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Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code

*Acoustique — Bruits émis par les machines et équipements — Règles
pour la préparation et la présentation d'un code d'essai acoustique*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12001 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This first edition of ISO 12001 replaces parts of ISO 2204.

Annexes A and B form an integral part of this International Standard. Annexes C and D are for information only.

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Introduction

In the determination, declaration and verification of noise emission values for specific types of machinery and equipment, standardized noise test codes are required for many purposes.

Several basic International Standards dealing with the noise emitted by machinery and equipment exist. In order to prepare a noise test code for a specific family of machinery or equipment, it is necessary to select the most appropriate basic documents and to establish additional requirements for that family (e.g. installation and mounting conditions, operating conditions, measurement positions, noise declarations, information to be recorded and reported, etc.).

A noise test code is a standard for a specific family, sub-family or type of machinery or equipment. Such a code gives all the information necessary to carry out as efficiently as possible the determination, declaration and verification of the noise emission characteristics of the machine under test. This International Standard specifies what information is necessary for the preparation of noise test codes.

Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code

1 Scope

This International Standard specifies the technical requirements of a noise test code for a specific family of machinery or equipment. It is primarily applicable to stationary machinery and equipment, including hand-held tools, as well as those that present hazards due to mobility or load lifting.

The purpose of a noise test code is to permit comparable test results to be obtained on the noise emissions of machines from the same family, thus enabling users to make comparisons and to check the declared noise emission data. The quantities described in a noise test code are also useful for noise specifications in private contracts, for planning and for noise reduction purposes.

Specific test codes for various types of machinery and equipment are established and used in accordance with the requirements of basic International Standards. Standardized noise test codes give detailed requirements on mounting, loading and operating conditions for the particular family to which the machinery under test belongs, as well as the location of a work station(s) and other specified positions (if any).

The purpose of this International Standard is to assist technical standardization committees responsible for specific families of machinery or equipment in preparing noise test codes to ensure that such noise test codes

- are as homogeneous as possible, with each individual test code having the same basic structure;

- are in full accordance with basic standards on measurement, declaration and verification of noise emissions; and
- reflect the latest technical knowledge of methods of determining the noise emissions from the specific family of machinery or equipment under consideration.

NOTE 1 Annex A lists the basic International Standards to be used in the drafting of a noise test code. An outline of a typical noise test code summarizing the information that is required is given in annex B. Noise emission quantities are described in annex C.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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*.

ISO 3741:—¹⁾, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms*.

1) To be published. (Revision of ISO 3741:1988 and ISO 3742:1988)

ISO 3743-1:1994, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields — Part 1: Comparison method for hard-walled test rooms.*

ISO 3743-2:1994, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering methods for small, movable sources in reverberant fields — Part 2: Methods for special reverberation test rooms.*

ISO 3744:1994, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane.*

ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*

ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane.*

ISO 3747:1987, *Acoustics — Determination of sound power levels of noise sources — Survey method using a reference sound source.*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment.*

ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points.*

ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning.*

ISO 11200:1995, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions.*

ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane.*

ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission*

sound pressure levels at a work station and at other specified positions — Survey method in situ.

ISO 11203:1995, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level.*

ISO 11204:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Method requiring environmental corrections.*

IEC 651:1979, *Sound level meters*, and Amendment 1:1993.

IEC 804:1985, *Integrating-averaging sound level meters*, and Amendment 1:1989 and Amendment 2:1993.

IEC 1043:1993, *Electroacoustics — Instruments for the measurement of sound intensity — Measurement with pairs of pressure sensing microphones.*

IEC 1260:1995, *Electroacoustics — Octave-band and fractional-octave-band filters.*

3 Definitions

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

3.1 basic noise emission standard (B-type standard): Standard which specifies the procedure for determining the noise emission of machinery and equipment in such a way as to obtain reliable, reproducible results with a specified degree of accuracy.

3.2 noise test code (C-type standard): A standard that is applicable to a particular class, family or type of machinery or equipment, which specifies all the information necessary to carry out efficiently the determination, declaration and verification of the noise emission characteristics under standardized conditions.

3.3 emission: Airborne sound radiated by a well-defined noise source (e.g. the machine under test) under specified operating and mounting conditions.

NOTE 2 Emission values may be incorporated in a product label and/or product specification. The basic noise emission quantities are the sound power level of the source itself and the emission sound pressure levels at a work station and/or at other specified positions (if any) in the vicinity of the source.

3.4 emission sound pressure, p : The sound pressure, at a specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface, excluding the effects of background noise and of reflections other than those from the plane or planes permitted for the purpose of the test. It is expressed in pascals.

3.5 emission sound pressure level, L_p : Ten times the logarithm to the base 10 of the ratio of the square of the emission sound pressure, $p^2(t)$, to the square of the reference sound pressure, p_0^2 , measured with a particular time weighting and a particular frequency weighting, selected from those defined in IEC 651. It is expressed in decibels. The reference sound pressure is 20 μ Pa.

NOTE 3 Examples include:

- maximum A-weighted emission sound pressure level with time weighting F: L_{pAFmax} ;
- C-weighted peak emission sound pressure level: $L_{pC,peak}$.

The emission sound pressure level shall be determined at a specified position and in accordance with either a test code for a specific family of machines or, if no test code exists, a method that complies with the ISO 11200 series.

3.6 time-averaged emission sound pressure level, L_{peqT} : Emission sound pressure level of a continuous steady sound that, within a measurement time interval, T , has the same mean square sound pressure as a sound under consideration which varies with time. It is expressed in decibels.

It is given by the following equation:

$$L_{peqT} = 10 \lg \frac{1}{T} \int_0^T \frac{p^2(t)}{p_0^2} dt \quad \text{dB} \quad \dots (1)$$

A-weighted time-averaged emission sound pressure levels are denoted by L_{pAeqT} , which is usually abbreviated to L_{pA} . L_{pAeqT} shall be measured with an instrument which complies with the requirements of IEC 804.

NOTES

4 In general, the subscripts "eq" and "T" are omitted since time-averaged emission sound pressure levels are necessarily determined over a certain measurement time interval.

5 Equation (1) is identical to that for the familiar ISO environmental noise descriptor "equivalent continuous sound pressure level" defined in ISO 1996-1. However, the emission quantity defined above is used to characterize the noise emitted by a machine under test and assumes that standardized measurement and operating conditions as well as a controlled acoustical environment are used for the measurements.

3.7 sound power, W : The rate per unit time at which airborne sound energy is radiated by a source. It is expressed in watts.

3.8 sound power level, L_w : Ten times the logarithm to the base 10 of the ratio of the sound power radiated by the source under test to the reference sound power. It is expressed in decibels.

The frequency weighting or the width of the frequency band used shall be indicated. The reference power is 1 pW (10^{-12} W).

NOTE 6 For example, the A-weighted sound power level is L_{wA} .

The sound power level shall be determined in accordance with either a test code for a specific family of machinery or equipment or, if no test code exists, a method that complies with one of the standards selected from ISO 3741 to ISO 3747, inclusive, or with parts 1 or 2 of ISO 9614.

3.9 noise emission value: A general term by which any one or more of the A-weighted sound power level, L_{wA} , or the A-weighted time-averaged emission sound pressure level, L_{pA} , or the C-weighted peak emission sound pressure level, $L_{pC,peak}$, is inferred.

3.10 measured noise emission value, L : The A-weighted sound power level, or the A-weighted time-averaged emission sound pressure level, or the C-weighted peak emission sound pressure level, as determined from measurements. Measured values may be determined either from a single machine or from the average of a number of machines, and are not rounded.

3.11 noise emission declaration: Information on the noise emitted by the machine, given by the manufacturer or supplier in technical documents or other literature concerning noise emission values. The noise emission declaration may take the form of either the declared single-number noise emission value or the declared dual-number noise emission value.

3.12 uncertainty, K : Value, in decibels, of the measurement uncertainty associated with a measured noise emission value.

NOTE 7 Guidance on appropriate values for K is given in annex A of ISO 4871:1996.

3.13 declared single-number noise emission value, L_d : The sum of a measured noise emission value and the associated uncertainty factor, rounded to the nearest decibel:

$$L_d = L + K$$

NOTE 8 ISO 9296 requires that the declared A-weighted sound power level, $L_{WA,d}$, of computers and business equipment be expressed in bels using the identity 1 B = 10 dB, rounded to the nearest 0,1 B.

3.14 declared dual-number noise emission value, L and K : A measured noise emission value, L , and its associated uncertainty K , both rounded to the nearest decibel.

NOTE 9 If a specific noise test code requires that the mean emission sound pressure level from a number of specified positions be declared, it is denoted by L_{pAm} .

3.15 work station; operator's position: A position in the vicinity of the machine under test which is intended for the operator.

3.16 operator: An individual whose work station is in the vicinity of a machine and who is performing a work task associated with that machine.

3.17 specified position: A position defined in relation to a machine, including, but not limited to, an operator's position. The position can be a single, fixed point, or a combination of points along a path or on a surface located at a specified distance from the machine, as described in the relevant noise test code, if any.

NOTES

10 Positions located in the vicinity of a work station, or in the vicinity of an unattended machine, may be identified as "bystander positions".

11 The following definitions are of a general nature. Reference should be made to specific standards of the ISO 3740 series and the ISO 11200 series for more detailed definitions.

3.18 steady noise: A noise with negligibly small fluctuations of level within the period of observation. See figure 1 a).

3.19 non-steady noise: A noise whose level shifts significantly during the period of observation.

3.19.1 fluctuating noise: A noise whose level varies continuously and to an appreciable extent during the period of observation. See figure 1 b).

3.19.2 intermittent noise: A noise whose level abruptly drops to the level of the background noise several times during the period of observation. The time during which the level remains at a constant value different from that of the ambient is of the order of 1 s or more. See figure 1 c).

3.19.3 impulsive noise: A noise consisting of a series of bursts of sound energy, each burst having a duration of less than approximately 1 s.

3.19.3.1 isolated burst of sound energy: A single burst of sound energy or a series of bursts with intervals larger than 0,2 s between the individual bursts. See figure 1 d).

3.19.3.2 quasi-impulsive noise: A series of noise bursts of comparable amplitude with intervals shorter than 0,2 s between the individual bursts. See figure 1 e).

3.20 broad-band noise: Noise in which the acoustical energy is distributed over a relatively wide range of frequencies.

NOTES

12 The spectrum is generally smooth and continuous, although it may vary significantly from "flat". If the broad-band sound does not contain any significant discrete tones, the sound will lack a subjective quality of pitch or tonality.

13 Examples of broad-band sounds without discrete tones are the sound of a waterfall, the noise from an air diffuser outlet in a typical room, and the noise from a highway.

3.21 narrow-band noise: Noise in which the acoustical energy is concentrated in a relatively narrow range of frequencies.

NOTES

14 The spectrum will generally show a localized "hump" or peak in amplitude. Narrow-band sound may be superimposed on broad-band sound. If the narrow-band sound does not contain any significant discrete tones, the sound will generally lack a subjective quality of pitch or tonality.

15 Examples of narrow-band sounds without discrete tones are the sound of distant thunder (low frequency), the sound of wind gusting over a prairie or through a canyon (mid frequency), and the sound of an air leak in an automobile tyre (high frequency).