

**Akustika. Helisummutussüsteemide ja
välgupüüdurite laboratoorse mõõdistamise
protseduur. Sisestuskadu, mõõtemüra ja
üldine rõhukadu (ISO 7235:2003)**

Acoustics - Laboratory measurement procedures for
ducted silencers and air-terminal units - Insertion
loss, flow noise and total pressure loss

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 7235:2004 sisaldab Euroopa standardi EN ISO 7235:2003 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 23.11.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN ISO 7235:2004 consists of the English text of the European standard EN ISO 7235:2003.</p> <p>This document is endorsed on 23.11.2004 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

<p>Käsitlusala:</p> <p>This International Standard specifies methods for determining - the insertion loss, in frequency bands, of ducted silencers with and without airflow, - the sound power level, in frequency bands, of the flow noise (or regenerated sound) generated by ducted silencers, - the total pressure loss of silencers with airflow, and the transmission loss, in frequency bands, of air-terminal unit</p>	<p>Scope:</p> <p>This International Standard specifies methods for determining - the insertion loss, in frequency bands, of ducted silencers with and without airflow, - the sound power level, in frequency bands, of the flow noise (or regenerated sound) generated by ducted silencers, - the total pressure loss of silencers with airflow, and the transmission loss, in frequency bands, of air-terminal unit</p>
---	---

ICS 91.120.20

Võtmesõnad:

English version

Acoustics

**Laboratory measurement procedures for ducted
silencers and air-terminal units**

Insertion loss, flow noise and total pressure loss
(ISO 7235 : 2003)

Acoustique – Modes opératoires de
mesure en laboratoire pour silencieux
en conduit et unités terminales – Perte
d'insertion, bruit d'écoulement et
perte de pression totale
(ISO 7235 : 2003)

Akustik – Labormessungen an Schall-
dämpfern in Kanälen – Einfüguungs-
dämpfung, Strömungsgeräusch und
Gesamtdruckverlust (ISO 7235 : 2003)

This European Standard was approved by CEN on 2003-06-20.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom.

CEN

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

Management Centre: rue de Stassart 36, B-1050 Brussels

Foreword

International Standard

ISO 7235 : 2003 Acoustics – Laboratory measurement procedures for ducted silencers and air-terminal units – Insertion loss, flow noise and total pressure loss,

which was prepared by ISO/TC 43 'Acoustics' of the International Organization for Standardization, has been adopted by Technical Committee CEN/TC 211 'Acoustics', the Secretariat of which is held by DS, as a European Standard.

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 the relevant EU Directive.

For relationship with this directive, see Annex ZA.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, and conflicting national standards withdrawn, by February 2004 at the latest.

In accordance with the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard:

Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 7235 : 2003 was approved by CEN as a European Standard without any modification.

Contents

Page

Foreword	2
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Symbols	11
5 Test facilities and requirements for instrumentation	13
5.1 Purpose and types of test facilities	13
5.2 Equipment for acoustic testing of silencers	13
5.3 Equipment for acoustic testing of air-terminal units	19
5.4 Equipment for flow testing	20
5.5 Equipment for dynamic testing	25
6 Test procedures	26
6.1 General	26
6.2 Insertion loss	26
6.3 Transmission loss	28
6.4 Sound power level of the flow noise (or regenerated sound)	28
6.5 Volume flow rate and pressure loss coefficient	29
7 Information to be recorded	33
7.1 Description of the test object	33
7.2 Instrumentation	33
7.3 Sound-source equipment	34
7.4 Test, substitution and transmission ducts	34
7.5 Transitions	34
7.6 Anechoic termination	34
7.7 Reverberation room	34
7.8 Acoustical test results	34
7.9 Measurement uncertainty	35
8 Information to be reported	35
Annex A (normative) Design of the sound field excitation equipment and qualification tests	36
Annex B (normative) Transmission element	38
Annex C (normative) Duct walls and limiting insertion loss	41
Annex D (normative) Conversion of one-third-octave-band attenuation values to octave-band attenuation values	44
Annex E (normative) Measurements on large parallel-baffle silencers	45
Annex F (normative) Test of longitudinal attenuation	47
Annex G (informative) Anechoic terminations	48
Annex H (informative) Examples of measurement arrangements	50
Bibliography	52

Introduction

This International Standard specifies the substitution method for determining the insertion loss of ducted silencers and a method for determining the transmission loss of air-terminal units.

In the substitution method, the sound pressure level of the transmitted wave is first determined for the test object and then when the test object has been replaced by the substitution duct. The sound pressure level of the transmitted wave can be measured

- in a reverberation room,
- in a test duct after the silencer, or
- in an essentially free field.

The methods are listed in order of preference.

The acoustic performance of silencers depends on the modal composition of the sound field at the inlet and on reflections at the outlet side, on flanking transmission and on level differences between signals and flow noise (or regenerated sound).

This International Standard describes configurations at the inlet side providing for a predominant fundamental mode that suffers the least attenuation. For the outlet side, it describes anechoic terminations and measurement procedures which are not sensitive to reflections or which allow for specified corrections. Furthermore, this International Standard gives guidance on the suppression of flanking transmission and noise signals.

The transmission loss of an air-terminal unit is determined from the results of measurements in a reverberation room and theoretical reflection coefficients of a substitution duct.

The insertion loss of a silencer is generally affected by the airflow. The insertion loss is therefore preferably measured with superimposed airflow if the silencer is to be used in ducts with high flow velocity.

For absorptive silencers where the maximum internal flow velocity falls short of 20 m/s, the flow will hardly have an effect on the insertion loss. In practice, non-uniform flow distributions will occur. Therefore, the limit velocity of 20 m/s may correspond to a design velocity of 10 m/s to 15 m/s.

An airflow through a silencer regenerates noise. This flow noise (or regenerated sound) establishes the lowest sound pressure level that can be achieved after the silencer. It is, therefore, necessary to know the sound power level of the flow noise (or regenerated sound) behind the silencer. This is preferably determined in a reverberation room connected to the object 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.

1 Scope

This International Standard specifies methods for determining

- the insertion loss, in frequency bands, of ducted silencers with and without airflow,
- the sound power level, in frequency bands, of the flow noise (or regenerated sound) generated by ducted silencers,
- the total pressure loss of silencers with airflow, and
- the transmission loss, in frequency bands, of air-terminal units.

The measurement procedures are intended for laboratory measurements at ambient temperature. Measurements on silencers *in situ* are specified in ISO 11820.

It is to be noted that the results determined in a laboratory according to this International Standard will not necessarily be the same as those obtained *in situ* (installation), as different sound and flow fields will yield different results. For example, the pressure loss will be lower under laboratory conditions than *in situ*, but will be comparable between different laboratories.

This International Standard is applicable to all types of silencer including silencers for ventilating and air-conditioning systems, air intake and exhaust of flue gases, and similar applications. Other passive air-handling devices, such as bends, air-terminal units or T-connectors, can also be tested using this International Standard.

This International Standard is not applicable to reactive silencers used for motor vehicles.

NOTE 1 Annex A specifies the sound field excitation equipment. Annex B gives requirements for the transition element. Annex C gives details of duct walls and limiting insertion loss. Annex D specifies how to convert one-third-octave band attenuation values to octave band values. Annex E gives requirements for measurements on large parallel-baffle silencers. Annex F specifies a test of longitudinal attenuation. Annex G gives guidelines on anechoic terminations and Annex H shows examples of measurement arrangements.

NOTE 2 Acoustic testing of air-terminal devices and fan-coil units is to be carried out as described for air-terminal units.

NOTE 3 Sound power measurements on air-terminal units are specified in ISO 5135. Measurements of the pressure loss of air-terminal units are described in EN 12238, EN 12239 and EN 12589.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3741:1999, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms*

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

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

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

ISO 9614-3, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 3: Precision method for measurement by scanning*

IEC 60651:2001, *Sound level meters*

IEC 60804:2000, *Integrating-averaging sound level meters*

IEC 60942:1997, *Electroacoustics — Sound calibrators*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1 insertion loss

D_i
(of the test object) reduction in the level of the sound power in the duct behind the test object due to the insertion of the test object into the duct in place of a substitution duct, given by the equation

$$D_i = L_{WII} - L_{WI} \quad (1)$$

where

L_{WI} is the level of the sound power in the frequency band considered, propagating along the test duct or radiating into the connected reverberation room when the test object is installed;

L_{WII} is the level of the sound power in the frequency band considered, propagating along the test duct or radiating into the connected reverberation room when the substitution duct replaces the test object.

NOTE 1 The insertion loss is expressed in decibels (dB).

NOTE 2 For measurements according to this International Standard, the insertion loss of a silencer equals its transmission loss.

3.2 transmission loss

D_t
(of an air-terminal unit) difference between the levels of the sound powers incident on and transmitted through the test object

NOTE 1 The transmission loss is expressed in decibels (dB).

NOTE 2 Adapted from ISO 11820:1996.