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

**Part 1:
Direct method**

Vibrations et chocs mécaniques — Mesurage du flux de puissance vibratoire transmis par des machines aux structures de support dont elles sont solidaires — Partie 1: Méthode directe





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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.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 18312-1 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 1: Direct 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, under operational conditions on to supporting structures to which the machines are directly connected via bolted joints. This part of ISO 18312 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 force and velocity (or acceleration) transducers mounted on to the bolted joints under operational conditions of interest. 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 in the frequency domain are obtained by computing the cross-spectrum of the force and velocity measurement pairs with a given narrow band width at each bolted joint.

This direct method assumes that the supporting structures are adequately rigid and, hence, it is not applicable to cases where the foundation or supporting structures are resilient, which will potentially go into a state of resonance within the frequency range of interest. Practical frequency limits of the method are specified in this part of ISO 18312.

This part of ISO 18312 can be used in operational conditions for:

- a) specification of vibration power emission of machines at the (bolted) joints;
- b) identification of vibration power severity;
- c) resolving diagnostics issues;
- d) planning vibration control measures.

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*

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 velocity vector

$\mathbf{v}^n$

velocity vector at the n th bolt joint, consisting of three translational and three rotational components along the coordinate axes x , y and z

3.2

vibration velocity component

$$v_i^n$$

component of the vibration velocity vector in the degree of freedom i at the n th bolted joint; $i = 1, 2$ and 3 for 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

3.3

vibration acceleration component

$$a_i^n$$

vibration acceleration component in the degree of freedom i at the n th bolted joint

3.4

root mean square value of acceleration component

r.m.s. value of acceleration component

$$a_{i:\text{rms}}^n$$

root mean square value of the vibration acceleration component in the degree of freedom i at the n th bolted joint

3.5

force vector

$$\mathbf{F}^n$$

vibration force vector at the n th joint, consisting of three components of linear force and three components of angular force, i.e. moment, along the coordinate axes x , y and z

3.6

force component

$$F_i^n$$

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

3.7

vibration power component

$$P_i^n$$

vibration power in the degree of freedom i at the n th bolted joint, equal to the time-averaged scalar product of the vibration force vector and vibration velocity vector in the degree of freedom i at the n th bolted joint

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

3.8

vibration power at a joint

$$P^n$$

vibration power at the n th bolted joint, equal to the sum of the vibration power components in each degree of freedom at that point

3.9

vibration power

$$P$$

sum of vibration power of the machine over all joints and in every degree of freedom

3.10

vibration power spectrum

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

decomposition of the vibration power of the machine into frequency domain with a given centre frequency, f , narrow frequency band, Δf , equal to the sum of the vibration power spectra over all joints and in every degree of freedom