

Australian Standard<sup>®</sup>

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**ROTATING AND RECIPROCATING  
MACHINERY—MECHANICAL  
VIBRATION**

**Part 2—TEST AND MEASUREMENT  
CONDITIONS FOR ROTATING  
ELECTRICAL MACHINES**

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This Australian standard was prepared by Committee ME/41, Vibration and Shock, in conjunction with Committee EL/9, Rotating Electrical Machinery. It was approved on behalf of the Council of the Standards Association of Australia on 7 July 1983 and published on 5 September 1983.

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The following interests are represented on Committees ME/41 and EL/9:

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## PREFACE

This standard was prepared by the Association's Committees on Vibration and Shock and on Rotating Electrical Machinery, at the request of industry and government organizations because of the lack of Australian standards in this area. It is based on ISO 2373 and IEC 34-14. This standard is technically similar but not identical to ISO 2373 and IEC 34-14.

This standard deals with test and measuring conditions and has to be used in conjunction with AS 2625, Rotating and Reciprocating Machinery—Mechanical Vibration, Part 1—Basis for Specifying Evaluation Standards.

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**Australian Standard**

**for**

**ROTATING AND RECIPROCATING MACHINERY—MECHANICAL VIBRATION**

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**PART 2—TEST AND MEASUREMENT CONDITIONS FOR ROTATING  
ELECTRICAL MACHINES**

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**FOREWORD**

Vibrations in rotating electrical machinery are caused, for example by—

- unbalance in the rotating masses;
- electromagnetic effects;
- the rolling element bearings;
- aerodynamic loads and other effects such as instability of the shaft in the bearings, asymmetric expansion.

In spite of the balancing that can be obtained with dynamic balancing techniques, residual unbalance generally proves to be the main cause of once-per-revolution vibrations found in rotating machines.

The vibration of an electrical machine is closely linked with the mounting of the machine and it is usually desirable to carry out vibration measurements under actual installation and operating conditions. However, in order to estimate the quality of balancing and the level of vibration in an electrical machine, it is necessary to carry out tests on the machine alone under properly controlled test conditions, which will produce reproducible results and provide comparable measurements.

## STANDARD

**1 SCOPE.** This standard sets out test and measurement conditions for the testing of vibration severity of rotating electrical machines run alone under controlled test conditions.

**2 APPLICATION.** This standard applies to d.c. and three-phase a.c. machines with shaft heights 56 mm and higher and a rated power of up to 50 MW, at nominal speeds from 10 r/s up to and including 60 r/s.

For vertical machines this standard is only applicable to those machines that are measured in a state of soft suspension, and it excludes those that exceed a shaft height of 400 mm (see Clause 6).

This standard is to be read in conjunction with the procedures set out in AS 2625, Part 1.

NOTE: Vibration limits for certain machines are specified in AS 1359, Part 50.

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

- AS 1359 General Requirements for Rotating Electrical Machinery  
Part 31—Service and Operating Conditions  
Part 50—Vibration Limits
- 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.** The criterion adopted for vibration severity is the r.m.s. value of the vibration velocity in millimetres per second. The greatest value determined at the prescribed measuring points (see Clause 7.3), characterizes the vibration severity of the machine. (See AS 2625, Part 1.)

**5 MEASURING EQUIPMENT.** The measuring equipment shall comply with the requirements of ISO 2954.

**6 MACHINE MOUNTING.** A soft suspension is preferred in all cases and is mandatory up to a shaft height of 400 mm. Comparable vibration levels of machines under test are most readily achieved when the machines are soft mounted. The machine shall be soft mounted so that all the rigid body natural frequencies of the machine are less than 25 percent of the lowest important excitation frequency. In addition the effective mass of the resilient system shall not exceed 10 percent of the mass of the machine to be tested.

## NOTES:

1. If soft mounting cannot be achieved on machines with shaft heights greater than 400 mm, mounting condition should be

by way of agreement between purchaser and manufacturer (e.g. a structural mounting approximating 'in situ' conditions may be used).

2. In case of flexible rotor machines, the test conditions shall be agreed between the purchaser and the manufacturer.

**7 CONDITIONS OF MEASUREMENT.**

**7.1 Key.** For the measurement of vibration, any shaft extension keyway shall be fitted with a full key or a half-height key as agreed between the manufacturer and the purchaser or as specified by the manufacturer.

**7.2 Vibration Pick-up.** Care shall be taken to ensure that the contact between the pick-up and the machine surface is as specified by the manufacturer of the pick-up and does not disturb the vibratory condition of the machine under test. It is important to ensure that the pressure and mass of the pick-up have no significant influence on the vibratory state of the machine. The total coupled mass of the pick-up assembly shall be less than 2 percent of the mass of the machine.

**7.3 Measuring Points.** Measurements shall be made preferably on the bearings or in the vicinity of the shaft, in three mutually perpendicular directions, the machine operating only in the position it occupies under normal conditions (shaft horizontal or vertical) as indicated in Figs 1, 2 and 3.

**7.4 Operating Conditions.** Measurement of vibration severity shall be made with the machine at no load and uncoupled. For the purpose of the test, a generator shall be operated as a motor.

Unless otherwise specified, for machines having more than one fixed speed or a range of speeds, the limits shall not be exceeded at any operational speed.

An a.c. machine shall be run at rated frequency and rated voltage with virtually sinusoidal waveform according to AS 1359, Part 31.

Where the direction of rotation is reversible the vibration limits shall apply for both directions.

An a.c. synchronous machine shall be run as a synchronous motor under the following conditions:

- (a) Power factor adjusted to any value within the possible range, i.e. from maximum to minimum excitation.
- (b) Subject to agreement, the test power factors may be restricted to a (lesser) number of points.

A d.c. machine shall be excited with rated field current and shall be energized with such voltage as to run at rated speed.

NOTE: For large machines, temperature conditions during the test may be the subject of agreement between manufacturer and purchaser.

\* An Australian standard is in course of preparation.