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Akustik – Bestämning av insättningsdämpning hos inbyggnader –
Del 1: Mätningar vid laboratorieförhållanden (för deklarationsändamål) (ISO 11546-1:1995)

Acoustics – Determination of sound insulation performances of enclosures –
Part 1: Measurements under laboratory conditions (for declaration purposes) (ISO 11546-1:1995)

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Denna standard ersätter SS-EN ISO 11546-1, utgåva 1.

The European Standard EN ISO 11546-1:2009 has the status of a Swedish Standard. This document contains the official English version of EN ISO 11546-1:2009.

This standard supersedes the Swedish Standard SS-EN ISO 11546-1, edition 1.

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EUROPEAN STANDARD

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EN ISO 11546-1

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Supersedes EN ISO 11546-1:1995

English Version

Acoustics - Determination of sound insulation performances of enclosures - Part 1: Measurements under laboratory conditions (for declaration purposes) (ISO 11546-1:1995)

Acoustique - Détermination de l'isolement acoustique des encoffrements - Partie 1: Mesurages dans des conditions de laboratoire (aux fins de déclaration) (ISO 11546-1:1995)

Akustik - Bestimmung der Schalldämmung von Schallschutzkapseln - Teil 1: Messungen unter Laborbedingungen (Zum Zweck der Kennzeichnung) (ISO 11546-1:1995)

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Contents

Foreword

The text of ISO 11546-1:1995 has been prepared by Technical Committee ISO/TC 43 “Acoustics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 11546-1:2009 by Technical Committee CEN/TC 211 “Acoustics” the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

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This document supersedes EN ISO 11546-1:1995.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directives.

For relationship with EC Directives, see informative Annexes ZA and ZB, which are integral parts of this document.

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The text of ISO 11546-1:1995 has been approved by CEN as a EN ISO 11546-1:2009 without any modification.

Acoustics — Determination of sound insulation performances of enclosures —

Part 1:
Measurements under laboratory conditions (for declaration purposes)

1 Scope

This part of ISO 11546 specifies laboratory methods for the determination of the sound insulation performance (insertion loss) of small machine enclosures.

It applies to a total enclosure only and not to the individual panels from which the enclosure is made.

NOTES

1 Sound insulation for enclosure panels such as wall elements, doors, windows, silencers, etc. should be measured in accordance with other relevant standards.

2 Related standards concern noise-attenuation measurements of enclosures *in situ* (ISO 11546-2) and cabins (ISO 11957).

The measurement methods specified in this part of ISO 11546 are based on International Standards in the series ISO 3740, ISO 9614 and ISO 11200 (see table 1). Depending on the method chosen, the sound insulation performance (insertion loss) of the enclosure is determined in terms of the reduction of sound power level or sound pressure level. Methods are given for measurements where the enclosure surrounds the actual sound source (machine). Where these methods are not practicable, alternative measurements can be performed using a reciprocity method (see definition 3.11 and subclause 7.2) or an artificial sound source.

This part of ISO 11546 is applicable without any restrictions to freestanding enclosures with volumes less than 2 m^3. If the actual sound source is used, the sound insulation performance of enclosures with volumes exceeding 2 m^3 can be determined provided that the requirements concerning maximum permissible volume in the standard used are fulfilled. The actual sound source method is applicable for any kind of enclosure design, for example enclosures fixed to the machine.

When the reciprocity method or the artificial sound source method is used, the maximum volume of the enclosure is limited to 2 m^3. These methods are not applicable to close-fitting enclosures.

The wording "laboratory conditions" used in the title of this part of ISO 11546 indicates that test conditions and test environment (indoor or outdoor) fully conform to the respective International Standards given in table 1.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11546. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11546 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 140-6:1978, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 6: Laboratory measurements of impact sound insulation of floors.*

ISO 717-1:—[1], *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation.*

ISO 3741:1988, *Acoustics — Determination of sound power levels of noise sources — Precision methods for broad-band sources in reverberation rooms.*

ISO 3742:1988, *Acoustics — Determination of sound power levels of noise sources — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.*

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 4871:—[2], *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:—[3], *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning.*

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 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.*

IEC 804:1985, *Integrating-averaging sound level meters.*

IEC 942:1988, *Sound calibrators.*

IEC 1260:—[4], *Electroacoustics — Octave-band and fractional-octave-band filters.*

3 Definitions

For the purposes of this part of ISO 11546, the following definitions apply.

3.1 A-weighting: Frequency weighting as defined in IEC 651.

3.2 enclosure: A structure enveloping a noise source (machine), designed to protect the environment from this noise source (machine).

NOTE 3 An enclosure can be, for example, a freestanding structure terminated on the floor or a structure more or less fixed to the machine. (Concerning enclosures fixed to the machine, see clause 4.)

3.3 sound pressure level, L_p: Ten times the logarithm to the base 10 of the ratio of the square of the sound pressure of a sound to the square of the reference sound pressure. Sound pressure levels are expressed in decibels. The reference sound pressure is 20 µPa (2×10^{-5} Pa).

3.4 average sound pressure level, $\bar{L}_p$: Mean-square of the sound pressure levels:

$$\bar{L}_p = 10 \lg \left(\frac{10^{0,1L_{p1}} + 10^{0,1L_{p2}} + \ldots + 10^{0,1L_{pn}}}{n} \right) \text{ dB}$$

where L_{p1}, L_{p2}, ..., L_{pn} are the sound pressure levels, in decibels, to be averaged.

1) To be published. (Revision of ISO 717-1:1982 and ISO 717-3:1982)

2) To be published. (Revision of ISO 4871:1984)

3) To be published.

4) To be published. (Revision of IEC 225:1966)

3.5 sound power level, L_W: Ten times the logarithm to the base 10 of the ratio of a given sound power to the reference sound power. It is expressed in decibels. The reference sound power is 1 pW (10^{-12} W).

3.6 average sound power level, $\bar{L}_W$: Mean-square of the sound power levels:

$$\bar{L}_W = 10 \lg\left(\frac{10^{0,1L_{W1}} + 10^{0,1L_{W2}} + \ldots + 10^{0,1L_{Wn}}}{n}\right) \text{ dB}$$

where L_{W1}, L_{W2}, ..., L_{Wn} are the sound power levels, in decibels, to be averaged.

3.7 sound power insulation, D_W: Reduction in sound power level obtained due to the enclosure (octave bands or one-third-octave bands). It is expressed in decibels.

3.8 A-weighted sound power insulation, D_{WA}: Reduction in the A-weighted sound power level obtained due to the enclosure for the actual sound source spectrum. It is expressed in decibels.

3.9 sound pressure insulation, D_p: Reduction in the sound pressure level at a specified position due to the enclosure (octave bands or one third octave bands). It is expressed in decibels.

3.10 A-weighted sound pressure insulation, D_{pA}: Reduction in A-weighted sound pressure level at a specified position due to the enclosure for the actual sound source spectrum. It is expressed in decibels.

3.11 sound pressure insulation (reciprocity method), D_{pr}: Difference between the averaged sound pressure level in an external diffuse sound field and the averaged sound pressure level inside an enclosure located in this field. It is expressed in decibels.

3.12 estimated noise insulation due to the enclosure, $D_{WA,e}$, $D_{pA,e}$ or $D_{prA,e}$: Calculated reduction in A-weighted sound power or sound pressure level obtained from D_W, D_p or D_{pr}, measured in accordance with this part of ISO 11546, and a specific noise spectrum. (See annex C.) It is expressed in decibels.

3.13 weighted sound pressure insulation (reciprocity method), $D_{pr,w}$: Single-number value determined in accordance with the method stated in ISO 717-1 except that the sound reduction index is replaced by the sound pressure insulation, reciprocity method, D_{pr}. It is expressed in decibels.

3.14 weighted sound power insulation, $D_{W,w}$: Single-number value determined in accordance with the method stated in ISO 717-1 except that the sound reduction index is replaced by the sound power insulation, D_W. It is expressed in decibels.

3.15 fill ratio, ϕ: Ratio of the volume of the source in an enclosure to the interior volume of that enclosure.

In cases where the shape of the source complicates calculation of the source volume, the volume of a reference box determined in accordance with ISO 3744 can be used.

3.16 leak ratio, θ: Ratio between the area of all openings of the enclosure and the total interior surface area of the enclosure (including openings).

NOTES

4 Openings provided with sufficiently efficient sound-attenuating silencers are not regarded as openings with respect to the leak ratio.

5 The reciprocal value of the leak ratio is designated the seal ratio, Ψ ($\Psi = 1/\theta$).

4 Choice of measurement method

Accurate values of the sound insulation performance of an enclosure can only be obtained when the measurements take place with the actual sound source for which the enclosure is designed. Thus, whenever practicable, methods using the real source shall be used. If the enclosure is fixed or otherwise connected to the sound source, the sound insulation performance can only be determined with the actual sound source.

If the actual sound source cannot be used, a reciprocity method using an external sound field to determine the sound insulation performance is the preferred method. In cases where neither the real sound source method nor the reciprocity method are applicable, the sound insulation performance can be obtained using inside the enclosure the artificial sound source described in annex A. These methods are particularly useful when sound insulation data are required for universally usable enclosures with sound-absorbing interior surfaces and small leak ratios (preferably $\theta < 2$ %). The reciprocity method and the artificial sound source method are applicable to enclosures with volumes less than 2 m^3.

NOTE 6 The more the enclosure deviates from these ideal conditions regarding the leak ratio and absorption, the more there is a need to take measurements using the actual sound source. The reciprocity method and the artificial sound source method are not applicable to close-fitting enclosures (covers and cladding) where there is no free vol-