SLOVENSKI STANDARD
SIST EN ISO 10846-4:2004

01-januar-2004

Akustika in vibracije - Laboratorijsko merjenje vibro-akustičnih prenosnih lastnosti elastičnih elementov – 4. del: Dinamična togost elementov, razen elastičnih podpor za translatorno gibanje (ISO 10846-4:2003)

Acoustics and vibration - Laboratory measurement of vibro-acyustic transfer properties of resilient elements - Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion (ISO 10846-4:2003)

Akustik und Schwingungstechnik - Laborverfahren zur Messung der vibro-akustischen Transfereigenschaften elastischer Elemente - Teil 4: Bestimmung der dynamischen Transfersteifigkeit von elastischen Elementen mit Ausnahme elastischer Stützelemente für translatorische Schwingungen (ISO 10846-4:2003)

Acoustique et vibrations - Mesurage en laboratoire des propriétés de transfert vibro-acoustique des éléments élastiques - Partie 4: Raideur dynamique en translation des éléments autres que les supports élastiques (ISO 10846-4:2003)

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17.160	Vibracije, meritve udarcev in vibracij	Vibrations, shock and vibration measurements

SIST EN ISO 10846-4:2004 **en**

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EN ISO 10846-4

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Acoustics and vibration - Laboratory measurement of vibro-acyustic transfer properties of resilient elements - Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion (ISO 10846-4:2003)

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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 Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

This document (EN ISO 10846-4:2003) has been prepared by Technical Committee ISO/TC 43 "Acoustics" in collaboration with 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 March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

NOTE FROM CMC The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of ISO 10846-4:2003 has been approved by CEN as EN ISO 10846-4:2003 without any modifications.

INTERNATIONAL STANDARD

ISO 10846-4

First edition
2003-09-01

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

Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion

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

Partie 4: Raideur dynamique en translation des éléments autres que les supports élastiques

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10846-4 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*, in collaboration with ISO/TC 108, *Mechanical vibration and shock*.

ISO 10846 consists of the following parts, under the general title *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements*:

— *Part 1: Principles and guidelines*

— *Part 2: Dynamic stiffness of elastic supports for translatory motion — Direct method*

— *Part 3: Indirect method for determination of the dynamic stiffness of resilient supports for translatory motion*

— *Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion*

— *Part 5: Driving point method for the determination of the low frequency dynamic stiffness of elastic supports for translatory motion*

Introduction

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

This part of ISO 10846 specifies a direct and an indirect method for measuring the dynamic transfer stiffness function of linear resilient elements (other than resilient supports) such as resilient bellows, hoses, shaft couplings, power supply cables and pipe hangers. This part of ISO 10846 belongs to a series of International Standards on methods for the laboratory measurement of the vibro-acoustic properties of resilient elements, which also includes documents on measurement principles and on a direct, an indirect and a driving point method for resilient supports. ISO 10846-1 provides global guidance for the selection of the appropriate International Standard.

The laboratory conditions described in this part of ISO 10846 include the application of static preload, where appropriate.

The results of the method described in this part of ISO 10846 are useful for resilient elements that are used to reduce the transmission of structure-borne sound (primarily frequencies above 20 Hz). The method does not characterize completely elements that are used to attenuate low-frequency vibration or shock excursions.

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

Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion

1 Scope

This part of ISO 10846 specifies two methods for determining the dynamic transfer stiffness for translations of resilient elements other than resilient supports. Examples are resilient bellows, shaft couplings, power supply cables, hoses and pipe hangers (see Figure 1). Elements filled with liquids, such as oil or water, are excluded.

NOTE 1 Pipe hangers are extensionally deflected, as opposed to elastic supports which are compressed. Therefore, the test conditions are different from those described in ISO 10846-2 and ISO 10846-3.

The methods are applicable to resilient elements with flat flanges or flat clamp interfaces. It is not necessary that the flanges be parallel.

Resilient elements which are the subject of this part of ISO 10846 are those that 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 unwanted sound (airborne, waterborne or other), and

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

In practice, the size of the available test rig(s) determines restrictions for very small and for very large resilient elements.

Measurements for translations normal and transverse to the flanges or clamp interfaces are covered in this part of ISO 10846. Annex A provides guidance for the measurement of transfer stiffnesses that include rotatory components.

The direct method can be applied in the frequency range from 1 Hz up to a frequency that is usually determined by the lowest resonance frequency of the test arrangement frame (typically 300 Hz for test rigs with dimensions of the order of 1 m).

NOTE 2 In practice, the lower frequency limit depends on the dynamic excitation system.

The indirect method covers a frequency range that is determined by the test set-up and the isolator under test. The range is typically from a lower frequency between 20 Hz and 50 Hz, to an upper frequency between 2 kHz and 5 kHz.

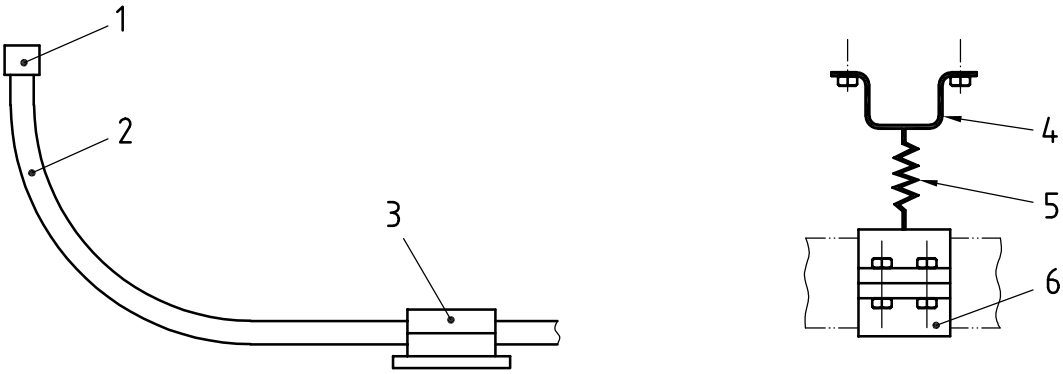
The data obtained according to the methods specified in this part of ISO 10846 can be used for

— product information provided by manufacturers and suppliers,

— information during product development,

— quality control, and

— calculation of the transfer of vibration through resilient elements.



a) Power cable including connector and clamping device

b) Pipe hanger

Key

1 connector
2 cable
3 clamp
4 fixture
5 flexible element
6 pipe clamp

Figure 1 — Examples of resilient elements with flat flanges or clamps

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 266, *Acoustics — Preferred frequencies*

ISO 2041, *Vibration and shock — Vocabulary*

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

ISO 7626-1, *Vibration and shock — Experimental determination of mechanical mobility — Part 1: Basic definitions and transducers*

ISO 7626-2, *Vibration and shock — Experimental determination of mechanical mobility — Part 2: Measurements using single-point translation excitation with an attached vibration exciter*

ISO 10846-1, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 1: Principles and guidelines*

ISO 16063-21, *Methods for the calibration of vibration and shock transducers — Part 21: Vibration calibration by comparison with a reference transducer*

GUM:1993, *Guide to the expression of uncertainty in measurement.* BIPM/IEC/IFCC/ISO/IUPAC/IUPAP/OIML

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041 and the following apply.

3.1
resilient element
element of which one of the functions is the reduction of the vibration transmission in a certain frequency range

3.2
resilient support
resilient element suitable for supporting part of the mass of a machine, a building or another type of structure

3.3
test element
resilient element under test, including flanges and auxiliary fixtures, if any

3.4
blocking force
F_b
dynamic force on the output side of a resilient element which results in zero displacement output

3.5
dynamic transfer stiffness
$k_{2,1}$
frequency-dependent ratio of the complex blocking force $\underline{F}_{2,b}$ on the output side of a resilient element to the complex displacement $\underline{u}_1$ on the input side during simple harmonic motion, defined by the following formula

$$k_{2,1} = \underline{F}_{2,b}/\underline{u}_1$$

NOTE The value of $k_{2,1}$ can be dependent upon the static preload, temperature and other conditions.

3.6
loss factor of resilient element
η
ratio of the imaginary part of $k_{2,1}$ and 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

3.7
frequency-averaged dynamic transfer stiffness
k_{av}
function of the frequency of the average value of the modulus of the dynamic transfer stiffness over a frequency band Δf

NOTE See 8.3.

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

3.9
normal translation
translational vibration normal to the flange of a resilient element

3.10
transverse translation
translational vibration in a direction perpendicular to that of the normal translation