Australian Standard®

ROTATING AND RECIPROCATING MACHINERY—MECHANICAL VIBRATION

Part 3—MEASUREMENT AND EVALUATION OF VIBRATION SEVERITY OF LARGE MACHINES IN SITU

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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
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New South Wales Institute of Technology
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 at the request of industry and government organizations, because of the lack of Australian standards in this area.

This standard is concerned with severity of vibration of individual machines measured in situ. It is based on ISO 3945, Mechanical Vibration of Large Rotating Machines With Speed Range from 10 to 200 rev/s—Measurement and Evaluation of Vibration Severity In Situ, and apart from editorial changes is technically identical with that standard.

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1 SCOPE. This standard sets out the procedure for evaluating the vibration performance of large prime movers and other large machines with rotating masses only, a power of more than 300 kW, and speeds from 10 r/s to 200 r/s. Examples of these types of machines are electric motors and generators, steam and gas turbines, turbo-compressors, turbo-pumps and fans. Some of these machines can be coupled rigidly or flexibly, or they can be connected through gears. The axis of the rotating shaft may be horizontal, vertical or inclined at any angle between these directions.

2 APPLICATION. The values of vibration severity recommended as limits in this standard are intended to serve as standard values for machines of similar types, when measured in accordance with the procedure specified herein and evaluated under similar conditions. These vibration severity values are useful for comparison purposes or general machine acceptance, but they are not intended to reflect specific design criteria and/or specifications which may exist for a given machine. Thus, in some instances, requirements either more or less stringent, or additional to the recommended limits stated herein, may be invoked.

This standard does not apply to prime movers or driven equipment in which the major working components have a reciprocating motion.

Since the vibration severity of the machine is intended to reflect the vibratory forces generated by the machine, vibration entering the unit under test from other sources must be excluded. Therefore, this standard is not applicable to marine or similar installations in which an active vibration environment, as defined in Clause 8.4, may exist and unduly influence the vibration measurements.

3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 2625	Rotating and Reciprocating Machinery—Mechanical Vibration Part 1—Basis for Specifying Evaluation Standards
ISO 2954	Mechanical Vibration of Rotating and Reciprocating Machinery—Requirements for Instruments for Measuring Vibration Severity

4 MEASUREMENT QUANTITY (VIBRATION SEVERITY). The term 'vibration severity', as used here, is defined as a comprehensive and simple characteristic quantity which can describe the vibratory state of a machine. This quantity is defined as the root-mean-square value of the vibration velocity in the range of 10 Hz to 1000 Hz. The greatest measured value, determined at prescribed measuring points and in prescribed directions, characterizes the vibratory state of a machine.

In general, vibration severity should lead to a relatively reliable evaluation which requires only simple prescribed measurements. In critical cases and under special conditions, an evaluation of the behaviour of a machine based on vibration severity should not be used in lieu of more precisely measured significant parameters, e.g. stresses at bearings and joints (see AS 2625, Part 1, Clause 4).

5 MEASUREMENT EQUIPMENT. The measurement equipment shall comply with ISO 2954.

6 MEASUREMENT POINTS. A measurement is to be made at or near each main bearing on the bearing housing, in both transverse and axial directions referred to the shaft axis, as shown in Fig. 1. For vertical or inclined machines, the locations that give the maximum readings shall be used and the specific locations are to be recorded with the measurement. It is expected that measurements will usually be taken on exposed parts of the machine that are normally accessible. Care must be taken that measurements represent fairly the vibration of the bearing housings and do not include any local resonances.

7 OPERATIONAL CONDITIONS. Measurements shall be carried out when the rotor and the main bearings have reached their normal steady operating temperatures and with the machine running under rated conditions, e.g. at rated voltage, flow, pressure, load. On machines with fixed speeds or loads, the conditions for rated speed or load are as shown on the rating plate.

On machines with varying speeds or loads, measurements shall be made at all extreme rating conditions in addition to specified conditions within the operating range of the machine. The maximum measured value shall be considered representative of vibration severity. (The equipment may be expected to operate at any operating combination within its rating limits during its life.)

8 MACHINE/SUPPORT SYSTEM.

8.1 General. Two passive support conditions are used to classify machine systems according to vibration severity. These support conditions are determined by the relationship between the machine and foundation's flexibilities in the direction of measurement. For a flexible support, the fundamental natural frequency of the machine/support system is significantly lower than its main excitation frequency. For a rigid support, the fundamental natural frequency of the machine/support system is significantly higher than its main excitation frequency.