
International Standard



3740

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards and for the preparation of noise test codes

Acoustique — Détermination des niveaux de puissance acoustique émis par les sources de bruit — Guide pour l'utilisation des normes fondamentales et pour la préparation des codes d'essais relatifs au bruit

First edition — 1980-04-01

Corrected and reprinted —

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 3740:1980](#)

<https://standards.iteh.ai/catalog/standards/sist/e64a78cc-7aab-4226-88d1-9b8ca402219e/iso-3740-1980>



UDC 534.83.08

Ref. No. ISO 3740-1980 (E)

Descriptors : acoustics, acoustic tests, acoustic measurement, sound power, sound pressure, engine noise.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3740 was developed by Technical Committee ISO/TC 43 *Acoustics*, and was circulated to the member bodies in May 1976.

It has been approved by the member bodies of the following countries :

Australia	India	Poland
Austria	Israel	Romania
Belgium	Italy	South Africa, Rep. of
Canada	Japan	Spain
Czechoslovakia	Korea, Rep. of	Sweden
Denmark	Mexico	Switzerland
Finland	Netherlands	Turkey
France	New Zealand	United Kingdom
Germany, F. R.	Norway	USA
Hungary	Philippines	USSR

No member body expressed disapproval of the document.

This International Standard cancels and replaces ISO Recommendation R 495-1966, of which it constitutes a technical revision.

Contents

	Page
Foreword	1
0 Introduction	1
1 Scope and field of application	2
2 References	2
3 Selection of appropriate International Standard for determination of sound power level	2
4 Preparation of noise test codes	3
Annexes	
A Synopses of basic International Standards on sound power level determinations	7
B Factors affecting choice of measurement method	11
C Acoustical test environments	13
D Preferred format for reporting octave and third-octave band sound power levels .	14

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/c64a78cc-7aab-4226-88d1-9b8ca402219e/iso-3740-1980>

iTeh STANDARD PREVIEW
This page intentionally left blank
(standards.iteh.ai)

[ISO 3740:1980](#)

<https://standards.iteh.ai/catalog/standards/sist/e64a78cc-7aab-4226-88d1-9b8ca402219e/iso-3740-1980>

Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards and for the preparation of noise test codes

Foreword

The most important factor in the selection of a noise measurement method is the ultimate use of the data that are to be obtained. This International Standard introduces a series of six International Standards describing various methods for determining the sound power levels of machines and equipment. Sound power level data are useful for :

- a) calculating the approximate sound pressure level at a given distance from a machine operating in a specified environment;
- b) comparing the noise radiated by machines of the same type and size;
- c) comparing the noise radiated by machines of different types and sizes;
- d) determining whether a machine complies with a specified upper limit of sound emission;
- e) planning in order to determine the amount of transmission loss or noise control required under certain circumstances;
- f) engineering work to assist in developing quiet machinery and equipment.

The sound power level data determined according to one of the basic International Standards are essentially independent of the environment in which the data are obtained. This is one of the reasons for using sound power level to characterize the noise emitted by various types of machines and equipment.

These basic standards specify the acoustical requirements for measurements appropriate for different test environments and accuracies.

When applying these basic standards to sound measurements on specific machines, it is necessary to decide which one of the basic standards is most appropriate for the particular class of machine or equipment and for the purpose of the test. It is also necessary to decide on specific details for mounting and operating the machine to be tested within the general principles stated in the basic documents.

Guidelines for making these decisions are provided in this International Standard. These guidelines are essential for the proper application of the basic acoustical measurement standards and for the preparation of specific sound test codes for various types of machines and equipment.

If no specific sound test code exists for a particular type of machine, the most suitable of the basic documents should be followed and the mounting and operating conditions used should be described in the test report. These conditions should be in accordance with the general principles given in the basic documents.

0 Introduction

Control of noise from machines or equipment requires effective exchange of acoustical information among the several parties concerned. These include the manufacturer, specifier, installer and user of the machine or equipment. This acoustical information is obtained from measurements. These measurements are useful only if they are carried out under specified conditions to obtain defined acoustical quantities using standardized instruments.

The set of basic International Standards for which this International Standard serves as the introduction is :

ISO 3741 — Precision methods for broad-band sources in reverberation rooms.

ISO 3742 — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.

ISO 3743 — Engineering methods for special reverberation test rooms.

ISO 3744 — Engineering methods for free-field conditions over a reflecting plane.

ISO 3745 — Precision methods for anechoic and semi-anechoic rooms.

ISO 3746 — Survey method.

Additional International Standards may be added to the series in the future.

In principle, the methods of measurement described in ISO 3741 to ISO 3746 cover all types of machines and equipment. For noise measurements on a particular kind and size of machine or equipment, or when only certain kinds of facilities are available for the measurements, only one of these International Standards may be applicable. For type testing, only one method should be prescribed.

The basic International Standards prescribe the acoustical conditions for the noise measurements and the instruments to be

used. Only general information is given on the installation and operation of the sound source during the measurements. Different types of machines and equipment require more detailed instructions concerning the installation and operation of the equipment during the noise tests.

1 Scope and field of application

1.1 Scope

This International Standard provides guidelines comprising :

- a) brief explanations of the principles underlying the set of basic International Standards for measuring the noise emitted by machines and equipment;
- b) assistance in the selection of the appropriate basic International Standard;
- c) general information on supplementing the basic International Standards with instructions concerning the installation and operating conditions for the particular type of machines or equipment; such instructions are usually incorporated in test codes.

1.2 Field of application

These guidelines are applicable to the preparation of all noise test codes for any type of machine or equipment, with the exception of moving vehicles or other non-stationary equipment. These guidelines apply only to airborne sound and are applicable only to test codes requiring the determination of sound power levels of noise sources.

2 References

ISO 2204, *Acoustics — Guide to International Standards on the measurement of airborne acoustical noise and evaluation of its effects on human beings.*

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 reverberation rooms.*

ISO 3744, *Acoustics — Determination of sound power levels of*

noise sources — Engineering methods for free-field conditions over a reflecting plane.

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

ISO 3746, *Acoustics — Determination of sound power levels of noise sources — Survey method.*

IEC Publication 263, *Scales and sizes for plotting frequency characteristics and polar diagrams.*

3 Selection of appropriate International Standard for determination of sound power level

3.1 Quantities to be measured and determined

Methods are prescribed for measuring the sound pressure levels, either A-weighted or in frequency bands, in a specified acoustical environment. From these data, the sound power level of the source is calculated either as an A-weighted value or in frequency bands.

NOTES

- 1 Other weightings such as C-weighting may give additional information concerning low-frequency components.
- 2 Other meter characteristics such as "impulse" may give additional information concerning impulsive components.

The sound power levels are mean values obtained by time and space averaging. For certain kinds of noise and under certain measurement conditions, it is useful to supplement the sound power level data with information concerning fluctuations of the values is both space and time.

3.2 Considerations affecting choice of measurement method

The applicability of individual parts of this set of International Standards is determined by

- a) the size of the noise source which, for laboratory measurements, is given in terms of the percentage of test room volume;
- b) the test environment available for the measurements;
- c) the character of the noise produced by the source (for example : broad-band, narrow-band, discrete-frequency; steady, non-steady, impulsive);

- d) frequency range of interest;
- e) the highest grade of accuracy required as classified according to ISO 2204;
- f) the acoustical data required including the sound power level data and other acoustical information (for example : directivity of source, temporal pattern).

3.3 Synopses

Synopses of ISO 3741 to ISO 3746 are to be found in annex A.

3.4 Test environments

For descriptions of the several test environments described in ISO 3741 to ISO 3746, reference should be made to annex C.

3.5 Procedure for selection

Table 1 summarizes the applicability of each of the series of six basic International Standards. Table 2 gives the uncertainties involved in the determinations of the sound power levels according to the six documents in the series.

Measurements made in conformity with this series of International Standards tend to result in standard deviations which are equal to or less than those given in table 2. The standard deviations of table 2 reflect the cumulative effects of all causes of measurement uncertainty, excluding those variations in the sound power level from test to test which may be caused, for example, by changes in the mounting or operating conditions of the source. The inter-laboratory 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.

The purpose for which the noise measurements are to be made determines the grade of accuracy required. The several factors influencing the selection of an appropriate test method are shown in table 3. This table gives guidance for the selection of the appropriate International Standard. The left side of the table lists the selection criteria. In the right-hand column, bars along the vertical lines combine the appropriate test conditions according to each of the individual International Standards.

After defining the requirements of the test, the appropriate International Standard can be selected by following the bars along the appropriate vertical line. A solid bar indicates that the corresponding International Standard is fully applicable to the test condition and the sound power levels are within their given ranges of uncertainty. An open bar means that the data obtained are optional.

If the source can be moved and the test environments are available, one of the methods described in ISO 3741 to ISO 3746 should be selected. If the machine or equipment to be tested cannot be moved, only the methods described in ISO 3744 and ISO 3746 are applicable. The method selected will depend upon the factors discussed in 3.2.

Additional information concerning the topics covered in table 1 and 3 is given in annex B.

4 Preparation of noise test codes

4.1 General

Each noise test code requiring the determination of the sound power level of a particular kind of machine or equipment should preferably be based on

- a) one of the precision methods (ISO 3741, ISO 3742 or ISO 3745);
- b) one of the engineering methods (ISO 3743 or ISO 3744);
- c) the survey method (ISO 3746).

For the establishment of noise test codes for particular types of machines and equipment, the most appropriate method of measurement shall be selected from the basic International Standards listed in clause 0 of this International Standard. The decision shall then be made concerning the need for preparing supplementary requirements giving detailed specifications on :

- a) operating conditions;
- b) installation and mounting conditions;
- c) microphone array, microphone traverses and measurement surface.

The decision may be made that supplementary requirements are not necessary and that the basic International Standard is sufficient for the purposes of the noise test code.

If the basic International Standard is to be used in preparing the noise test code for a particular class of machine or equipment, the code should cover the subjects listed in 4.2.

4.2 Use of basic International Standards

4.2.1 Under "Scope", the test code should carefully define the types of machines or equipment for which the test code is applicable. For large machines with many components and sub-assemblies, a clear definition should be made of the noise sources that are to be considered part of the machine under test.

4.2.2 Under "Purpose", the test code should define the specific purpose(s) for which the data are to be obtained (see Foreword). The test code should state whether the noise emission is to be expressed in terms of a weighted sound power level or in terms of the sound power level spectrum (in octave or one-third octave bands).

4.2.3 A "General Statement" should refer specifically to the basic International Standard which is to be used in applying the test code.

4.2.4 The text of the basic International Standard should not be included verbatim in the test code.

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, 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	Any	A-weighted	Sound pressure levels as a function of time; other weighted sound power levels



iTech STANDARD PREVIEW
 (standards.iteh.ai)
 ISO 3740:1980
<https://standards.iteh.ai/catalog/standards/sist/c64a78cc-7aab-4226-88d1-9b8ca402219e/iso-3740-1980>





























































Table 2 – Uncertainty in determining sound power levels, expressed at the largest value of the standard deviation of decibels

International Standard No.*	Octave bands (Hz)	125	250	500	1 000 to 4 000	8 000	A-weighting
	1/3 Octave bands (Hz)	100 to 160	200 to 315	400 to 630	800 to 5 000	6 300 to 10 000	
3741 3742		3	2	1,5		3	—
3743		5	3	2		3	2
3744		3	2		1,5	2,5	2
3745	(Anechoic room)	1	1		0,5	1	—
	(Semi-anechoic room)	1,5	1,5		1	1,5	—
3746		—	—	—	—	—	5

* See clause 2.

Table 3 – Factors influencing the choice of the method

 Information in accordance with International Standards
 Optional information

		ISO 3741	ISO 3742	ISO 3743	ISO 3744	ISO 3745	ISO 3746
Size of source	Large sources – not movable						
	Small sources – movable						
Character of noise	Steady – broad-band						
	Steady – narrow-band – discrete-frequency						
	Non-steady						
Classification of method	Precision						
	Engineering						
	Survey						
Application of data	Noise control work						
	Type testing Comparison of machines or equipment: different types same type						
Information obtained	Octave band levels						
	1/3 octave band levels						
	A-weighted levels						
	Other weightings						
	Directivity information						
Temporal pattern							
Test environment	Laboratory reverberation rooms						
	Special reverberation test room						
	Large rooms, outdoors						
	Laboratory anechoic rooms						
	<i>In situ</i> , indoors, outdoors						

ISO 3741 ISO 3742 ISO 3743 ISO 3744 ISO 3745 ISO 3746

4.2.5 Under "Information to be Recorded", the test code should require that the source locations and microphone positions in the test environment be described in detail.

Under "Information to be Reported", the test code should indicate the result of the measurement and the minimum of technical information that will be communicated for general information. Details of measurement procedure, measurement instruments, rooms, etc., need not be reported.

4.2.6 All factors related to the installation, mounting, location and operation of the particular type of machine and equipment covered by the code, which could have an influence on the amount and character of the sound emitted, should be studied. The installation and operating conditions to be specified in the noise test code should be selected. The section of the test code dealing with the installation and operating conditions will generally be the major section of the code.

NOTES

1 Mounting conditions : The equipment to be tested should be installed and mounted in one or more positions that are typical of normal use if practicable.

If the source is placed in close proximity to a wall (or ceiling) during normal usage, its sound radiation is influenced by these surfaces and special precautions should be taken to imitate their effects during measurements. For measurements in reverberation test rooms, the source should be placed with respect to the walls (or ceiling) as for normal use. If the source during normal use is in close proximity to two planes (e.g. wall and floor or wall and ceiling), it should be tested in a similar environment, simulated by erecting an auxiliary wall on the reflecting plane and mounting the source appropriately.

Mounting conditions should be described in detail.

Requirements should be given that all auxiliary equipment necessary

for operating the equipment on test that is not a part of the source should be located outside the test environment.

2 Operating conditions : During the acoustical measurements, the source shall be operated in a specified manner. One or more of the following operating conditions should be chosen and described in detail by means of specifically defined parameters for the particular kind of equipment covered by the test code :

- a) equipment under load and operating conditions that are typical of normal use;
- b) equipment under full load [if different from a)];
- c) equipment under no load (idling);
- d) equipment under operating condition corresponding to maximum sound generation representative of normal use;
- e) equipment with conventional load operating under carefully defined conditions.

4.3 Data presentation

This section of the noise test code should contain sufficient information to assure uniformity in the reporting of the noise data. In particular, the test code should provide a suitable form sheet on which all data pertinent to the particular test are to be presented as octave or one-third octave spectra. A table or graph sheet for reporting the data should be included. The plotting scales should be

20 mm per 10 dB for the ordinate

and 15 mm per octave for the abscissa

as specified in IEC Publication 263.

A sample graph sheet is shown in annex D.

Annex A

Synopses of basic International Standards on sound power level determinations

A.1 ISO 3741 — Precision methods for broad-band sources in reverberation rooms.

A.1.1 Applicability

Noise control work, type testing, comparison of machines or equipment of the same or different types.

A.1.2 Test environment

Reverberation room with prescribed volume and absorption or qualified according to a test procedure given in annex A of ISO 3741. Guidelines for the design of reverberation rooms are given in annex D of ISO 3741. The minimum test room volume depends on lowest frequency band of interest ($V_{\min} = 200 \text{ m}^3$ corresponds to 100 Hz for the lowest allowable one-third octave band).

A.1.3 Size of noise source

Volume of the source preferably less than 1 % of test room volume.

A.1.4 Character of noise radiated by the source

Steady (as defined in ISO 2204), broad-band.

A.1.5 Accuracy

Precision (standard deviation for determining sound power levels for 1 kHz octave band is less than or equal to 1,5 dB).

A.1.6 Quantities to be measured

Sound pressure levels in frequency bands on a prescribed path or at several discrete microphone positions.

A.1.7 Quantities to be determined

Sound power levels in frequency bands, A-weighted sound power levels (optional).

A.1.8 Quantities which cannot be obtained

Directivity characteristics of the source, temporal pattern of radiated noise for sources emitting non-steady noise.

A.2 ISO 3742 — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.

A.2.1 Applicability

Noise control work, type testing, comparison of machines or equipment of the same or different types.

A.2.2 Test environment

Prescribed reverberation room which is to be qualified according to a test procedure given in clause 3 of the main part of ISO 3742 and in annex A of ISO 3742. Additional test room requirements as given in ISO 3741.

A.2.3 Size of noise source

Volume of the source preferably less than 1 % of test room volume.