
International Standard



8002

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Mechanical vibrations — Land vehicles — Method for reporting measured data

Vibrations mécaniques — Véhicules terrestres — Méthode de présentation des résultats des mesures

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8002 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Mechanical vibrations — Land vehicles — Method for reporting measured data

0 Introduction

It is often useful to compare and/or to compile measured vibration data from various sources. These endeavours are more difficult when the data are presented in different forms, such as constant bandwidth r.m.s. curves (of various bandwidths), proportional bandwidth curves, or power spectral density (PSD) curves, sometimes on linear scales and sometimes on logarithmic scales. Tedious and time-consuming mathematical transformation and replotting are therefore necessary, and this introduces the risk of errors.

This International Standard specifies a uniform method for reporting data to facilitate comparing and compiling data.

The results of a measurement of random vibration are an estimate based on a sample. This International Standard specifies the analysis parameters to be reported so that the statistical precision of the reported data can be determined.

The measured vibration on land vehicles is a function both of the vehicle and of external factors, such as the operating conditions and the road or terrain profile. For work machines, the operating conditions are the machine work cycle and may vary considerably between segments of a specific work cycle. This International Standard specifies the reporting of the operating conditions, of the road or terrain conditions and of the work cycle (for work machines) as related to the reported vibration data. This information is necessary to assess and to compare data.

This International Standard emphasizes the need to include most of the relevant information on the curves or tables of results. The intent is to encourage putting details and results in a complete form on a few pages. This will facilitate compiling and comparing data and will facilitate international use of the data because the amount of translation necessary to identify the data will be reduced.

The purpose of this International Standard is to specify complete and uniform reporting of parameters, methods and results. It is not the purpose of this International Standard to specify any particular method to be used in the work itself.

An example which meets the minimum requirements of this International Standard is given in the annex.

1 Scope

This International Standard specifies a uniform method for reporting measured vibration data for all forms of land vehicles and work machines.

2 Field of application

This International Standard applies to reporting data to be used for certain types of structural testing of land vehicles and work machines or their components and to reporting data on vibration measured at the vehicle-occupant interface.

This International Standard applies to original reports of measured data and to reports or other publications which assess, summarize, compare or compile measured data from original reports.

It is not applicable to the reporting of any form of transfer function or other dynamic property of a system as derived from the measured data.

3 References

ISO 2041, *Vibration and shock — Vocabulary*.

ISO 2631, *Evaluation of human exposure to whole-body vibration*.

ISO 4865, *Vibration and shock — Methods for analysis and presentation of data*.¹⁾

ISO 5008, *Agricultural wheeled tractors and field machinery — Measurement of whole-body vibration to the operator*.

ISO 5349, *Guidelines for the measurement and the assessment of human exposure to hand-transmitted vibration*.

IEC Publication 225, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations*.

4 Definitions

For the purposes of this International Standard, the terminology given in ISO 2041 and ISO 4865, and the following definitions apply.

1) At present at the stage of draft.

4.1 detrending : Any time domain process to reduce or remove frequency components the period of which is longer than the record length.

4.2 land vehicle: A self-propelled device for carrying passengers, goods, or equipment, for example, car, bus, highway truck or train.

4.3 magnitude window: The incremental range of magnitude of the time history, as used to calculate the probability functions (magnitude distributions) of vibration data.

4.4 work machine: A self-propelled or mobile device designed to alter or transmit energy and force for the performance of useful work, for example, tractor, loader, grader, ditcher or combine. Also a self-propelled device designed for carrying goods, material, or equipment on a work site, for example, dumper or fork-lift truck.

5 Symbols and subscripts

5.1 Symbols

- a* Acceleration (m/s²)
- B* Bandwidth of a filter (Hz)
- g* Acceleration due to gravity (m/s²)
- T* Total time of analysed data (s)
- W* Magnitude window width used in the calculation of probability density, as a proportion of the r.m.s. of the data.

5.2 Subscripts *x*, *y*, *z*

These lower case subscripts refer to the direction of rectilinear vibrations. For vehicle-occupant interface vibration, these shall be stated in accordance with ISO 2631 and ISO 5349. For vehicle or vehicle component vibration, *a_x* is the fore-and-aft direction of vehicle motion, *a_y* is the side-to-side direction, and

a_z is the vertical direction. If it is necessary to denote the positive direction of vehicle motion, it should be done in accordance with the relevant International Standards.

5.3 Subscripts *rx*, *ry*, *rz*

These lower case subscript pairs refer to rotational vibrations about the *x*, *y* and *z* axes, i.e. roll, pitch and yaw.

5.4 Subscript capital letters

Subscript capital letters refer to the location of the measurements.

6 Uniform method of reporting

6.1 Reporting of spectral data

Curves or tables of spectral data shall conform to table 1.

For curves or tables of spectral data, the information stated on the curve sheet or table sheet shall include that given in 7.1, 7.2, 7.3, 8.1 c), 8.1 d), 8.1 e), 9.2 a), 9.2 b), 9.2 c), 9.2 e), 9.3 a) and 9.3 b).

6.2 Reporting of magnitude distribution data

Magnitude distribution data shall be reported as zero-mean probability density curves of the instantaneous values of the acceleration, normalized to the r.m.s. value. The curves shall be on logarithmic scales for probability density and linear scales for standard deviation (that is, a semi-logarithmic plot with logarithmic ordinates and linear abscissae). The abscissae shall also include a secondary scale in metres per second squared. The analysed data shall be plotted at the centre of the magnitude window. The Gaussian probability density function shall be included on the curve sheet for reference purposes.

NOTES

1 A standard Gaussian probability density function can be shown if the data is analysed with a magnitude window width of 0,5 standard deviations or smaller. For larger magnitude window widths, Gaussian probability density values should be calculated and shown for the magnitude window width used in the data analysis.

Table 1

Type of data	Form	Scale
Vehicle-occupant interface:		
Whole-body	Third-octave bandwidth r.m.s. acceleration (unweighted) versus frequency (in conformity with ISO 2631)	Logarithmic on both axes
Hand	Octave or third-octave bandwidth r.m.s. acceleration (unweighted) versus frequency (in conformity with ISO 5349)	Logarithmic on both axes
All other	Acceleration power spectral density (PSD) versus frequency	Linear on both axes See the note

NOTE — Acceleration power spectral density may be plotted on logarithmic scales on both axes if the data range is so large as to make linear scales impractical.

Logarithmic scales are usually used to present data analysed by proportional bandwidths.