Acoustics and vibration - Laboratory measurement of vibro-acoustic transfer properties of resilient elements - Part 1: Principles and guidelines

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Acoustique et vibrations - Mesurage en laboratoire des propriétés de transfert vibro-acoustique des éléments élastiques - Partie 1: Principes et lignes directrices (ISO 10846-1:2008)

Akustik und Schwingungstechnik - Laborverfahren zur Messung der vibro-akustischen Transfereigenschaften elastischer Elemente - Teil 1: Grundlagen und Übersicht (ISO 10846-1:2008)

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Foreword

This document (EN ISO 10846-1:2008) 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of an identical text or by endorsement, at the latest by February 2009, and conflicting national standards shall be withdrawn at the latest by February 2009.

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Endorsement notice

The text of ISO 10846-1:2008 has been approved by CEN as a EN ISO 10846-1:2008 without any modification.

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Introduction

Passive vibration isolators of various kinds are used to reduce the transmission of vibrations. Examples include 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 serves as an introduction and a guide to ISO 10846-2, ISO 10846-3, ISO 10846-4 and ISO 10846-5, which describe laboratory measurement methods for the determination of the most important quantities which govern the transmission of vibrations through linear resilient elements, i.e. frequency-dependent dynamic transfer 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, where appropriate.

The results of the methods are useful for resilient elements, which are used to prevent low-frequency vibration problems and to attenuate structure-borne sound. However, for complete characterization of resilient elements that are used to attenuate low-frequency vibration or shock excursions, additional information is needed, which is not provided by these methods.

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 ISO 10846-2, ISO 10846-3, ISO 10846-4 and ISO 10846-5 for determining the transfer properties of resilient elements from laboratory measurements, and provides assistance in the selection of the appropriate part of this series. It is applicable to resilient elements that are used to reduce

a) the transmission of audio frequency vibrations (structure-borne sound, 20 Hz to 20 kHz) to a structure which may, for example, radiate fluid-borne 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.

The data obtained with the measurement methods, which are outlined in this part of ISO 10846 and further detailed in ISO 10846-2, ISO 10846-3, ISO 10846-4 and ISO 10846-5, can be used for

— product information provided by manufacturers and suppliers,

— information during product development,

— quality control, and

— calculation of the transfer of vibrations through resilient elements.

The conditions for the validity of the measurement methods are

a) linearity of the vibrational behaviour of the resilient elements (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), and

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

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 2041:—[1)], *Mechanical vibration, shock and condition monitoring — Vocabulary*

1) To be published. (Revision of ISO 2041:1990)

ISO/IEC Guide 98-3 [2)], *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM 1995)*

3 Terms and definitions

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

3.1
vibration isolator
resilient element
isolator designed to attenuate the transmission of the vibration in a certain frequency range

NOTE Adapted from ISO 2041:—[1)], definition 2.120.

3.2
resilient support
vibration isolator(s) suitable for supporting a machine, a building or another type of structure

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

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

3.5
dynamic driving point stiffness
$k_{1,1}$
frequency-dependent ratio of the force phasor $\underline{F}_1$ on the input side of a vibration isolator with the output side blocked to the displacement phasor $\underline{u}_1$ on the input side

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

NOTE 1 The subscripts "1" denote that the force and displacement are measured on the input side.

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

NOTE 3 At low frequencies, elastic and dissipative forces solely determine $k_{1,1}$. At higher frequencies, inertial forces play a role as well.

3.6
dynamic driving point stiffness of inverted vibration isolator
$k_{2,2}$
dynamic driving point stiffness, with the physical input and output sides of the vibration isolator interchanged

NOTE At low frequencies, where elastic and dissipative forces solely determine the driving point stiffness, $k_{1,1} = k_{2,2}$. At higher frequencies inertial forces play a role as well and $k_{1,1}$ and $k_{2,2}$ will be different in case of asymmetry.

2) ISO/IEC Guide 98-3 will be published as a re-issue of the *Guide to the expression of uncertainty in measurement* (GUM), 1995.