STANDARD **9611**

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Acoustics — Characterization of sources of structure-borne sound with respect to sound radiation from connected structures — Measurement of velocity at the contact points of machinery when resiliently mounted

Acoustique — Caractérisation des sources de bruit solidien pour estimer le bruit rayonné par les structures auxquelles elles sont fixées — Mesurage de la vitesse aux points de contact des machines à montage élastique

Reference number
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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.

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 9611 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

Annexes A to D form an integral part of this International Standard. Annexes E to J are for information only.

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Introduction

This International Standard is one of a series of frame documents specifying various methods for the characterization of machines or equipment as sources of structure-borne sound with respect to sound radiation from connected structures.

The application of this International Standard to a certain family of machines needs additional requirements such as, for example, well-defined operating conditions given in a specific test code. This International Standard describes how, at each connection point for a resilient element, six components of the vibration can be measured and gives estimated standard deviations for their measurement uncertainty for frequencies in a given range of frequency. For a specific machine, a family of machines or for a specific application, fewer components may be sufficient to characterize the source, thus the number of components measured could be reduced and the defined frequency range could be appropriately expanded or reduced.

0.1 General considerations

Airborne sound in buildings, ships and vehicles and the underwater sound radiated by ships is very often caused by vibrations of machinery or equipment. In general, such sound is emitted in at least two ways:

a) directly from the outer surface of the machine into surrounding air; measurement methods for its determination are given in the series ISO 3740 to ISO 3747 and in ISO/TR 7849; and

b) from structures connected to the machine; this sound radiation results from structure-borne sound being emitted by the machine into the connected structures such as foundation, pipes, other coupled machines or linked auxiliary equipment.

This International Standard deals according to b) with machines or equipment which are sources of structure-borne sound emission into connected structures with respect to airborne or liquid-borne sound radiation of connected structures.

The measurement and evaluation of machinery vibration with respect to human response, trouble-free operation of coupled or connected machinery, as well as structural fatigue and the lifetime of the machine itself are outside the scope of this International Standard. These fields are covered by International Standards of Technical Committee ISO/TC 108, *Mechanical vibration and shock* (see, for example, ISO 10816-1).

A major problem associated with the measurement of structure-borne sound emission is the choice of the quantities that characterize the "strength" of a source. The complete and fully accurate characterization of a source of structure-borne sound would involve an extremely large number of measurements; thus, one has somehow to trade accuracy against the simplicity of the method. In the context of standardization, emphasis is

"strength" by a limited number of frequency-dependent quantities.

Simplified source descriptions are possible when the two following assumptions are both satisfied:

a) the connections of the machine with the surrounding structure can be treated as "points"; and

b) there is a considerable mobility mismatch for all degrees of freedom of vibration at the connection points.

In such cases, the sources can be described with a limited number of force spectra if the source has relatively high mobilities, and with a limited number of velocity spectra if the source has relatively low mobilities as compared with the corresponding point mobilities of the receiving structure. An important feature is the fact that, for a certain range of receiving structures, these source descriptions are independent of the precise characteristics of the receiving structure.

For many practical purposes, the resulting source descriptions are still too complicated and a further simplification to one-, two- or three-frequency dependent quantities is necessary. The annexes give guidelines for the selection of circumstances under which further simplifications are possible.

0.2 Specific considerations

This International Standard is one of a series specifying various methods for the characterization of sources of structure-borne sound (i.e. for the characterization of sources of vibrations) in the frequency range of audible sound. It gives a detailed description of a first method of a series[1)]. The results of this International Standard may be used for the following purposes:

a) obtaining data for preparing technical specifications;

b) comparing the structure-borne sound emission of resiliently mounted machines of the same type and size;

c) obtaining input data for planning and noise purposes (e.g. input data for the calculation of structure-borne sound transmission through resilient mountings into the connected structure).

The method concerns the measurement of translational and angular velocity levels on the supports and other contact points of a machine which is mounted on resilient mountings (isolators). In the frequency range of the method, the selected isolators, flexible connections and foundation are such that the vibration of the contact point is not significantly affected by their presence. Consequently the results represent the free vibratory velocity levels of the contact points. The method is further restricted by the requirement that a machine support or the contact structure of a machine to another flexible connection can be considered to vibrate as a rigid body. This implies an upper frequency limit.

The direct application of the results is limited by the above restrictions. In spite of these restrictions, there is a large variety of machines for which the method may be valuable. Examples are diesel engines, diesel gener-

1) International Standards describing the other methods and one giving a basic summary are in preparation.