

BS ISO 18312-2:2012



BSI Standards Publication

Mechanical vibration and shock — Measurement of vibration power flow from machines into connected support structures

Part 2: Indirect method

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National foreword

This British Standard is the UK implementation of ISO 18312-2:2012.

The UK participation in its preparation was entrusted to Technical Committee GME/21/2, Mechanical vibration, shock and condition monitoring - Vibration and shock measuring instruments and testing equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Mechanical vibration and shock —
Measurement of vibration power flow
from machines into connected support
structures —**

**Part 2:
Indirect method**

*Vibrations et chocs mécaniques — Mesurage du flux de puissance
vibratoire transmis par des machines aux structures de support dont
elles sont solidaires —*

Partie 2: Méthode indirecte





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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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 18312-2 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*.

ISO 18312 consists of the following parts, under the general title *Mechanical vibration and shock — Measurement of vibration power flow from machines into connected support structures*:

- *Part 1: Direct method*
- *Part 2: Indirect method*

Mechanical vibration and shock — Measurement of vibration power flow from machines into connected support structures —

Part 2: Indirect method

1 Scope

This part of ISO 18312 specifies a method for evaluating the vibration power emitted by machines or pipelines (referred to hereinafter as machines) on to supporting structures to which the machines are connected through vibration isolators. This part of ISO 18312 also specifies the method for evaluating the vibration power components emitted in the six degrees of freedom of a Cartesian coordinate system at each joint, i.e. three translations and three rotations. The vibration power is determined by processing the signals from two sets of velocity (or acceleration) transducers mounted at the isolator connection points, one set on the machine side (input) and the other on the foundation side (output). This method is applicable for machines under the assumption that their vibration can be characterized by a stationary random process.

The components of emitted vibration power are computed using the cross-spectra of the two sets of velocity in narrow band (or one third-octave) and the dynamic stiffness characteristics of the isolator over the frequency range of interest.

The upper frequency limits of this method are established in this part of ISO 18312.

This part of ISO 18312 can be used for:

- a) evaluating a machinery system from isolator design concept;
- b) obtaining data for preparation of technical requirements for allowable machine vibration power emission;
- c) determining appropriate and cost-effective vibration control procedures;
- d) solving diagnostics issues.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

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

3 Terms and definitions

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

3.1

velocity vector

$v^{n,m}$

vibration velocity vector at the n th isolator on a machine, consisting of three translational and three rotational components along the coordinate axes x , y , and z

Note to entry: The symbol $v^{n,f}$ denotes velocity vector at the same isolator on a foundation.

3.2

velocity component

$v_i^{n,m}$

component of vibration velocity vector in the degree of freedom i at the n th isolator on the machine; $i = 1, 2$, and 3 for the linear components in the x -, y -, and z -directions, respectively, and $i = 4, 5$, and 6 for angular components in the x -, y -, and z -directions, respectively

Note to entry: The symbol $v_i^{n,f}$ represents vibration velocities at the same isolator on the foundation.

3.3

acceleration component

$a_i^{n,m}$

component of vibration acceleration in the degree of freedom i at the n th isolator on the machine

3.4

root mean square value of acceleration component

r.m.s. value of acceleration component

$a_{i:rms}^{n,m}$

root mean square value of the vibration acceleration component in the degree of freedom i at the n th isolator on the machine

3.5

force vector

$F^{n,m}$

(indirect method) vibration force vector acting at the n th isolator by the machine, consisting of three linear force components and three angular force components or moments, along the coordinate axes x , y , and z

Note to entry: The symbol $F^{n,f}$ represents a force vector acting at the same isolator by the foundation, which becomes the same as $-F^{n,m}$ if the vibration isolators are massless.

3.6

force component

$F_i^{n,m}$

(indirect method) component of vibration force vector in the degree of freedom i at the n th isolator on the machine; $i = 1, 2$, and 3 for force components in the x -, y -, and z -directions, respectively, and $i = 4, 5$, and 6 for the moment components in the x -, y -, and z -directions, respectively

3.7

vibration power component

$P_i^{n,m}$

(indirect method) vibration power component emitted from the machine into the n th isolator in the degree of freedom i , given by time average of scalar product of force vector and velocity vector at the n th isolator on the machine in the degree of freedom i

Note to entry 1: A vibration power component is expressed in watts.

Note to entry 2: The symbol $P_i^{n,f}$ represents vibration power components transmitted into foundation via the n th isolator.

3.8

vibration power at a mount

$P^{n,m}$

sum of vibration power emitted from the machine into the n th isolator over all degrees of freedom

Note to entry: The symbol $P^{n,f}$ represents vibration power transmitted into the foundation via the same isolator.

3.9

vibration power

P^m

⟨indirect method⟩ total vibration power emitted from the machine into the isolators, given by the sum of vibration power emitted from the machine over all isolators and in every degree of freedom

Note to entry: The symbol P^f represents total power transmitted into the foundation via all isolators.

3.10

vibration power spectrum

$P^m(f, \Delta f)$

⟨indirect method⟩ decomposition of the total vibration power from the machine P^m into frequency domain with a given centre frequency f and bandwidth Δf

3.11

component of vibration power spectrum

$P_i^{n,m}(f, \Delta f)$

⟨indirect method⟩ spectrum of vibration power emitted from the machine in the degree of freedom i at the n th isolator

3.12

vibration power spectrum at an isolator

$P^{n,m}(f, \Delta f)$

spectrum of the vibration power emitted from the machine at the n th joint

3.13

velocity cross-spectrum

$G_{v_j^{n,m} v_i^{n,f}}(f, \Delta f)$

cross-spectrum of the vibration velocity $v_j^{n,m}(t)$ at the n th isolator in the degree of freedom j on the machine as the input and vibration velocity $v_i^{n,f}(t)$ in the degree of freedom i on the foundation as the output

Note to entry: Velocity cross-spectrum is expressed in metres per second squared.

3.14

vibration power level

L_W

$$L_W = 10 \lg \frac{P}{P_0} \text{ dB}$$

ten times the logarithm to the base 10 of the ratio of the measured vibration power, P , to a reference value, $P_0 = 1 \text{ pW}$, expressed in decibels

3.15

input dynamic stiffness matrix of vibration isolator

$K^{n,\text{in}}(f)$

matrix of frequency-dependent complex dynamic stiffness of the n th vibration isolator at the input or machine

3.16

output dynamic stiffness matrix of vibration isolator

$K^{n,\text{out}}(f)$

matrix of frequency-dependent complex dynamic stiffness of the n th vibration isolator at the output or foundation