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Australian Standard®

ROTATING AND RECIPROCATING MACHINERY—MECHANICAL VIBRATION

Part 1—BASIS FOR SPECIFYING EVALUATION STANDARDS

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The following interests are represented on Committee ME/41:

Association of Consulting Engineers Australia
Australian Gas Association
Australian Mining Industry Council
Australian Shipbuilders Association
Confederation of Australian Industry
Construction Equipment Importers and Manufacturers of Australia
CSIRO, National Measurement Laboratory
Department of Defence
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Department of Science and Technology
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Monash University
National Association of Testing Authorities, Australia
The New South Wales Institute of Technology
The Institute of Quarrying
University of Melbourne
University of Newcastle
University of New South Wales
University of Queensland

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PREFACE

This standard was prepared by the Association's Committee on Vibration and Shock. The work was requested by industry and government organizations because of the lack of Australian standards in this area.

The standard is based on ISO 2372, Mechanical Vibration of Machines with Operating Speeds from 10 to 200 rev/s—Basis for Specifying Evaluation Standards and apart from editorial changes and additional requirements showing more specific measuring positions for the evaluation of certain types of machines, the standard is technically identical with ISO 2372.

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STANDARDS ASSOCIATION OF AUSTRALIA

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FOREWORD

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 critical demands have been placed on the operating quality of machines. A complete evaluation should take into account the effect of the following general considerations:

(a) The characteristics of the machine.

(b) The stresses due to vibration in the machine, e.g. bearings, coupled machine parts, baseplates, floor.

(c) The necessity of maintaining the trouble-free operation of a machine which might be jeopardized by malfunction or degradation of components, e.g. excessive rotor deflections which occur when it passes through a resonance or the loosening of frictional joints as a result of shaking forces.

(d) The characteristics of the measuring instruments.

(e) The physical and mental strain on man.

(f) The effects of the machine vibration on its environment such as adjacently mounted instruments and machines.

This 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 Hz to 1000 Hz.

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 do not occur in the machine itself (e.g. due to internal resonance). 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 abovementioned 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 measurement 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 standard, the term ‘vibration severity’*, 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† 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.

An evaluation standard for a particular machine or class of machinery should, at a minimum, define the following:

—Scope (and field of application)
—Measurement quantity
—Measuring equipment
—Support for machine under test
—Points of measurement
—Operational conditions during testing
—Recommended limits of vibration severity.

The basis for making these specifications is the concern of this standard.

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* ‘Vibration severity’ is a generic term which designates a value such as a maximum average or other significant arithmetical value descriptive of vibration. The vibration seventy of a machine is defined as the maximum root-mean-square value of the vibration velocity, measured at significant points of a machine, such as a bearing or a mounting point.

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