SIST

SLOVENSKI STANDARD
SIST EN ISO 10846-1:1999

01-november-1999

Akustika in vibracije - Laboratorijsko merjenje vibro-akustičnih prenosnih lastnosti elastičnih elementov - 1. del: Načela in smernice (ISO 10846-1:1997)

Acoustics and vibration - Laboratory measurement of vibro-acoustic transfer properties of resilient elements - Part 1: Principles and guidelines (ISO 10846-1:1997)

Akustik und Schwingungstechnik - Laborverfahren zur Messung der vibro-akustischen Transfereigenschaften elastischer Elemente - Teil 1: Grundlagen und Übersicht (ISO 10846-1:1997)

Acoustique et vibrations - Mesurage en laboratoire des propriétés de transfert vibro-acoustique des éléments élastiques - Partie 1: Principes et lignes directrices (ISO 10846-1:1997)

Ta slovenski standard je istoveten z: **EN ISO 10846-1:1998**

ICS:

17.140.01	Akustična merjenja in blaženje hrupa na splošno	Acoustic measurements and noise abatement in general
17.160	Vibracije, meritve udarcev in vibracij	Vibrations, shock and vibration measurements

SIST EN ISO 10846-1:1999 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 10846-1

November 1998

ICS 17.140.01

Descriptors: see ISO document

English version

Acoustics and vibration - Laboratory measurement of vibro-acoustic transfer properties of resilient elements - Part 1: Principles and guidelines (ISO 10846-1:1997)

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This European Standard was approved by CEN on 8 November 1998.

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This European Standard exists 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 Central Secretariat has the same status as the official versions.

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

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 10846-1:1998 E

Foreword

The text of the International Standard from Technical Committee ISO/TC 43 "Acoustics" and ISO/TC 108 "Mechanical vibration and shock" of the International Organization for Standardization (ISO) has been taken over as an European Standard 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 May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, 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 10846-1:1997 has been approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 10846-1

First edition
1997-10-15

Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements —

Part 1:
Principles and guidelines

Acoustique et vibrations — Mesurage en laboratoire des propriétés de transfert vibro-acoustique des éléments élastiques —

Partie 1: Principes et lignes directrices

Reference number
ISO 10846-1:1997(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 10846-1 was prepared jointly by Technical Committees ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*, and ISO/TC 108, *Mechanical vibration and shock*.

Annexes A to E of this part of ISO 10846 are for information only.

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Printed in Switzerland

Introduction

Passive vibration isolators of various kinds are used to reduce the transmission of vibrations. Examples are automobile engine mounts, elastic supports for buildings, elastic mounts and flexible shaft couplings for shipboard machinery and small isolators in household appliances.

This part of ISO 10846 serves as an introduction and a guide to parts 2 to 5 of ISO 10846, which describe laboratory measurement methods for the determination of the most important quantities which govern the transmission of vibrations through linear isolators, i.e. frequency-dependent dynamic stiffnesses.

This part of ISO 10846 provides the theoretical background, the principles of the methods, the limitations of the methods and guidance for the selection of the most appropriate standard of the series.

The laboratory conditions described in all parts of ISO 10846 include the application of static preload.

The results of the methods are useful for isolators which are used to prevent low-frequency vibration problems and to attenuate structure-borne sound. The methods are not sufficiently appropriate to characterize completely isolators which are used to attenuate shock excursions.

Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements —

Part 1:
Principles and guidelines

1 Scope

This part of ISO 10846 explains the principles underlying parts 2 to 5 of ISO 10846 for determining the transfer properties of vibration isolators from laboratory measurements, and provides assistance in the selection of the appropriate part of this series.

This part of ISO 10846 is applicable to vibration isolators which are used to reduce:

a) the transmission of audiofrequency vibrations (structure-borne sound, 20 Hz to 20 kHz) to a structure which may, for example, radiate fluid-borne sound (airborne, waterborne, or other);

b) the transmission of low frequency vibrations (typically 1 Hz to 80 Hz) which may, for example, act upon humans or cause damage to structures when vibration is too severe.

The data obtained with the measurement methods which are outlined in this part of ISO 10846 and further detailed in parts 2 to 5 of ISO 10846 can be used for:

— product information provided by manufacturers and suppliers;

— information during product development;

— quality control;

— computation of the transfer of vibrations through isolators.

The conditions for the validity of the measurement methods are

a) linearity of the vibrational behaviour of the isolator (this includes elastic elements with non-linear static load-deflection characteristics as long as the elements show approximate linearity for vibrational behaviour for a given static preload);

b) the contact interfaces of the vibration isolator with the adjacent source and receiver structures can be considered as point contacts.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 10846. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10846 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2041:1990, *Vibration and shock — Vocabulary.*

3 Definitions

For purposes of this part of ISO 10846, the definitions given in ISO 2041 and the following apply.

3.1
resilient element
(see vibration isolator)

3.2
vibration isolator
isolator designed to attenuate the transmission of vibration in a frequency range [ISO 2041:1990, 2.110]

3.3
elastic support
vibration isolator suitable for supporting a part of the mass of a machine, a building or another type of structure

3.4
blocking force
F_b
dynamic force at the output side of a vibration isolator which results in zero displacement output

3.5
dynamic driving point stiffness
$k_{1,1}$
frequency-dependent complex ratio of the force on the input side of a vibration isolator with the output side blocked to the complex displacement on the input side during simple harmonic vibration

NOTE 1 $k_{1,1}$ may depend on the static preload, temperature and other conditions.

NOTE 2 At low frequencies $k_{1,1,}$ is solely determined by elastic and dissipative forces. At higher frequencies inertial forces in the resilient element play a role as well.

3.6
dynamic transfer stiffness
$k_{2,1}$
frequency-dependent complex ratio of the force on the blocked output side of a vibration isolator to the complex displacement on the input side during simple harmonic vibration

NOTE 1 $k_{2,1}$ may depend on the static preload, temperature and other conditions.

NOTE 2 At low frequencies $k_{2,1}$ is solely determined by elastic and dissipative forces and $k_{2,1} = k_{1,1}$ At higher frequencies inertial forces in the resilient element play a role as well and $k_{2,1} \neq k_{1,1}$

3.7
loss factor of resilient element
η
frequency-dependent ratio of the imaginary part of $k_{2,1}$ to the real part of $k_{2,1}$ (i.e. tangent of the phase angle of $k_{2,1}$) in the low-frequency range where inertial forces in the element are negligible

3.8
point contact
contact area which vibrates as the surface of a rigid body

3.9
linearity
property of the dynamic behaviour of a vibration isolator if it satisfies the principle of superposition

NOTE 1 The principle of superposition can be stated as follows: if an input $x_1(t)$ produces an output $y_1(t)$ and in a separate test an input $x_2(t)$ produces an output $y_2(t)$, superposition holds if the input $\alpha x_1(t) + \beta x_2(t)$ produces the output $\alpha y_1(t) + \beta y_2(t)$. This must hold for all values of α, β and $x_1(t)$, $x_2(t)$; α and β are arbitrary constants.

NOTE 2 In practice the above test for linearity is impractical and a limited check of linearity is done by measuring the dynamic transfer stiffness for a range of input levels. For a specific preload, if the dynamic transfer stiffness is nominally invariant the system can be considered linear. In effect this procedure checks for a proportional relationship between the response and the excitation.

3.10
direct method
method in which either the input displacement, velocity or acceleration and the blocking output force are measured

3.11
indirect method
method in which the transmissibility (for displacement, velocity or acceleration) of an isolator is measured, with the output loaded by a mass/effective mass

3.12
driving point method
method in which either the input displacement, velocity or acceleration and the input force are measured, with the output side of the vibration isolator blocked

4 Selection of appropriate International Standard

Table 1 provides guidance for the selection of the appropriate part of ISO 10846.

Table 1 — Guidance for selection

	International Standard and method type			
	ISO 10846-2 Direct method	ISO 10846-3 Indirect method	ISO 10846-4 Indirect method	ISO 10846-5 Driving point method
Type of vibration isolator	support	support	other than support	support
Examples	resilient mountings for instruments, equipment, machinery and buildings		bellows, hoses, elastic shaft couplings, power supply cables	see under ISO 10846-2 and ISO 10846-3
Frequency range	1 Hz to f_1 f_1 dependent on test rig; typically (but not limited to) 300 Hz < f_1 < 500 Hz	f_2 to f_3 f_2 typically (but not limited to) 20 Hz to 50 Hz. For very stiff mountings f_2 > 100 Hz. f_3 typically 2 kHz to 5 kHz, but dependent on the test rig	f_2 to f_3 f_2 typically (but not limited to) 20 Hz to 50 Hz. For very stiff elements f_2 > 100 Hz. f_3 typically 2 kHz to 5 kHz, but dependent on the test rig	1 Hz to f_4 f_4 typically (but not limited to) < 100 Hz
Translational components	1, 2 or 3	1, 2 or 3	1, 2 or 3	1, 2 or 3
Rotational components	none	informative annex	informative annex	none
Classification of method	engineering	engineering	engineering/survey	engineering/survey
NOTE At the low-frequency end, the direct method and the driving point method yield the same result.				

Further guidance is given in clauses 5 and 6.