SLOVENSKI STANDARD
SIST EN ISO 7235:1997

01-april-1997

Akustika - Merilni postopki za dušilnike za kanale - Dodano dušenje, hrup zaradi pretoka in padec totalnega tlaka (ISO 7235:1991)

Acoustics - Measurement procedures for ducted silencers - Insertion loss, flow noise and total pressure loss (ISO 7235:1991)

Akustik - Messungen an Schalldämpfern in Kanälen - Einfügungsdämpfungsmaß, Strömungsgeräusch und Gesamtdruckverlust (ISO 7235:1991)

Acoustique - Méthodes de mesurage pour silencieux en conduit - Perte d'insertion, bruit d'écoulement et perte de pression totale (ISO 7235:1991)

Ta slovenski standard je istoveten z: **EN ISO 7235:1995**

ICS:

17.140.01	Akustična merjenja in blaženje hrupa na splošno	Acoustic measurements and noise abatement in general
91.120.20	Akustika v stavbah. Zvočna izolacija	Acoustics in building. Sound insulation
91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning

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EUROPEAN STANDARD

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English version

Acoustics - Measurement procedures for ducted silencers - Insertion loss, flow noise and total pressure loss (ISO 7235:1991)

Acoustique - Méthodes de mesurage pour silencieux en conduit - Perte d'insertion, bruit d'écoulement et perte de pression totale (ISO 7235:1991)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Ref. No. EN ISO 7235:1995 E

Foreword

The text of the International Standard has been taken as a European Standard by the Technical Committee CEN/TC 211 "Acoustics" from ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO).

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of an identical text or by endorsement, at the latest by November 1995, and conflicting national standards shall be withdrawn at the latest by November 1995.

This european standard 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 Directive(s).

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 7235:1991 has been approved by CEN as a European Standard without any modification.

NOTE: Normative references to International Standards are listed in annex ZA (normative).

Annex ZA (normative)
Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

Publication	Year	Title	EN/HD	Year
ISO 3741	1988	Acoustics - Determination of sound power levels of noise sources - Precision methods for broad-band sources in reverberation rooms	EN 23741	1991
ISO 5136	1990	Acoustics - Determination of sound power radiated into a duct by fans - In-duct method	EN 25136	1993

INTERNATIONAL STANDARD

ISO 7235

First edition
1991-04-15

Acoustics — Measurement procedures for ducted silencers — Insertion loss, flow noise and total pressure loss

Acoustique — Méthodes de mesurage pour silencieux en conduit — Perte d'insertion, bruit d'écoulement et perte de pression totale

Reference number
ISO 7235:1991(E)

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 7235 was prepared by Technical Committee ISO/TC 43, *Acoustics*.

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

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Introduction

This International Standard specifies the substitution method for determining the insertion loss of ducted silencers. Another measurement method, the direct method, was also considered when preparing this International Standard, but this method is not specified here. It may form the subject of a future International Standard.

The test arrangement is designed to allow the application of either the substitution method or the direct method (method not covered by this International Standard). It is such that the measured data arise only from the silencer under test and not from elements to which the silencer is connected.

In the substitution method the sound pressure level of the transmitted wave is first determined with the silencer installed between the test ducts and then when the silencer is replaced by the substitution duct (a hard-duct element). The sound pressure level of the transmitted wave can be measured either in the test duct after the silencer or in a reverberation room connected to this test duct via a transmission element. A reverberation room is used when the flow noise of the microphone in the test duct cannot be sufficiently suppressed. In the substitution method, the determination of the sound power level of the incident wave is not necessary. The method does, however, create the problem of maintaining an unchanged sound power and pressure distribution in the incident wave when replacing the silencer by the substitution duct.

The insertion loss of a silencer is generally affected by the air flow. The insertion loss is therefore measured with superimposed air flow if the silencer is to be used in flow ducts. This measurement requires the provision of an additional air-moving device with its own silencer. The same arrangement is necessary for measuring the flow noise and pressure loss of the silencer under test.

An air flow through a silencer produces noise. This flow noise establishes the lowest sound pressure level which can be achieved after the silencer. It is, therefore, necessary to know the sound power level of the flow noise behind the silencer. This is preferably determined in a reverberation room connected to the test duct via a transmission element.

In accordance with this International Standard, the total pressure loss of a silencer to be used with flow is to be determined. It is, therefore, useful to equip the test facility with the instruments and devices necessary for the determination of the total pressure loss.

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Acoustics — Measurement procedures for ducted silencers — Insertion loss, flow noise and total pressure loss

1 Scope

This International Standard specifies the substitution method for determining the insertion loss of ducted silencers. It sets out requirements for determining

— the insertion loss, in frequency bands, of silencers with and without air flow;

— the sound power level, in frequency bands, of the flow noise generated by silencers;

— the total pressure loss of silencers with air flow.

The measurement procedures are intended for laboratory measurements on silencers but may also be used for *in situ* measurements on silencers if the requirements of this International Standard can be met.

This International Standard applies to silencers for ventilating and air-conditioning systems which are usually connected to ducts or splitter absorbers mounted in ducts. Other duct elements, such as bends or T-connectors, may also be tested using this International Standard.

This International Standard does not apply to reactive silencers used for motor vehicles.

NOTE 1 Exact information on the precision of the method cannot be given at this time. Interlaboratory tests are necessary for the determination of the reproducibility standard deviation σ_R of the method (relevant terms and methods are given in ISO 5725). The following estimates of the reproducibility standard deviation, σ_R, were determined from tests made on splitter-type silencers.

Centre frequencies of the one-third octave hand Hz	Reproducibility standard deviation, σ_R dB
50 to 1 250	3
1 600 to 10 000	2

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 266:1975, *Acoustics — Preferred frequencies for measurements.*

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

ISO 5136:1990, *Acoustics — Determination of sound power radiated into a duct by fans — In-duct method.*

ISO 5221:1984, *Air distribution and air diffusion — Rules to methods of measuring air flow rate in an air handling duct.*

IEC 225:1966, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.*

IEC 651:1979, *Sound level meters.*

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

3 Definitions

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

3.1 sound pressure level, L_p, in decibels: Ten times the logarithm to the base 10 of the ratio of the mean-square sound pressure p of a sound wave to the square of the references sound pressure, p_o:

$$L_p = 10 \lg \frac{p^2}{p_o^2}$$

The width of a restricted frequency band shall be indicated, for example, octave band pressure level, one-third octave band pressure level, etc. The reference sound pressure is $p_o = 20$ µPa.

3.2 sound power level, L_W, in decibels: Ten times the logarithm to the base 10 of the ratio of a given sound power, P, to the reference sound power, P_o:

$$L_W = 10 \lg \frac{P}{P_o}$$

The width of a restricted frequency band shall be indicated, for example, octave band power level, one-third octave band power level, etc. The reference sound power is $P_o = 1$ pW.

3.3 insertion loss, D, in decibels (of a silencer): The reduction in sound power level at a given location behind the silencer due to the insertion of the silencer into the duct in place of a hard-walled duct section

$$D = L_{WII} - L_{WI}$$

where

L_{WI} is the sound power level in the frequency band considered in the test duct or in the connected reverberation room when the test silencer is installed;

L_{WII} is the sound power level in the frequency band considered in the test duct or in the connected reverberation room when the test silencer is replaced by the substitution duct.

3.4 test duct: Straight, hard-walled duct of constant cross-section in front of or after the test silencer in which the sound pressure and the static pressure mesurements are performed.

3.5 in front of (behind): Indication of a position relative to the direction of the sound propagation of the sound signal to be measured corresponding to the "source side" ("receiving side") of the silencer.

3.6 total pressure loss, Δp_t (of a silencer): The difference between the total pressure upstream and downstream of the test silencer. The total pressure loss coefficient ζ is the total pressure loss divided by the velocity pressure upstream of the test silencer.

3.7 transition: A duct element which connects two different duct cross-sections to each other.

3.8 anechoic termination: A device intended to reduce sound reflections at the end of the test duct.

3.9 transmission element: The connection from the test duct on the receiving side of a silencer to a reverberation room. It transmits the sound energy from the duct into the room, avoiding acoustical reflections.

3.10 substitution duct: A rigid, non-absorbing duct element with no sound leakage into the test room; this duct element has the same length and the same connecting cross-section as the silencer.

3.11 reverberation room: A room specially designed to facilitate the production of approximately diffuse sound fields.

3.12 background noise: The sound pressure level at the indicating instrument when the signal to be measured is not present.

NOTE 2 The signal may be either the airborne sound pressure from the loudspeaker equipment propagating through the test duct or the flow noise generated by the silencer being tested.

The main elements in background noise are

— flow noise generated at the microphone;

— flow noise from the fan or from the duct system;

— structure-borne sound from the fan or from the loudspeaker equipment propagating along the duct walls to the measurement position;

— airborne sound radiated from the fan or from the loudspeaker equipment into the test room and transmitted through the duct walls to the microphone;

— electrical noise in the measurement equipment.

3.13 reflection coefficient, r_a: The ratio of the reflected sound pressure amplitude to the pressure amplitude of the sound wave incident on the reflecting object.

3.14 transmission coefficient, τ (of the transmission element): The ratio of the sound power transmitted into the reverberation room to the incident sound power. For transmission elements which comply with the requirements of this International Standard the transmission coefficient is determined from the reflection coefficient using the following equation:

$$\tau = 1 - r_a^2$$