
Sound power levels of noise sources

Part 6. Survey method for determination of sound power levels of noise sources

[ISO title : Acoustics—Determination of sound power levels of noise sources—Survey method]

Niveaux de puissance acoustique émis par les sources de bruit
Partie 6. Méthode de control pour la détermination des niveaux de puissance acoustique des sources

Schalleistungspegel von Schallquellen
Teil 6. Übersichtsverfahren zur Bestimmung der Schalleistungspegel von Quellen

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National foreword

This Part of this British Standard has been prepared under the direction of the Environment and Pollution Standards Committee and is identical with ISO 3746 'Acoustics — Determination of sound power levels of noise sources — Survey method', prepared by sub-committee 1, Noise, of ISO technical committee 43, Acoustics, and published in 1979 by the International Organization for Standardization (ISO).

This Part of this standard, together with the other Parts listed below, supersedes BS 4196 : 1967, which is therefore now withdrawn.

Terminology and conventions. The text of the international standard has been approved as suitable for publication, without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'British Standard'.

Cross-references

International Standard	Corresponding British Standard
ISO 266-1975	BS 3593 : 1963 Recommendation on preferred frequencies for acoustical measurements (Technically equivalent)
ISO/R 354-1963	BS 3638 : 1963 Method for the measurement of sound absorption coefficients (ISO) in a reverberation room (Technically equivalent)
ISO 3740-1980	BS 4196 Sound power levels of noise sources Part 0 : 1981 Guide for the use of basic standards and for the preparation of noise test codes (Identical)
ISO 3741-1975	Part 1 : 1981 Precision methods for determination of sound power levels for broad-band sources in reverberation rooms (Identical)
ISO 3742-1975	Part 2 : 1981 Precision methods for determination of sound power levels for discrete-frequency and narrow-band sources in reverberation rooms (Identical)
ISO 3743-1976	Part 3 : 1981 Engineering methods for determination of sound power levels for sources in special reverberation rooms (Identical)
ISO 3744-1981*	Part 4 : 1981* Engineering methods for determination of sound power levels for sources in free-field conditions over a reflecting plane (Identical)
ISO 3745-1979	Part 5 : 1981 Precision methods for determination of sound power levels for sources in anechoic and semi-anechoic rooms (Identical)

The technical committee has reviewed the provisions of ISO 2204-1979, to which reference is made in 0.3, 1.2.1 and clause 2, IEC 179 : 1973†, to which reference is made in clause 2 and 5.1, and IEC 225 : 1966, to which reference is made in clause 2 and has decided that they are acceptable for use in conjunction with this standard. The related British Standards for IEC 179 and IEC 225 are BS 4197 : 1967 'A precision sound level meter' and BS 2475 : 1964 'Octave and one third octave band-pass filters' respectively.

Additional information. The references to IEC 179A, which appear in clause 2 and 5.1, are essentially of an advisory nature and not a mandatory requirement and the lack of an equivalent British Standard therefore does not affect the validity of this standard. There is no intention to implement this Publication in the United Kingdom, as it is not considered suitable for the measurement of impulsive noise components.

In 1979, ISO/TC 43/SC 1 decided that the text of clause 8 should be editorially amended to show more clearly the nature of the environmental correction factor K . The proposed change would improve the consistency within the series ISO 3740 to ISO 3746 but would make no numerical difference to the specified calculation. It has not been considered necessary to publish an immediate amendment but a text was approved for incorporation when the standard is next reviewed, which is expected to be in 1984. The proposed text is given, for informative purposes, in National appendix A.

In 1979, the UK also proposed that the text of A.3.1 should be amended so as to reduce the variability of determinations of the environmental correction when test rooms are used. The proposed change would prevent underestimates of the sound power output of sources being obtained when the method given in A.3.1 is used. The opportunity was also taken to amend the whole of the annex editorially so as to help the reader make a more logical choice from the options described. This UK proposal will be considered when the standard is next reviewed. The proposed text is given, for informative purposes, in National appendix B.

This British Standard will be amended when the International Standard is updated.

*In course of preparation.

†IEC 179 has been superseded by IEC 651 : 1979. The British Standard which is identical to IEC 651 : 1979 is BS 5969 : 1981 'Specification for sound level meters'.

British Standard

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0.1 RELATED INTERNATIONAL STANDARDS

This International Standard is one of a series specifying various methods for determining the sound power levels of machines and equipment. These basic documents specify only the acoustical requirements for measurements appropriate for different test environments as shown in table 1.

When applying these basic documents, it is necessary to decide which one is most appropriate for the conditions

and purposes of the test. The operating and mounting conditions of the machine or equipment to be tested must be in accordance with the general principles stated in the basic documents.

Guidelines for making these decisions are provided in ISO 3740. If no sound test code is specified for a particular machine, the mounting and operating conditions shall be fully described in the test report.

TABLE 1 — International Standards specifying various methods for determining the sound power levels of machines and equipment

International Standard No.*	Classification of method	Test environment	Volume of source	Character of noise	Sound power levels obtainable	Optional information available
3741	Precision	Reverberation room meeting specified requirements	Preferably less than 1 % of test room volume	Steady, broad-band	In one-third octave or octave bands	A-weighted sound power level
3742				Steady, discrete-frequency or narrow-band		
3743	Engineering	Special reverberation test room		Steady, broad-band, narrow-band, or discrete-frequency	A-weighted and in octave bands	Other weighted sound power levels
3744	Engineering	Outdoors or in large room	Greatest dimension less than 15 m	Any	A-weighted and in one-third octave or octave bands	Directivity information and sound pressure levels as a function of time; other weighted sound power levels
3745	Precision	Anechoic or semi-anechoic room	Preferably less than 0,5 % of test room volume	Any		
3746	Survey	No special test environment	No restrictions : limited only by available test environment	Steady, broad-band, narrow-band, or discrete-frequency	A-weighted	Sound pressure levels as a function of time; other weighted sound power levels

* See clause 2.

0.2 SYNOPSIS OF ISO 3746

Applicability

Test environment

Installation (indoors or outdoors) meeting prescribed requirements.

Type of source

Device, machine, component, subassembly.

Size of noise source

No restrictions.

Character of noise radiated by the source

Steady; broad-band, discrete-frequency or narrow-band.

Accuracy

Survey (standard deviation for determining A-weighted sound power levels is about 5 dB for discrete tone sources and 4 dB for sources which radiate steady, broad-band noise).

Quantities to be measured

Weighted sound pressure levels at prescribed microphone positions.

Quantities to be determined

Weighted sound power level : A-weighting is required; other weightings are optional.

0.3 INTRODUCTION

This International Standard specifies a survey method for determining the weighted sound power level of a device or machine. The sound power level of the source is calculated from the measured values of the weighted sound pressure levels at prescribed microphone positions. The method specified in this International Standard is particularly useful for rating the sound output of a source that produces steady noise (as defined in ISO 2204) and cannot be moved from its location to a special test environment.

The method requires measurement of the A-weighted sound pressure level at four or more microphone positions located on a hypothetical measurement surface which envelops the source. One of two alternative measurement surfaces may be selected, either a hemisphere or a rectangular parallelepiped. The hemispherical surface is best suited for measurement of the noise emitted by small sources as well as that emitted by larger sources which are approximately cubical in shape. The rectangular parallelepiped is best suited for long or tall sound sources as well as for those situations in which measurements must be carried out close to the source. This may occur when use of the hemispherical surface leads to microphone positions that are not sufficiently far away from reflecting surfaces, when measured levels with the source in operation are close to the background noise levels,

or when other unfavorable environmental conditions are present. In general, the hemispherical surface is preferred when the measuring distance is large compared to the dimensions of the source and the rectangular parallelepiped is preferred for close-in measurements.

The method specified in this International Standard yields physical data that may be useful for

- a) comparing machines which are similar in size and kind;
- b) rating apparatus in terms of its overall weighted sound power output.

This method should not be used when it is feasible to use a more precise method, for example, when a laboratory semi-anechoic room is available for the measurements.

The method specified in this International Standard requires that the background noise be lower than the noise produced by the source.

The annex gives a procedure for qualifying the acoustic environment for the purposes of measurements made according to the requirements of this International Standard. If the test environment does not meet the requirements of the annex, the method specified in this International Standard shall not be used for determining the sound power level of a source.

The method specified in this International Standard permits the determination of the A-weighted sound power level of a noise source. If additional information is required, for example, the sound power levels in frequency bands, ISO 3744 should be used.

This International Standard, together with the others in this series (see table 1), supersedes ISO/R 495.

1 SCOPE AND FIELD OF APPLICATION

1.1 General

This International Standard specifies a survey method for measuring the weighted sound pressure levels at prescribed microphone positions around a noise source. The A-weighted sound power level of the source is calculated from the measured values. This method may be applied *in situ* to sources which cannot be moved to a special test environment and to which the methods specified in ISO 3741, ISO 3742, ISO 3743, ISO 3744 and ISO 3745 cannot be applied or should not be applied because they require too much effort.

1.2 Field of application

1.2.1 Types of noise

This International Standard applies to sources which radiate broad-band noise, narrow-band noise, discrete tones and combinations thereof. The procedures specified in this International Standard are primarily applicable to sources that radiate steady noise. These procedures may also be

applied to sources that radiate non-steady noise as defined in ISO 2204, with the exception of an isolated burst of sound energy or a burst train with a repetition rate less than 5 per second.

1.2.2 Size of source

The method specified in this International Standard does not restrict the volume of the noise source. However, if the measurements are made indoors, the volume of the test room must be sufficiently larger than the volume of the source to permit the microphones to be located as specified in clause 7.

1.3 Measurement uncertainty

Measurements made in conformity with this International Standard tend to result in standard deviations which are equal to or less than those given in table 2.

TABLE 2 – Uncertainty in determining A-weighted sound power level by the survey method

Application	Standard deviation dB
For a source which produces sounds that contain prominent discrete tones	5
For a source which produces sounds that are uniformly distributed in frequency over the frequency range of interest	4

NOTES

1 If the method specified in this International Standard is used to compare the sound power levels of similar machines that are omnidirectional and radiate broad-band noise, the uncertainty in this comparison tends to result in a standard deviation which is equal to less than 3 dB, provided that the measurements are performed in the same environment.

2 The standard deviations given in this table reflect the cumulative effects of all causes of measurement uncertainty, excluding variations in the sound power level from machine to machine or from test to test which may be caused, for example, by changes in the mounting or operating conditions of the source. The reproducibility and repeatability of the test results may be considerably better (i.e., smaller standard deviations) than the uncertainties given in table 2 would indicate.

2 REFERENCES

ISO 266, *Preferred frequencies for acoustical measurements.*

ISO/R 354, *Measurement of absorption coefficients in a reverberation room.*

ISO 2204, *Acoustics – Guide to the measurement of airborne acoustical noise and evaluation of its effects on man.*

ISO 3740, *Acoustics – Determination of sound power level of noise sources – Guidelines for the use of basic International Standards and for the preparation of noise test codes.*

ISO 3741, *Acoustics – Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms.*

ISO 3742, *Acoustics – Determination of sound power levels of noise sources – Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.*

ISO 3743, *Acoustics – Determination of sound power levels of noise sources – Engineering methods for special reverberation test rooms.*

ISO 3744, *Acoustics – Determination of sound power levels of noise sources – Engineering methods for free-field conditions over a reflecting plane.¹⁾*

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

IEC Publication 179, *Precision sound level meters.*

IEC Publication 179A, *First supplement to Publication 179, Additional characteristics for the measurement of impulsive sounds.*

IEC Publication 225, *Octave, half-octave and third-octave band filters intended for the analysis of sound and vibrations.*

3 DEFINITIONS

For the purposes of this International Standard, the following definitions apply.

3.1 sound pressure level, L_p , in decibels: Twenty times the logarithm to the base 10 of the ratio of the sound pressure to the reference sound pressure. The weighting network used shall be indicated: for example, A-weighted sound pressure level, L_{pA} . The reference sound pressure is 20 μ Pa.

3.2 A-weighted surface sound pressure level, $\overline{L_{pA}}$, in decibels: The A-weighted sound pressure level averaged over the measurement surface as required in clause 8.

3.3 sound power level, L_W , in decibels: Ten times the logarithm to the base 10 of the ratio of a given sound power to the reference sound power. The weighting network used shall be indicated: for example, A-weighted sound power level, L_{WA} . The reference sound power is 1 pW ($= 10^{-12}$ W).

¹⁾ At present at the stage of draft.