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Mechanical vibration and shock — Mechanical mounting of accelerometers

Vibrations et chocs mécaniques — Fixation mécanique des accéléromètres

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring.*

This third edition cancels and replaces the second edition (ISO 5348:1998), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the theory of mass and stiffness influence on the frequency response obtained has been expanded;

— the frequency responses have been replaced by actual measurements and have been made more comparable;

— the influence of electrical loops has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The method most commonly used for determining the vibratory motion of a structure or body is the use of an electromechanical vibration transducer, also called a transducer or a vibration sensor. These vibration transducers can be divided into the two broad classes: non-contacting and contacting transducers.

Non-contacting transducers are relative measuring transducers recording a motion in relation to a fixed space coordinate system. Typical examples are eddy-current probes, optical sensors and laser vibrometers. These transducers have no direct mechanical contact with the structure and are therefore not dealt with in this document.

Contacting transducers are mounted onto the structure by mechanical coupling. This includes, for example, piezoelectric, capacitive and piezoresistive accelerometers as well as seismic velocity transducers. These absolute measuring transducers record the motion by seismic forces from the space coordinate system onto which they are mounted. If such a transducer is mounted onto a structure, the properties of the mounting can significantly influence the frequency response of the structure as well as the vibration transducer. Very large measurement deviations can occur in case of lack of care in the mounting property, particularly at high frequencies.

Under certain circumstances the mass, geometry and mounting stiffness of the transducer can directly influence the measured vibration amplitude of the structure. This effect occurs for example if the masses of the transducer and the structure are in the same order of magnitude.

This document is concerned with the contacting type of seismic accelerometers and seismic velocity transducers which are currently in wide use. The concern with using such transducers is that the mechanical coupling between the accelerometer and the test structure can significantly alter the response of the accelerometer, the structure or both. This document attempts to isolate parameters of concern in the selection of a method to mount the accelerometer onto the structure.

In a basic sense, many aspects of velocity transducer mounting are similar to those of accelerometers, but they are not identical. Please refer to 6.2.1.

This document does not cover geophones.

Mechanical vibration and shock — Mechanical mounting of accelerometers

1 Scope

This document specifies the important technical properties of the different methods for mounting vibration transducers and describes recommended practices. It also shows examples of how accelerometer mounting can influence frequency response and gives examples of how other influences can affect the fidelity of the representation of actual motion in the structure being observed.

This document applies to the contacting type of accelerometer which is currently in wide use. It is applicable to both uniaxial and multi-axial transducers. This document can also be applied to velocity transducers.

This document enables the user to estimate the limitations of a mounting and consequent potential measurement deviations.

Transducer mounting issues are not the only problem that can affect the validity of acceleration measurement. Other such problems include, amongst others: transverse movements, alignment of the transducer, base bending, cable movement, temperature changes, electric and magnetic fields, cable whip and mounting torque. Issues other than mounting and their possible effects are outside the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 8042, *Shock and vibration measurements — Characteristics to be specified for seismic pick-ups*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Basics

A vibration transducer is mounted on the surface of a structure in motion, as illustrated in the simplified diagram shown in Figure 1. Under ideal conditions, the vibration transducer supplies an electric signal at its output which is proportional to the magnitude of the mechanical acceleration input vector, a_N. The vector a_N is normally directed to the transducer base and measures the projection of the structure vibration acceleration vector, a_S, in the direction of the transducer nominal sensitive vectorial axis, a_N (measurement direction).

The vibration in the direction of the acceleration vector, a_S, on the structure is transferred into the measurement direction of the transducer via the mechanical mounting fixture. Frequency-dependent

