of measurement of the testing laboratory, does not exceed the specified tolerance limit. Laboratories performing these tests shall calculate the uncertainties associated with all the measurements in accordance with the guidelines given in the ISO/IEC *Guide to the expression of uncertainty in measurement*. Actual expanded uncertainties shall be calculated for a level of confidence of 95 %, using the necessary coverage factor. Where a testing laboratory is only required to make a single measurement it is necessary for the laboratory to make an estimate of the random contribution to the total uncertainty, using an earlier evaluation based on several measurements for a similar sound calibrator.

NOTE Generally a coverage factor of 2 approximates to a level of confidence of 95 %, unless the contributions are such that is necessary to use a different coverage factor to maintain the 95 % level of confidence.

B.0.3 The expanded uncertainties of measurement given for the corresponding tests in Annex A are also the maximum permitted for demonstration of conformance to the requirements of this annex. If the actual expanded uncertainty of a measurement performed by the test laboratory exceeds the maximum permitted value, the measurement shall not be used to demonstrate conformance to the requirements of this annex.

B.0.4 For legal metrology purposes, the relevant periodic tests are those described in this Annex B. These tests apply to both initial and subsequent verification. Following successful testing to Annex B, if desired, the sound calibrator may be marked with a verification mark in accordance with national regulations.

B.0.5 The test laboratory shall use instruments with current calibrations for the appropriate quantities. The calibrations shall be traceable to national standards, as required.

B.1 Submission for test

The sound calibrator, together with all relevant accessories (such as adaptors or barometer), shall be submitted for test together with a copy of the instruction manual, if required by the testing laboratory. A class LS sound calibrator shall also be supplied with an individual calibration chart.

B.2 Preliminary inspection

Prior to any measurements, the sound calibrator and all accessories shall be visually inspected, and any controls operated to ensure that they are in working order. It shall be established that the power supply of the instrument is within the operating limits specified in the instruction manual, by using the method specified in the instruction manual.

B.3 Performance tests

B.3.1 Orientation

If a specific orientation for application of the sound calibrator is stated in the instruction manual, this orientation shall be used for testing.

B.3.2 Environmental conditions

B.3.2.1 All tests in Clause B.3 shall be carried out within the following ranges of environmental conditions: 80 kPa to 105 kPa, 20 °C to 26 °C and 25 % to 70 % relative humidity.

B.3.2.2 For class LS and class 1 sound calibrators with a letter designation 'C', where appropriate, data supplied in the instruction manual shall be applied for the influence of static pressure, to correct measured sound pressure levels to reference environmental conditions. If a barometer is supplied with the sound calibrator it shall be used to measure the static pressure.

NOTE The barometer may provide the data directly in the form to be used to correct measured sound pressure levels to the reference static pressure.

B.3.2.3 For class 2 sound calibrators with a letter designation 'C', data supplied in the instruction manual, for the influence of static pressure, temperature and relative humidity, shall be applied, where appropriate, to correct measured sound pressure levels to the reference environmental conditions. If a means of measuring the relevant environmental condition is supplied with the sound calibrator, the means shall be used to measure the relevant environmental condition.

NOTE The 'supplied means' may provide the data directly in the form to be used to correct measured sound pressure levels to the reference environmental conditions.

B.3.3 Additional equipment

If a barometer is provided with the sound calibrator, prior to making any measurements of the sound pressure level generated by the sound calibrator, the indication of the barometer shall be checked by comparison with that of a calibrated precision barometer at the prevailing static pressure. The reading of the barometer under test shall be recorded, and if tolerances for the measurement of static pressure are provided in the instruction manual for the sound calibrator, the indicated static pressure shall be within the limits of the tolerances given in the instruction manual.

NOTE A single-point pressure check of a barometer gives no information about performance at other static pressures. It is therefore good practice to compare the indication of the supplied barometer with that of a calibrated precision barometer over the applicable pressure range. OIML International Recommendation R97 gives information on suitable test procedures.

B.3.4 Sound pressure level

B.3.4.1 Following coupling of the microphone to the sound calibrator, the time specified in the instruction manual shall be allowed for the microphone and sound calibrator to stabilize. The sound pressure level generated by the sound calibrator shall then be measured, as an average over 20 s of operation, at the principal sound pressure level and principal frequency. For class LS sound calibrators the microphone shall be a laboratory standard microphone as specified in IEC 61094-1. For class 1 and class 2 sound calibrators the microphone shall be a working standard microphone as specified in IEC 61094-4.

NOTE 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.

B.3.4.2 The procedure given in the instruction manual shall be followed to ensure that the level of ambient sound reaching the microphone during testing is sufficiently low that the sound calibrator operates as intended.

B.3.4.3 Sound pressure levels shall be measured using one of the two following methods.

B.3.4.3.1 Microphone method

The sound pressure level generated by the sound calibrator under test shall be measured using a calibrated microphone or microphone system. The insert voltage technique (see IEC 61094-2) or an equivalent method may be used.

NOTE It is recommended that the testing laboratory maintain two independent lines of traceability to national standards, by use of the microphone or microphone system and a calibrated in-house artefact, such as a sound calibrator. The performance of the calibrated microphone or microphone system should be verified using the in-house artefact before and after making any measurements of conformance according to this annex.

B.3.4.3.2 Sound calibrator comparison method

The sound pressure level generated by the sound calibrator under test shall be measured by comparison with the sound pressure level generated by a calibrated sound calibrator.

NOTE 1 It is recommended that the testing laboratory maintain two independent lines of traceability to national standards, by use of the calibrated sound calibrator and a calibrated in-house artefact, such as another sound calibrator, or a microphone or microphone system. The performance of the calibrated sound calibrator should be verified using the in-house artefact before and after making any measurements of conformance according to this annex.

NOTE 2 When the calibrated sound calibrator does not operate at the same sound pressure level and frequency as the sound calibrator under test, it will be necessary for the testing laboratory to establish the level linearity and frequency response of the measurement system at all frequencies of interest.

B.3.4.4 Measurements

B.3.4.4.1 Using the method described in B.3.4.3.1 or B.3.4.3.2, the measurement of the principal sound pressure level at the principal frequency shall be replicated twice to give a total of three tests. The absolute value of the difference between the mean measured sound pressure level and the specified sound pressure level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.1 for the class of sound calibrator.

B.3.4.4.2 For multi-frequency sound calibrators, measurements of the principal sound pressure level, as described in B.3.4.4.1, shall be repeated for the maximum and minimum frequency settings of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard.

B.3.4.4.3 The measurement of sound pressure level shall be repeated (excluding replications) for all other combinations of sound pressure level and frequency settings for which the instruction manual states that the instrument conforms to the requirements of this standard. The absolute value of the difference between each measured sound pressure level and the corresponding specified sound pressure level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 1 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.1 for the class of sound calibrator.

NOTE 1 Testing will normally be performed for one model of microphone only.

NOTE 2 The model of microphone used for each subsequent periodic verification test of the same sound calibrator should preferably be the same model as for any previous periodic verification. Provided no sensitivity adjustments have been made to the sound calibrator, this test procedure provides information on long-term stability.

B.3.5 Frequency

The frequency of the sound generated by the sound calibrator coupled to the microphone used in B.3.4 shall be measured, at the principal sound pressure level, for each frequency setting of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard. The absolute value of the difference in per cent between each measured frequency and the corresponding specified frequency, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 3 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.2 for the class of sound calibrator.

B.3.6 Total distortion

Total distortion of the sound pressure signal generated by the sound calibrator shall be measured over the frequency range from at least 22,5 Hz to 20 kHz, with the microphone used in B.3.4, at the maximum and minimum sound pressure level settings available at each frequency for which the instruction manual states that the instrument conforms to the requirements of this standard. The measured total distortion, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given in Table 6 for the class of sound calibrator. Actual expanded uncertainties of measurement shall not exceed those given in Table A.3 for the class of sound calibrator.

NOTE 1 The total distortion may be measured using a rejection filter device (distortion factor meter) or an appropriate analyser.

NOTE 2 Where a choice of microphone model is available, a microphone model should be used for which the electroacoustical characteristic is designated by the letter P in IEC 61094-1 or IEC 61094-4.

B.4 Calibration of the sound calibrator with other models of microphone

Clause B.3 provides details of the tests necessary to demonstrate conformance of a sound calibrator to the requirements given in this annex for periodic testing, using a particular microphone model. In addition to these tests, it is possible that a calibration of the sound calibrator with other models of microphone may be required. For these additional tests, the measured sound pressure level, frequency and total distortion are to be stated in the test documentation. In this case the measurements shall be performed using the required model(s) of microphone and the test methods described in Clause B.3. Any additional model(s) of microphone for which a calibration of the sound calibrator is required shall be model(s) intended for use with the particular model of sound calibrator. The method of measurement used, the measured values obtained and the corresponding actual expanded uncertainties of measurement shall be given in the test documentation.

B.5 Documentation

This clause is only a recommendation. The extent and content of the documentation provided by the test laboratory will vary depending on national regulations. However, following testing of a sound calibrator, the testing laboratory should issue a document containing, as a minimum, the following information:

a) the name and location of the laboratory performing the tests;

b) the name of the manufacturer or supplier and the model designation of the sound calibrator;

c) the serial number of the sound calibrator, together with details of any adaptors used;

d) the name of the manufacturer or supplier and the model and configuration of the microphone(s) used;

e) a statement as to the availability to the public of evidence, from a testing organization responsible for performing pattern evaluation tests, to demonstrate that the model of sound calibrator submitted for periodic testing had successfully completed the pattern evaluation tests of Annex A of this standard;

f) a statement that the sound calibrator has been tested as specified in Annex B of this standard;

g) where public evidence of conformance of the model of sound calibrator to the requirements of Annex A for pattern evaluation was available, and the results of the tests according to Annex B are satisfactory, a statement as follows: ‘As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class X requirements of IEC 60942:2003.’ A reference should be given to the source of the publicly available evidence that allowed this conclusion to be stated;

h) where public evidence of conformance of the model of sound calibrator to the requirements of Annex A for pattern evaluation was not available and the results of the tests according to Annex B are satisfactory, a statement as follows: ‘The sound calibrator has been shown to conform to the class X requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public

evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.'

i) the date(s) on which the periodic verification tests were performed;

j) a description of the methods used for the measurements;

k) the measured sound pressure level(s), corrected to the reference environmental conditions if the sound calibrator has a letter designation 'C', together with associated uncertainty(ies) and the information on the source (instruction manual or instrument, for example, a barometer) of the environmental correction data used, if any;

l) the measured frequency(ies) and total distortion(s), together with associated expanded uncertainty(ies) of measurement, as appropriate;

m) the environmental conditions at the time the tests were performed;

n) if any adjustments were made to the sound calibrator or a supplied barometer, all indications observed, or sound pressure levels measured, prior to adjustment;

o) where the sound calibrator does not conform to the requirements of Annex B of this standard for the designated class for the conditions under which the tests were performed, a statement indicating which tests did not conform;

p) where applicable, additional values of sound pressure level, frequency and total distortion, together with the expanded uncertainties of measurement, measured using other model(s) of microphone according to Clause B.4.

Annex C
(normative)

Format for the pattern evaluation report

C.0 Introduction

C.0.1 Sound calibrators that are submitted to the control of legal metrology services shall conform to the requirements given in this standard.

C.0.2 For legal metrology purposes, the tolerance limits stated in this standard are considered as the maximum permissible errors for pattern evaluation.

C.0.3 The pattern evaluation report given in this Annex C presents, together in a standardized format, the results of the various tests to which a pattern of a sound calibrator shall be submitted with a view to its approval. The tests are described in Annex A of this standard. All specified tests shall be performed, as applicable.

C.0.4 It is recommended that information on models of sound calibrator which have successfully undergone pattern evaluation be made publicly available by the testing laboratory.

C.1 Marking

Following successful testing to the requirements of Annex A, sound calibrators of the model tested may be marked with a pattern approval sign in accordance with national regulations, in addition to the markings required by 6.1.

C.2 Submission for test

C.2.1 The number of specimens of the same pattern of sound calibrator submitted for pattern evaluation testing shall conform to the requirement of A.1.1. As a minimum, the testing laboratory shall select two of the specimens of sound calibrator for pattern evaluation testing. At least one of these two specimens shall then be tested fully according to the procedures given in Annex A. The testing laboratory shall decide whether the full tests shall also be performed on the second specimen, or whether limited testing is adequate to provide approval of the pattern.

NOTE Depending on the number of specimens tested, the pattern approval may be limited to two years so that further experience with the pattern may be gained.

C.2.2 All accessories (for example, a barometer or connecting leads) described in the instruction manual shall be supplied with the sound calibrator.

C.2.3 An individual calibration chart containing all the information required by 6.2 shall be supplied with each class LS sound calibrator.

C.2.4 An instruction manual shall be supplied with the sound calibrator.

C.3 Pattern evaluation report

C.3.1 The following pages constitute the pattern evaluation report format for the testing of a pattern of sound calibrator to the requirements of Annex A. This pattern evaluation report consists of two parts. Part 1 gives a summary of the content of the report and statements on conformity, and verifies that all information required by this standard was available. Part 2 gives detailed test results. The two parts of the report may be completed by different organizations within the same country. Also, it is possible that all the tests in part 2 may not be performed by one laboratory, and that additional laboratories may be involved in the testing. In either of these cases, each organization or laboratory shall be responsible for completing the relevant parts of the pattern evaluation report. The full name and address of each organization and laboratory involved shall be supplied. For part 2, the tests that each laboratory performed shall be clearly identified in the pattern evaluation report.

C.3.2 In addition to the content given in the following pages, each pattern evaluation report shall display a header on each page giving the following information: reference to IEC 60942:2003 Annex C, the page number of the report, identification of the observer or operator, the date when the test was performed and a unique report identification number. For each table, the serial number of the sound calibrator under test, and information on the adaptor and the microphone used for the tests shall be clearly stated.

C.3.3 Relevant pages of the report, as applicable, shall be completed for each specimen of sound calibrator tested.

C.3.4 The tables in part 2 give details of the results that shall be supplied. Depending on the sound calibrator under test it will be necessary to extend or replicate these tables as appropriate, for example to cover several frequencies and sound pressure levels for multi-frequency or multi-level sound calibrators, or both.

SOUND CALIBRATORS

PATTERN EVALUATION REPORT

Report number .....

Sound calibrator model designation .....

The specifications and test requirements for sound calibrators are given in IEC 60942:2003. This pattern evaluation report gives details of the examinations and tests performed for the pattern of sound calibrator to determine conformance to the specifications.

The report is divided into two parts. Part 1 gives a summary of the content of the report and statements on conformity, and verifies that all information required by this standard was provided.

Part 1 has been completed according to the following example:

+	–	
x		Approved
	x	Not approved
n/a	n/a	Not applicable

Part 2 gives detailed test results.

OFFICE OR LABORATORY RESPONSIBLE FOR PART 1 OF THIS REPORT AND FOR DETERMINING APPROVAL OF THE PATTERN:

Name .....

Address .....

Signature .....

LABORATORY RESPONSIBLE FOR PART 2 OF THIS REPORT:

Name .....

Address .....

Signature .....

Where all the tests in Part 2 have not been performed by one laboratory, the above information shall be repeated for each laboratory, and the tests that each laboratory performed shall be clearly indicated within the report.

DATE OF THE REPORT: .....

PART 1

GENERAL INFORMATION CONCERNING THE PATTERN

Application No: .....

Manufacturer: .....

Manufacturer's address: .....

Applicant: .....

Applicant's address: .....

Instrument model: .....

Class of sound calibrator according to IEC 60942:2003 as specified in the instruction manual: .....

Number of specimens supplied: .....(at least five)

The following table gives details of the frequency(ies), sound pressure level(s) and configuration or models of microphone for which the instruction manual states conformance to the requirements of IEC 60942:2003 for the stated class.

Nominal frequency Hz	**Specified frequency** Hz	**Configuration or model of microphone**	**Nominal sound pressure level** dB re 20 μPa	**Specified sound pressure level** dB re 20 μPa

SUMMARY

Test number	Clause of IEC 60942: 2003	Description	+	–	Page number of test report	Remarks*
–	5	General examination				
–	6.1	Marking of the sound calibrator				
–	6.2	Individual calibration chart for class LS sound calibrator				
–	6.3	Instruction manual				
1	A.4.3	Sound pressure level**				
2	A.4.4	Sound pressure level stability – short-term level fluctuation				
3	A.4.5	Frequency				
4	A.4.6	Total distortion				
5	A.5.2	Influence of static pressure				
6	A.5.4	Abbreviated test of influence of temperature and humidity combined				
7	A.5.5	Influence of air temperature				
8	A.5.6	Influence of relative humidity				
9	A.5.7	Influence of temperature and humidity combined				
10	A.6.2	Radiofrequency emissions				
11	A.6.3	Electrostatic discharges				
12	A.6.4	Immunity to power- and radiofrequency fields				

* The page number of the report where the relevant remark appears shall be entered.

** The abbreviation SPL is used to represent sound pressure level in this report.

General

Subclause of IEC 60942 containing requirement	Description	+	–	Remarks
5.1.3	Calibration chart supplied if class LS sound calibrator			
5.1.7	Design and materials			
5.2.1.3	Principal sound pressure level at least 90 dB re 20 μPa			
5.3.1.1	Principal frequency in the range 160 Hz to 1 250 Hz			
5.3.1.2	Principal sound pressure level available at principal frequency			

Marking of the sound calibrator

Subclause of IEC 60942 containing requirement	Inscription or mark	+	–	Remarks
6.1 a)	Manufacturer's or supplier's name or trade mark			
6.1 b)	Model designation and serial number			
6.1 c)	Reference to IEC 60942:2003			
6.1 d)	Class of instrument, including the letter 'C' designation where applicable, and the quantity(ies) for which corrections need to be applied			
6.1 e)	A clear indication of all available combinations of sound pressure level and frequency that conform to the requirements of the class			
6.1 f)	The nominal sound pressure level or sound pressure levels			
6.1 g)	The nominal frequency or frequencies			
6.1 h)	Where possible, and applicable, an indication of the required orientation			
6.1 i)	If the sound calibrator is battery operated, the preferred battery type			
6.1 j)	Adaptors marked with model designations, where provided			

Instruction manual

Subclause of IEC 60942 containing requirement	Information	+	–	Remarks
6.3 a)	Identification of microphone models and configurations, adaptors and instructions to ensure sound calibrator operates as intended			
6.3 b)	For class LS – the nominal sound pressure level(s) and frequency(ies) For class 1 and class 2 – the specified sound pressure level(s) and frequency(ies) quoted with at least 0,1 dB resolution			
6.3 c)	Specific orientation of sound calibrator, if required			
6.3 d)	Elapsed time before specified sound pressure level and frequency stabilize Elapsed time necessary to stabilize micro-phone/sound calibrator combination after coupling			
6.3 e)	The principal sound pressure level			
6.3 f)	The principal frequency			
6.3 g)	The range of environmental conditions over which the sound calibrator is specified to operate, and the correction data, if applicable, together with the expanded uncertainties of measurement for the correction data. For class 2/C sound calibrators not supplied with a barometer, information on how to calculate the correction for the influence of static pressure when operating at different heights above sea-level			
6.3 h)	Identification of the combinations of sound pressure level and frequency available which conform to the requirements of IEC 60942 for the stated class			
6.3 i)	Recommended procedure to ensure that the ambient sound level is sufficiently low such the sound calibrator operates as intended at each level setting			
6.3 j)	For class LS and class LS/C sound calibrators, the typical change in sound pressure level produced by the sound calibrator with changes in the effective load volume of the inserted microphone			
6.3 k)	If applicable, types of battery and typical lifetime, details of any battery status indicator and its operation. The nominal, maximum and minimum supply voltages. Where applicable, method of connection to external power supply			

6.3 l)	For sound calibrators with letter 'C' designation, a statement giving the maximum expanded uncertainty of the measurement of environmental conditions such that the ability of a sound calibrator to conform to the requirements of the relevant class is not affected; where a barometer is supplied, details of the expanded uncertainty of measurement of static pressure using the barometer			
6.3 m)	For class LS sound calibrators where a barometer is required but not supplied, details of a suitable device for measuring static pressure			
6.3 n)	The configuration for the normal mode of operation			
6.3 o)	Details of any cables and accessories with which the sound calibrator conforms to the electromagnetic compatibility requirements			
6.3 p)	The reference orientation for testing effects of radio-frequency fields			
6.3 q)	If applicable, the unmodulated root-mean-square electromagnetic field strength greater than 10 V/m for which the sound calibrator conforms to IEC 60942:2003			
6.3 r)	The configuration, sound pressure level and frequency settings for greatest radiofrequency emissions			
6.3 s)	The configuration and connecting devices, if any, which produce minimum immunity to power- and radiofrequency fields			
6.3 t)	Details of the combinations of sound pressure level and frequency that do not conform to the requirements for the class, together with a description of their acoustical characteristics, and a statement of the nominal tolerance limits maintained about the design goals.			

PART 2
INFORMATION FOR TESTING

General information concerning the pattern is given in part 1 of this report.

More specific information used during testing is given below:

Specimens of sound calibrator submitted for test:

Specimen of sound calibrator	Sound calibrator serial number	Barometer model / serial number (if applicable)	Specimen selected for full tests*	Specimen selected for limited tests*
1				
2				
3				
4				
5				
* Indicate specimens selected by marking x in appropriate column and row of table				

Adaptors submitted:

Specimen of sound calibrator	Adaptor 1		Adaptor 2		Adaptor 3	
	IEC microphone classification or microphone model	Model of adaptor	IEC microphone classification or microphone model	Model of adaptor	IEC microphone classification or microphone model	Model of adaptor
1						
2						
3						
4						
5						

IEC microphone classification is according to the IEC 61094 series.

Accessories submitted:

Type of accessory	Manufacturer	Model	Serial number (if applicable)

Principal sound pressure level ..... dB re 20 μPa

Principal frequency ..... Hz

Static pressure range over which sound calibrator is specified to operate: ..... to ..... (kPa)

If letter 'C' designation sound calibrator –
details of static pressure correction data supplied: .....

Temperature range over which sound calibrator is specified to operate: ..... to ..... (^{o}C)

If letter 'C' designation sound calibrator (class 2 only for temperature) –
details of temperature correction data supplied: .....

Relative humidity range over which sound calibrator is specified to operate: ..... to ..... (%)

If letter 'C' designation sound calibrator (class 2 only for relative humidity) –
details of relative humidity correction data supplied: .....

Orientation: ..... Stabilizing times: .....

Battery: type .....; nominal voltage ..... V; number required .....

For each of the 12 tests described in this part 2 of the pattern evaluation report, the tolerance limits shown in the accompanying tables shall be those specified in Clause 5 of IEC 60942:2003. The maximum permitted expanded uncertainties of measurement shall be those specified in Annex A of IEC 60942:2003.

Microphones used during testing

Indicate the microphone used for each test by marking x in the appropriate column and row of table.

	Microphone number					
	1	2	3	4	5	6
Manufacturer						
Model						
Serial no.						
IEC classification from IEC 61094 series						
Method of calibration						
Pressure coefficient (if required) (dB/kPa)						
Temperature coefficient (if required) (dB/°C)						
Relative humidity coefficient (if required) (dB/ %)						
Test 1 Sound pressure level						
Test 2 Sound pressure level stability – short-term level fluctuation						
Test 3 Frequency						
Test 4 Total distortion						
Test 5 Influence of static pressure						
Test 6 Abbreviated test of temperature and humidity combined						
Test 7 Influence of air temperature						
Test 8 Influence of relative humidity						

Test 9 Influence of temperature and humidity combined						
Test 10 Radiofrequency emissions						
Test 11 Electrostatic discharges						
Test 12 Immunity to power- and radiofrequency fields						

Microphone number 1 and microphone number 2 shall be of the same model.

Test 1 Sound pressure level at and around reference environmental conditions
(5.2.2 and A.4.3.1 to A.4.3.4 of IEC 60942:2003)

Principal sound pressure level

Microphone number 1

Frequency setting Hz	**Specified SPL** dB re 20 μPa	**Mean measured SPL** dB re 20 μPa*	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between measured SPL and specified SPL extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB

* Corrected where necessary to reference environmental conditions, if sound calibrator has letter 'C' designation

Microphone number 2

Frequency setting Hz	**Specified SPL** dB re 20 μPa	**Mean measured SPL** dB re 20 μPa*	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between measured SPL and specified SPL extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB

* Corrected where necessary to reference environmental conditions, if sound calibrator has letter 'C' designation

Other sound pressure levels (5.2.2 and A.4.3.5 of IEC 60942:2003)

Table to be replicated for each additional sound pressure level

Microphone number 1

Frequency setting Hz	**Specified SPL** dB re 20 μPa	**Mean measured SPL** dB re 20 μPa*	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between measured SPL and specified SPL extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
* Corrected where necessary to reference environmental conditions, if sound calibrator has letter 'C' designation						

Static pressure range during measurements ___ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

Effect of reduced operating voltage on sound pressure level
(*5.2.4 and A.4.3.7 of IEC 60942:2003)*

Reduced operating voltage (within 5 % of minimum operating voltage) V

Microphone number 1

Settings – SPL and frequency	**Measured output voltage from microphone at nominal sound calibrator operating voltage** V	**Measured output voltage from microphone at reduced sound calibrator operating voltage** V	**Actual expanded uncertainty of measure-ment** dB	**Absolute value of difference between SPL measured at reduced operating voltage and SPL generated at nominal operating voltage extended by actual expanded uncertainty of measurement *** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
Principal SPL + principal frequency						
Maximum SPL + minimum frequency at that SPL setting						
Maximum SPL + maximum frequency at that SPL setting						
Minimum SPL + minimum frequency at that SPL setting						
Minimum SPL + maximum frequency at that SPL setting						
Minimum frequency + minimum SPL at that frequency						
Minimum frequency + maximum SPL at that frequency						
Maximum frequency + minimum SPL at that frequency						
Maximum frequency + maximum SPL at that frequency						

* Corrected where necessary to reference environmental conditions if sound calibrator has letter ‘C’ designation

NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.

These results are also used to verify that the sound calibrator conforms to the tolerance limits of Table 1 at the reduced sound calibrator operating voltage.

Effect of operation with an external power supply on sound pressure level
(*5.2.4 and A.4.3.9 of IEC 60942:2003)*

Microphone number 1

Settings – SPL and frequency	**Measured output voltage from microphone at nominal sound calibrator operating voltage** V	**Measured output voltage from microphone at maximum permitted sound calibrator supply voltage** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between SPL measured when sound calibrator powered by external supply voltage and SPL generated at nominal operating voltage extended by actual expanded uncertainty of measurement*** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
Principal SPL + principal frequency						
* Corrected where necessary to reference environmental conditions if sound calibrator has letter ‘C’ designation						

These results are also used to verify that the sound calibrator conforms to the tolerance limits of Table 1 at the maximum permitted sound calibrator operating voltage.

Static pressure range during measurements _____ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

Other microphone models *(5.2.2, 5.2.4 and A.4.3.10 of IEC 60942:2003)*

Unless the testing laboratory has reliable, justifiable evidence of the equivalence of other models of microphone, or of corrections to be applied, and presents details here to allow independent assessment, ALL OF TEST 1 SHALL BE REPEATED for all other microphone models. In this event, it will be necessary to replicate the above tables.

Test 2 Sound pressure level stability – short-term level fluctuation at and around reference environmental conditions
(*5.2.3, A.4.4.1 and A.4.4.3 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Ten measurements over period of 20 s

Microphone number 1

Maximum measured output voltage from microphone V	**Minimum measured output voltage from microphone** V	**Actual expanded uncertainty of measurement** dB	**One-half corresponding variation in SPL extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB

These results are also used to verify that the sound calibrator conforms to the tolerance limits of Table 1 for sound pressure level for all measured output sound pressure levels during the 20 s period.

Minimum sound pressure level and principal frequency

Ten measurements over period of 20 s

Microphone number 1

Maximum measured output voltage from microphone V	**Minimum measured output voltage from microphone** V	**Actual expanded uncertainty of measurement** dB	**One-half corresponding variation in SPL extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB

These results are also used to verify that the sound calibrator conforms to the tolerance limits of Table 1 for sound pressure level for all measured output sound pressure levels during the 20 s period.

Static pressure range during measurements _____ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

Test 3 Frequency *(5.3.2 and A.4.5.1 of IEC 60942:2003)*

Principal sound pressure level

Microphone number 1

Specified frequency Hz	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and specified frequency extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %

Effect of reduced operating voltage on frequency (*5.3.2 and A.4.5.2 of IEC 60942:2003)*

Reduced operating voltage (within 5 % of minimum operating voltage) V

Microphone number 1

Settings – SPL and frequency	**Specified frequency** Hz	**Measured frequency at reduced sound calibrator operating voltage** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency at reduced operating voltage and specified frequency extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
Principal SPL + principal frequency						
Maximum SPL + minimum frequency at that SPL setting						
Maximum SPL + maximum frequency at that SPL setting						
Minimum SPL + minimum frequency at that SPL setting						
Minimum SPL + maximum frequency at that SPL setting						
Minimum frequency + minimum SPL at that frequency						
Minimum frequency + maximum SPL at that frequency						
Maximum frequency + minimum SPL at that frequency						
Maximum frequency + maximum SPL at that frequency						
NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.						

Effect of operation with an external power supply on frequency
(*5.3.2 and A.4.5.4 of IEC 60942:2003)*

Settings – SPL and frequency	**Specified frequency** Hz	**Measured frequency at maximum permitted sound calibrator operating voltage** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency at maximum permitted operating voltage and specified frequency extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
Principal SPL + principal frequency						

Static pressure range during measurements _____ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

Test 4 Total distortion *(5.5 and A.4.6.1 of IEC 60942:2003)*

Maximum sound pressure level

Microphone number 1

Frequency setting Hz	**Measured distortion** %	**Actual expanded uncertainty of measurement** %	**Measured distortion extended by actual expanded uncertainty of measurement** %	**Maximum total distortion permitted** %	**Maximum permitted expanded uncertainty of measurement** %

Minimum sound pressure level

Microphone number 1

Frequency setting Hz	**Measured distortion** %	**Actual expanded uncertainty of measurement** %	**Measured distortion extended by actual expanded uncertainty of measurement** %	**Maximum total distortion permitted** %	**Maximum permitted expanded uncertainty of measurement** %

Effect of reduced operating voltage on total distortion
(5.5 and A.4.6.2 of IEC 60942:2003)

Reduced operating voltage (within 5 % of minimum operating voltage) V

Microphone number 1

Settings SPL and frequency	Measured distortion %	Actual expanded uncertainty of measurement %	Measured distortion extended by actual expanded uncertainty of measurement %	Maximum total distortion permitted %	Maximum permitted expanded uncertainty of measurement %
Maximum SPL + minimum frequency at that SPL setting					
Maximum SPL + maximum frequency at that SPL setting					
Minimum SPL + minimum frequency at that SPL setting					
Minimum SPL + maximum frequency at that SPL setting					
Minimum frequency + minimum SPL at that frequency					
Minimum frequency + maximum SPL at that frequency					
Maximum frequency + minimum SPL at that frequency					
Maximum frequency + maximum SPL at that frequency					
NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.					

Static pressure range during measurements ___ kPa to ____ kPa

Temperature range during measurements ____ °C to ____ °C

Relative humidity range during measurements ____ % to ____ %

Remarks:

Test 5 Influence of static pressure (*5.4 and A.5.2 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Sound pressure level

Target static pressure kPa	**Measured static pressure** kPa	**Measured output voltage from microphone** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and SPL measured at reference environmental conditions, extended by actual expanded uncertainty of measurement *** dB	**Tolerance limits**** dB	**Maximum permitted expanded uncertainty of measurement** dB
65,0						
101,3						
108,0						

* The correction applied shall take account of any variation in microphone sensitivity level with changing static pressure, temperature and relative humidity. For class LS or class 1 sound calibrators with a letter 'C' designation a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

** The tolerance limit shall be those specified in Table 1 or Table 4 as appropriate.

The above table is to be replicated for each frequency setting greater than the principal frequency.

Distortion

Maximum sound pressure level and principal frequency

Target static pressure kPa	**Measured static pressure** kPa	**Measured distortion** %	**Actual expanded uncertainty of measurement** %	**Measured distortion extended by actual expanded uncertainty of measurement** %	**Maximum total distortion permitted** %	**Maximum permitted expanded uncertainty of measurement** %
65,0						

Static pressure was measured using ……
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ kPa

Air temperature was measured using ……
(state manufacturer, model and serial no. of device used)

Air temperature range during measurements _____ °C to _____ °C

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using ……
(state manufacturer, model and serial no. of device used)

Relative humidity range during measurements for the air at ambient pressure _____ % to _____ %

Expanded uncertainty of measurement _____ %

Remarks:

Test 6 Abbreviated test of temperature and humidity combined
(*5.4, A.5.3 and A.5.4 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Sound pressure level

Target temperature and relative humidity °C and %	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured output voltage from micro-phone** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and first measure-ment of SPL at reference environmental conditions, extended by actual expanded uncertainty of measurement*** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measure-ment** dB
23 °C + 50 %							
23 °C + 50 %							

* The correction applied shall take account of any variation in microphone sensitivity level with changing temperature, relative humidity and static pressure. For class LS or class 1 sound calibrators with a letter 'C' designation, a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation, further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

Frequency

Target temperature and relative humidity °C and %	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and first measure-ment of frequency at reference environmental conditions, extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measure-ment** %
23 °C + 50 %							
23 °C + 50 %							

Static pressure was measured using ……
(state manufacturer, model and serial no. of device used)

Static pressure range during measurements _____ kPa to _____ kPa

Expanded uncertainty of measurement ___ kPa

Air temperature was measured using ……..
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using ……..
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ %

Remarks:

Additional measurements for multi-level and multi-frequency sound calibrators
(*5.4, A.5.3 and A.5.4 of IEC 60942:2003)*

Reference environmental conditions

Sound pressure level

Settings SPL and frequency	**Measured temperature** °C	**Measured relative humidity** %	**Measured output voltage from microphone** V
Maximum SPL + minimum frequency at that SPL setting			
Maximum SPL + maximum frequency at that SPL setting			
Minimum SPL + minimum frequency at that SPL setting			
Minimum SPL + maximum frequency at that SPL setting			
Minimum frequency + minimum SPL at that frequency			
Minimum frequency + maximum SPL at that frequency			
Maximum frequency + minimum SPL at that frequency			
Maximum frequency + maximum SPL at that frequency			
NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.			

Maximum temperature and maximum relative humidity
Minimum temperature and minimum relative humidity

For multi-level and multi-frequency sound calibrators it will be necessary to replicate the table below for each of the above sets of conditions.

Sound pressure level

Settings SPL and frequency	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured output voltage from microphone** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and SPL measured at reference environmental conditions, extended by actual expanded uncertainty of measurement *** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
Principal SPL + principal frequency							
Maximum SPL + minimum frequency at that SPL setting							
Maximum SPL + maximum frequency at that SPL setting							
Minimum SPL + minimum frequency at that SPL setting							
Minimum SPL + maximum frequency at that SPL setting							
Minimum frequency + minimum SPL at that frequency							
Minimum frequency + maximum SPL at that frequency							

Maximum frequency + minimum SPL at that frequency							
Maximum frequency + maximum SPL at that frequency							

* The correction applied shall take account of any variation in microphone sensitivity level with changing temperature, relative humidity and static pressure. For class LS or class 1 sound calibrators with a letter 'C' designation, a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation, further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.

Reference environmental conditions

Frequency

Settings SPL and frequency	**Measured temperature** °C	**Measured relative humidity** %	**Measured frequency** Hz
Maximum SPL + minimum frequency at that SPL setting			
Maximum SPL + maximum frequency at that SPL setting			
Minimum SPL + minimum frequency at that SPL setting			
Minimum SPL + maximum frequency at that SPL setting			
Minimum frequency + minimum SPL at that frequency			
Minimum frequency + maximum SPL at that frequency			
Maximum frequency + minimum SPL at that frequency			
Maximum frequency + maximum SPL at that frequency			
NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.			

Maximum temperature and maximum relative humidity
Minimum temperature and minimum relative humidity

For multi-level and multi-frequency sound calibrators it will be necessary to replicate the table below for each of the above sets of conditions.

Settings SPL and frequency	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and frequency measured at reference environmental conditions, extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
Principal SPL + principal frequency							
Maximum SPL + minimum frequency at that SPL setting							
Maximum SPL + maximum frequency at that SPL setting							
Minimum SPL + minimum frequency at that SPL setting							
Minimum SPL + maximum frequency at that SPL setting							
Minimum frequency + minimum SPL at that frequency							
Minimum frequency + maximum SPL at that frequency							

Maximum frequency + minimum SPL at that frequency							
Maximum frequency + maximum SPL at that frequency							
NOTE In most cases it will not be necessary to complete all the rows of the table, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.							

Static pressure was measured using .....
(state manufacturer, model and serial no. of device used)

Static pressure range during measurements _____ kPa to _____ kPa

Expanded uncertainty of measurement ___ kPa

Air temperature was measured using .....
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using .....
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ %

Remarks:

Test 7 Influence of air temperature (only to be performed if required by the results of test 6) *(5.4, A.5.3 and A.5.5 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Maximum sound pressure level and minimum frequency available at that sound pressure level

Maximum sound pressure level and principal frequency

Maximum sound pressure level and maximum frequency available at that sound pressure level

Minimum sound pressure level and minimum frequency available at that sound pressure level

Minimum sound pressure level and principal frequency

Minimum sound pressure level and maximum frequency available at that sound pressure level

Minimum frequency and minimum sound pressure level available at that frequency

Minimum frequency and principal sound pressure level

Minimum frequency and maximum sound pressure level available at that frequency

Maximum frequency and minimum sound pressure level available at that frequency

Maximum frequency and principal sound pressure level

Maximum frequency and maximum sound pressure level available at that frequency

For multi-level and multi-frequency sound calibrators it will be necessary to replicate the tables below, as required, for each of the above sets of settings.

NOTE In most cases it will not be necessary to replicate the tables for all of the above settings, as all the combinations will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.

Target temperature °C	**Measured temperature** °C	**Measured output voltage from microphone** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and SPL measured at reference environmental conditions, extended by actual expanded uncertainty of measurement** * dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
Minimum temperature						
23,0						
Maximum temperature						

* The correction applied shall take account of any variation in microphone sensitivity level with changing temperature, static pressure and relative humidity. For class LS or class 1 sound calibrators with a letter 'C' designation, a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation, further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

Frequency

Target temper-ature °C	**Measured temper-ature** °C	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and frequency measured at reference environmental conditions, extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
Minimum temperature						
23,0						
Maximum temperature						

Static pressure was measured using ……
(state manufacturer, model and serial no. of device used)

Static pressure range during measurements _____ kPa to _____ kPa

Expanded uncertainty of measurement ___ kPa

Air temperature was measured using ……
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using ……
(state manufacturer, model and serial no. of device used)

Relative humidity range during measurements _____ % to _____ %

Expanded uncertainty of measurement _____ %

Remarks:

Test 8 Influence of relative humidity (only to be performed if required by the results of test 6) (*5.4, A.5.3 and A.5.6 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Maximum sound pressure level and minimum frequency available at that sound pressure level

Maximum sound pressure level and principal frequency

Maximum sound pressure level and maximum frequency available at that sound pressure level

Minimum frequency and maximum sound pressure level available at that frequency

Maximum frequency and maximum sound pressure level available at that frequency

For multi-level and multi-frequency sound calibrators it will be necessary to replicate the tables below, as required, for each of the above sets of settings.

NOTE In most cases it will not be necessary to replicate the tables for all of the above settings, as all the combinations specified will only apply in the case of multi-level and multi-frequency sound calibrators that generate several sound pressure levels and frequencies.

Sound pressure level

Target relative humidity %	**Measured relative humidity** %	**Measured output voltage from microphone** V	**Actual expanded uncertainty of measure-ment** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and SPL measured at reference environmental conditions, extended by actual expanded uncertainty of measurement *** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
Minimum RH						
50						
Maximum RH						

* The correction applied shall take account of any variation in microphone sensitivity level with changing relative humidity, static pressure and temperature. For class LS or class 1 sound calibrators with a letter 'C' designation, a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation, further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

Frequency

Target relative humidity %	**Measured relative humidity** %	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and frequency measured at reference environmental conditions, extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
Minimum RH						
50						
Maximum RH						

Static pressure was measured using ……
(state manufacturer, model and serial no. of device used)

Static pressure range during measurements _____ kPa to _____ kPa

Expanded uncertainty of measurement _____ kPa

Air temperature was measured using ……
(state manufacturer, model and serial no. of device used)

Air temperature range during measurements _____ °C to _____ °C

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using ……
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ %

Remarks:

Test 9 Influence of temperature and relative humidity combined (only to be performed if required by the results of test 6) *(5.4, A.5.3 and A.5.7 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Sound pressure level

Target temperature and relative humidity °C and %	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured output voltage from micro-phone** V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL corrected to reference environmental conditions and SPL measured at reference environmental conditions, extended by actual expanded uncertainty of measurement*** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
23 °C + 50 %							

* The correction applied shall take account of any variation in microphone sensitivity level with changing temperature, relative humidity and static pressure. For class LS or class 1 sound calibrators with a letter 'C' designation, a further correction shall also be applied, where appropriate, to take account of the effect of static pressure on the output of the sound calibrator.

For class 2 sound calibrators with a letter 'C' designation, further corrections shall be applied, where appropriate, to take account of the effect of static pressure, temperature or relative humidity on the output of the sound calibrator.

Frequency

Target temperature and relative humidity °C and %	**Measured temper-ature** °C	**Measured relative humidity** %	**Measured frequency** Hz	**Actual expanded uncertainty of measurement** %	**Absolute value of percentage difference between measured frequency and measured frequency at reference environmental conditions, extended by actual expanded uncertainty of measurement** %	**Tolerance limits** %	**Maximum permitted expanded uncertainty of measurement** %
23 °C + 50 %							

Static pressure was measured using ……
(state manufacturer, model and serial no. of device used)

Static pressure range during measurements _____ kPa to _____ kPa

Expanded uncertainty of measurement ___ kPa

Air temperature was measured using ……
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ °C

Relative humidity was measured using ……
(state manufacturer, model and serial no. of device used)

Expanded uncertainty of measurement _____ %

Remarks:

Test 10 Radiofrequency emissions *(5.8.2, A.6.1 and A.6.2 of IEC 60942:2003)*

Sound calibrator configuration: .....

Sound calibrator settings: SPL ..... dB Frequency ..... Hz

Cables/connection devices fitted: .....

Measurement distance: ..... m

Reference orientation

Frequency range MHz	**Maximum measured electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at distance given above	**Maximum electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at 10 m *	**Maximum permitted electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at 10 m
30 to 230			30
>230 to 1 000			37
* This column may be left blank if the measurement distance is 10 m			

Additional plane approximately orthogonal to plane of reference orientation

Description of plane used .....

Frequency range MHz	**Maximum measured electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at distance given above	**Maximum electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at 10 m *	**Maximum permitted electromagnetic field strength of radio-frequency emissions** dB re 1 μV/m quasi peak at 10 m
30 to 230			30
>230 to 1 000			37
* This column may be left blank if the measurement distance is 10 m			

Static pressure range during measurements ____ kPa to ____ kPa

Temperature range during measurements ____ °C to ____ °C

Relative humidity range during measurements ____ % to ____ %

Remarks:

Test 11 Electrostatic discharges *(5.8.3, A.6.1 and A.6.3 of IEC 60942:2003)*

Principal sound pressure level and principal frequency

Cables and connection devices fitted: ……

Type of discharge	**Level of discharge** kV	**After discharge – sound calibrator fully operational/in configuration identical to that set before start of tests? Yes/No**
Contact discharge	+4	
	–4	
Air discharge	+8	
	–8	

Static pressure range during measurements _____ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

Test 12 Immunity to power- and radiofrequency fields
(5.8.4, A.6.1 and A.6.4 of IEC 60942:2003)

Principal sound pressure level and principal frequency

For multi-level, single frequency sound calibrators: all SPLs

For multi-frequency, single level sound calibrators: all frequencies

For multi-level and multi-frequency sound calibrators: all frequencies at minimum sound pressure level, and all sound pressure levels at principal frequency

For multi-level and/or multi-frequency sound calibrators it will be necessary to replicate the information and tables below for each of the required combinations of SPL and frequency.

Mode of operation: ……..

Cables and connection devices fitted: ……..

Sound pressure level or output voltage measured from microphone in absence of the radio

Frequency field …… dB or V

Reference orientation –
root-mean-square field strength up to 10 V/m (unmodulated) with 80 % sinusoidal amplitude modulation at 900 Hz

Frequency range MHz	**SPL or measured output voltage from microphone** dB or V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL and SPL in absence of radio frequency field extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
26 to <500					
500 to 1 000					

Additional plane approximately orthogonal to plane of reference orientation – root-mean-square field strength up to 10 V/m (unmodulated) with 80 % sinusoidal amplitude modulation at 900 Hz

Description of plane used .....

Frequency range MHz	**SPL or measured output voltage from microphone** dB or V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL and SPL in absence of radio frequency field extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
26 to <500					
500 to 1 000					

Sound pressure level or output voltage measured from microphone in absence of the power frequency field ..... dB or V

Reference orientation –
uniform root-mean-square alternating magnetic field strength of 80 A/m

Frequency Hz	**SPL or measured output voltage from microphone** dB or V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL and SPL in absence of power frequency field extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
50					
60					

Additional plane approximately orthogonal to plane of reference orientation –
uniform root-mean-square alternating magnetic field strength of 80 A/m

Description of plane used .....

Frequency Hz	**SPL or measured output voltage from microphone** dB or V	**Actual expanded uncertainty of measurement** dB	**Absolute value of difference between corresponding SPL and SPL in absence of power frequency field extended by actual expanded uncertainty of measurement** dB	**Tolerance limits** dB	**Maximum permitted expanded uncertainty of measurement** dB
50					
60					

Static pressure range during measurements _____ kPa to _____ kPa

Temperature range during measurements _____ °C to _____ °C

Relative humidity range during measurements _____ % to _____ %

Remarks:

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.

Publication	Year	Title	EN/HD	Year
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

Publication	Year	Title	EN/HD	Year
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	-	-

Bibliography

IEC 61000-6-2:1999, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

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