

INTERNATIONAL STANDARD



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## Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards

*Vibrations mécaniques des machines ayant une vitesse de fonctionnement comprise entre 10 et 200 tr/s — Base pour l'élaboration des normes d'évaluation*

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## FOREWORD

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It has been approved by the Member Bodies of the following countries :

Austria	Ireland	Sweden
Belgium	Japan	Switzerland
Egypt, Arab Rep. of	Netherlands	United Kingdom
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# Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards

## 0 INTRODUCTION

The problems of noise and vibration control have been brought to the forefront of mechanical and electromechanical engineering technology with the increasing power and continually increasing speed of present-day rotating machinery. As a consequence, more restrictive demands have been placed on the operating quality of the machines.

This International Standard is concerned only with the severity of the mechanical vibration of individual machines and not with the sound energy radiated from individual vibrating parts. The only vibrations considered are those occurring on the surfaces of the machines, on the bearings, or at the mounting points in the frequency range from 10 to 1 000 Hz. The evaluation takes account of the effect of the following general considerations:

- the characteristics of the machine;
- the stresses due to vibration in the machine (for example bearings, coupled machine parts, baseplates, floor);
- the necessity of maintaining the trouble-free operation of a machine which might be jeopardized by malfunction or degradation of components, for instance, excessive rotor deflections which occur when it passes through a resonance or the loosening of frictional joints as a result of shaking forces, and so on;
- the characteristics of the measuring instruments;
- the physical and mental strain on man;
- the effects of the machine vibration on its environment such as adjacently mounted instruments, machines, etc.

It is clear that vibrations measurable at a surface may provide only an indication of the state of the vibratory stresses or motions within a machine. They do not necessarily give evidence of the actual vibratory stresses or motions of critical parts; neither do they ensure that excessive local vibratory stresses may not occur in the machine itself (for example due to internal resonance).<sup>1)</sup>

1) "Vibration severity" is a generic term which designates a value such as a maximum, average, or other significant arithmetic value representative of a vibration. The vibration severity of a machine is defined as the maximum root-mean-square value of the vibratory velocity measured at significant points of a machine, such as a bearing, a mounting plate, etc.

2) Unless otherwise stated, the measured vibration values are taken normal to the machine surface.

In particular, the torsional vibration of rotating parts may not always be accurately indicated by vibrations measurable on a surface.

Although in some cases the above-mentioned factors may be treated theoretically, evaluation specifications arising therefrom are usually unnecessarily complicated and unsuitable for practical application. It is advantageous and may be decisive for the usefulness of a test that a single value be used to define the vibratory state of the machine under test. For industrial applications, therefore, it is preferable to choose a unit of measure that can be used as a figure of merit and can be displayed on a simple scale. The measured units and the chosen scale should ensure a credible evaluation appropriate to the majority of cases that occur in practice, i.e. the indicated evaluation should not contradict experience already obtained.

In this International Standard, the term "vibration severity"<sup>1)</sup>, defined as a comprehensive and simple characteristic unit for describing the vibratory state of a machine, is used as the basis of classification and, on the basis of theoretical considerations and practical experience, the root-mean-square value of vibration velocity<sup>2)</sup> has been chosen as the unit of measurement for indicating vibration severity.

In critical cases and under special conditions, evaluation of the behaviour of a machine based on vibration severity should not be used in lieu of more precisely measured significant parameters, for example, stresses measured at bearings and joints. In general, the use of vibration severity as a criterion provides a relatively reliable evaluation requiring only simple prescribed measurements.

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard defines the basis for specifying the rules to be employed in evaluating the mechanical vibration of machines in the operating range 10 to 200 rev/s in such a way that comparison is possible with similar measurements obtained from other like machines.