

Bibliographie

ISO 3743-1, *Acoustique – Détermination des niveaux de puissance acoustique émis par les sources de bruit – Méthodes d'expertise en champ réverbéré applicables aux petites sources transportables – Partie 1: Méthode par comparaison en salle d'essai à parois dures*

ISO 3743-2, *Acoustique – Détermination des niveaux de puissance acoustique émis par les sources de bruit à partir de la pression acoustique – Méthodes d'expertise en champ réverbéré applicables aux petites sources transportables – Partie 2: Méthodes en salle d'essai réverbérante spéciale*

AES-5id-1997,1998: *Information document for room acoustics and sound reinforcement systems – Loudspeaker modelling and measurement – Frequency and angular resolution for measuring, presenting and predicting loudspeaker polar data*

FINAL VERSION

VERSION FINALE

**Sound system equipment –
Part 5: Loudspeakers**

**Equipements pour systèmes électroacoustiques –
Partie 5: Haut-parleurs**

This is a preview. [Click here to purchase the full publication.](#)

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Conditions for measurement.....	8
3.1 General conditions	8
3.2 Measuring conditions	8
4 Test signals.....	9
4.1 General.....	9
4.2 Sinusoidal signal.....	9
4.3 Broadband noise signal.....	9
4.4 Narrow-band noise signal	9
4.5 Impulsive signal	9
5 Acoustical environment	9
5.1 General.....	9
5.2 Free-field conditions	9
5.3 Half-space free-field conditions.....	10
5.4 Diffuse sound field conditions	10
5.5 Simulated free-field conditions	10
5.6 Half-space simulated free-field conditions	10
6 Unwanted acoustical and electrical noise	10
7 Positioning of loudspeaker and measuring microphone.....	11
7.1 Measuring distance under free-field and half-space free-field conditions	11
7.2 Positioning of loudspeaker in diffuse field conditions.....	11
7.3 Positioning of loudspeaker and microphone in simulated free-field conditions	11
8 Measuring equipment	12
9 Accuracy of the acoustical measurement.....	12
10 Mounting of loudspeakers.....	12
10.1 Mounting and acoustic loading of drive units	12
10.2 Mounting and acoustic loading of a loudspeaker system	12
11 Standard baffle and measuring enclosures	13
11.1 Standard baffle	13
11.2 Standard measuring enclosures	13
12 Preconditioning.....	14
13 Type description	14
13.1 General.....	14
13.2 Loudspeaker drive units	14
13.3 Loudspeaker system	14
14 Marking of terminals and controls	14
14.1 General.....	14
14.2 Positive terminal	14
15 Reference plane, reference point and reference axis	15
15.1 Reference plane – characteristic to be specified	15
15.2 Reference point – characteristic to be specified	15
15.3 Reference axis – characteristic to be specified	15

16	Impedance and derivative characteristics	15
16.1	Rated impedance – characteristic to be specified	15
16.2	Impedance curve	16
16.3	Total Q-factor (Q_t)	16
16.4	Equivalent air volume of a loudspeaker drive unit compliance (V_{as})	17
17	Input voltage	18
17.1	Rated noise voltage	18
17.2	Short-term maximum input voltage	19
17.3	Long-term maximum input voltage	20
17.4	Rated sinusoidal voltage	20
18	Input electrical power	21
18.1	Rated noise power – characteristic to be specified	21
18.2	Short-term maximum power – characteristic to be specified	21
18.3	Long-term maximum power – characteristic to be specified	21
18.4	Rated sinusoidal power – characteristic to be specified	21
19	Frequency characteristics	21
19.1	Rated frequency range – characteristic to be specified	21
19.2	Resonance frequency	21
19.3	Tuning frequency of a bass reflex or passive radiator loudspeaker system – characteristic to be specified	22
20	Sound pressure under free-field and half-space free-field conditions	22
20.1	Sound pressure in a stated frequency band	22
20.2	Sound pressure level in a stated frequency band – characteristic to be specified	22
20.3	Characteristic sensitivity in a stated frequency band	23
20.4	Characteristic sensitivity level in a stated frequency band – characteristic to be specified	23
20.5	Mean sound pressure in a stated frequency band	23
20.6	Mean sound pressure level in a stated frequency band – characteristic to be specified	23
21	Response under free-field and half-space free-field conditions	23
21.1	Frequency response	23
21.2	Effective frequency range	24
21.3	Transfer function	25
22	Output power (acoustic power)	26
22.1	Acoustic power in a frequency band	26
22.2	Mean acoustic power in a frequency band	27
22.3	Efficiency in a frequency band	27
22.4	Mean efficiency in a frequency band	27
23	Directional characteristics	28
23.1	Directional response pattern	28
23.2	Radiation angle	28
23.3	Directivity index	29
23.4	Coverage angle or angles	30
24	Amplitude non-linearity	30
24.1	Total harmonic distortion	30
24.2	Harmonic distortion of the n^{th} order (where $n = 2$ or $n = 3$)	32
24.3	Characteristic harmonic distortion	33
24.4	Modulation distortion of the n^{th} order (where $n = 2$ or $n = 3$)	33

24.5	Characteristic modulation distortion of the n^{th} order (where $n = 2$ or $n = 3$).....	34
24.6	Difference frequency distortion (of the second order only).....	34
25	Rated ambient conditions	35
25.1	Temperature ranges.....	35
25.2	Humidity ranges.....	35
26	Stray magnetic fields	36
26.1	Static components	36
26.2	Dynamic components.....	36
27	Physical characteristics	37
27.1	Dimensions	37
27.2	Mass.....	37
27.3	Cable assemblies.....	37
28	Design data	38
29	Indication of the characteristics to be specified.....	38
Annex A (informative) Standard measuring enclosure type A		44
Annex B (informative) Standard measuring enclosure type B		46
Annex C (informative) Definitions of terms used in Clause 13		49
Annex D (informative) Listening tests.....		51
Bibliography.....		52
Figure 1 – Impedance curve of loudspeaker.....		17
Figure 2 – Standard baffle, dimensions.....		40
Figure 3 – Standard baffle with chamfer.....		40
Figure 4 – Standard baffle with sub-baffle.....		41
Figure 5 – Standard measuring enclosure type A.....		41
Figure 6 – Standard measuring enclosure type B.....		42
Figure 7 – Block diagram of test set-up.....		42
Figure 8 – Measuring apparatus for stray magnetic field		43
Figure A.1 – An example of standard measuring enclosure type A		44
Figure A.2 – The correction curve for the diffraction effect of the standard measuring enclosure from free-field to half-space free-field		45
Figure A.3 – The correction curve for the diffraction effect of a standard measuring enclosure from free-field to half-space free-field		45
Figure B.1 – An example of standard measuring enclosure type B		46
Figure B.2 – Construction of scalable measuring enclosure type B		47
Figure B.3 – The correction curve for the diffraction effect of the standard measuring enclosure from free-field to half-space free-field		48
Figure B.4 – The correction curve for the diffraction effect of the standard measuring enclosure from free-field to half-space free-field		48
Table 1 – Indication of the characteristics to be specified		39
Table B.1 – Dimensions and ratios of scalable enclosure type B.....		47

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOUND SYSTEM EQUIPMENT –

Part 5: Loudspeakers

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This Consolidated version of IEC 60268-5 bears the edition number 3.1. It consists of the third edition (2003) [documents 100/648/FDIS and 100/674/RVD] and its amendment 1 (2007) [documents 100/1189/CDV and 100/1245/RVC]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

This publication has been prepared for user convenience.

International Standard IEC 60268-5 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The bilingual version (2013-08) of this standard corresponds to the monolingual English version, published in 2007-09.

This standard is to be read in conjunction with IEC 60268-1, IEC 60268-2 and ISO 3741.

The French versions of this standard and its amendment 1 have not been voted upon.

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

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

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

SOUND SYSTEM EQUIPMENT –

Part 5: Loudspeakers

1 Scope

This standard applies to sound system loudspeakers, treated entirely as passive elements. Loudspeakers with built-in amplifiers are excluded.

NOTE 1 The term “loudspeaker” used in this standard relates to loudspeaker drive units themselves and also to loudspeaker systems, which comprise one or more loudspeaker drive units provided with a baffle, enclosure or horn and such relevant devices as built-in crossover filters, transformers and any other passive element.

The purpose of this standard is to give the characteristics to be specified and the relevant methods of measurement for loudspeakers using sinusoidal or specified noise or impulsive signals.

NOTE 2 The methods of measurement given in this standard have been chosen for their appropriateness to the characteristics.

NOTE 3 If equivalent results can be obtained using other methods of measurement, details of the methods used should be presented with the results.

NOTE 4 The following items are under consideration:

- loudspeakers with built-in amplifiers;
- measurements under conditions other than free-field, half-space free-field and diffuse field;
- measurements with signals other than sinusoidal or noise or impulsive signals.

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(151), *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60263, *Scales and sizes for plotting frequency characteristics and polar diagrams*

IEC 60268-1, *Sound system equipment – Part 1: General*

IEC 60268-2, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

IEC 60268-3, *Sound system equipment – Part 3: Amplifiers*

IEC 60268-11, *Sound system equipment – Part 11: Application of connectors for the interconnection of sound system components*

IEC 60268-12, *Sound system equipment – Part 12: Application of connectors for broadcast and similar use*

IEC 60268-14, *Part 14: Circular and elliptical loudspeakers; outer frame diameters and mounting dimensions*

IEC 60651, *Sound level meters*

IEC 61260, *Electroacoustics – Octave-band and fractional-octave-band filters*

ISO 3741, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for reverberation rooms*

ISO 3744, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane*

ISO 3745, *Acoustics – Determination of sound power levels of noise sources – Precision methods for anechoic and semi-anechoic rooms*

3 Conditions for measurement

3.1 General conditions

This standard is to be used in conjunction with IEC 60268-1, IEC 60268-2 and ISO 3741.

3.2 Measuring conditions

3.2.1 General

For convenience in specifying how loudspeakers are to be set up for measurement, normal measuring conditions are defined in this standard. To obtain the correct conditions for measurement, some values (known as “rated conditions”) shall be taken from the manufacturer's specification. These values themselves are not subject to measurement but they constitute the basis for measuring the other characteristics.

The following values and conditions are of this type, and shall be stated by the manufacturer:

- rated impedance;
- rated sinusoidal voltage or power;
- rated noise voltage or power;
- rated frequency range;
- reference plane;
- reference point;
- reference axis.

NOTE A full explanation of the term “rated” is given in IEC 60268-2. See also term 151-04-03 in IEC 60050(151).

3.2.2 Normal measuring conditions

A loudspeaker shall be understood to be working under normal measuring conditions when all the following conditions are fulfilled:

- a) the loudspeaker to be measured is mounted in accordance with Clause 10;
- b) the acoustical environment is specified and is selected from those specified in Clause 5;
- c) the loudspeaker is positioned with respect to the measuring microphone and the walls in accordance with Clause 7;
- d) the loudspeaker is supplied with a specified test signal, in accordance with Clause 4, of a stated voltage U , within the rated frequency range in accordance with 19.1. If required, the input power P can be calculated from the equation: $P = U^2/R$, where R is the rated impedance in accordance with 16.1;
- e) attenuators, if any, are set to their “normal” position as stated by the manufacturer. If other positions are chosen, for example those providing a maximally flat frequency response or maximum attenuation, these shall be specified;

- f) measuring equipment suitable for determining the wanted characteristics is connected in accordance with Clause 8.

4 Test signals

4.1 General

Acoustical measurements shall be made under one of the following measuring signal conditions, and the choice shall be indicated with the results.

4.2 Sinusoidal signal

The sinusoidal test signal shall not exceed the rated sinusoidal voltage (as defined in 17.4) at any frequency. The voltage across the input terminals of the loudspeaker under test shall be kept constant for all frequencies unless otherwise stated.

4.3 Broadband noise signal

NOTE This term is explained in IEC 60268-2.

The crest factor of a noise source should fall between 3 and 4 to avoid clipping of amplifiers.

A true r.m.s. voltmeter with a time constant at least as long as the “slow” constant of the sound level meter, specified in IEC 60651, shall be used to measure the amplitude of the signal.

4.4 Narrow-band noise signal

NOTE This term is explained in IEC 60268-2.

For measurement using narrow-band noise, constant relative bandwidth filters in accordance with IEC 61260 shall be used with a pink-noise generator, the relative bandwidth being usually 1/3 octave.

4.5 Impulsive signal

A short-duration pulse shall have constant spectral power per unit bandwidth over at least the bandwidth of interest in the measurement. Such a signal has low energy content relative to its peak amplitude.

NOTE To minimize the influence of acoustical and electrical noise on the measurement, the peak amplitude of the pulse should be as high as possible within the capability of the driving amplifier and consistent with linear operation of the loudspeaker.

5 Acoustical environment

5.1 General

Acoustical measurements shall be made under one of the acoustical field conditions specified in 5.2 to 5.6, and the choice shall be indicated with the results.

5.2 Free-field conditions

If acoustical conditions approach those of free-field space, an environment (for example an anechoic room) in which the sound pressure decreases with the distance (r) from a point source according to a $1/r$ law, with an accuracy of $\pm 10\%$, in the region that will be occupied by the sound field between the loudspeaker system and the microphone during the measurements shall be used. The minimum conditions shall be deemed to exist if this requirement is met along the axis joining the measuring microphone and the reference point on the loudspeaker.