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Human response to vibration — Measuring instrumentation

Réponse des individus aux vibrations — Appareillage de mesure



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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8041 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 3, *Use and calibration of vibration and shock measuring instruments*.

This second edition cancels and replaces the first edition (ISO 8041:1990), which has been technically revised, and incorporates its Amendment ISO 8041:1990/Amd.1:1999, and Technical Corrigendum ISO 8041:1990/Cor.1:1993.

The reasons for the main changes introduced in this edition are as follows:

- to improve the specifications for human response to vibration measuring instrumentation;
- to incorporate into one document the specifications introduced by the 1999 amendment to ISO 8041:1990, which themselves were required following the introduction of new frequency weightings in ISO 2631-1:1997;
- to recognise changes in the frequency weighting specification introduced in ISO 5349-1:2001 that allows frequencies outside the one-third octaves from 6,3 Hz to 1250 Hz to be excluded from the weighted acceleration calculation (this is achieved by changing the frequencies at which the tolerance is extended to –100 % to be the lower boundary of the 6,3 Hz one-third-octave bands and the upper boundary of the 1 250 Hz one-third-octave band);
- to introduce allowances for the uncertainties of testing the conformance of the human vibration measuring instruments;
- to introduce a hierarchy of testing requirements (pattern evaluation, periodic verification and *in-situ* check) with tests defined according to the needs of this hierarchy;
- to recognise the needs for the specification and testing of new parameters such as maximum transient vibration value (MTVV) and vibration dose value (VDV);
- to recognise the need to test multi-axis instrumentation and to test combined results from these multi-axis inputs;
- to introduce informative tests for mounting methods.

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Human response to vibration — Measuring instrumentation

1 Scope

This International Standard specifies the performance specifications and tolerance limits for instruments designed to measure vibration values, for the purpose of assessing human response to vibration. It includes requirements for pattern evaluation, periodic verification and *in-situ* checks, and the specification of vibration calibrators for *in-situ* checks.

Vibration instruments specified in this International Standard can be single instruments, combinations of instrumentation or computer-based acquisition and analysis systems.

Vibration instruments specified in this International Standard are intended to measure vibrations for one or more applications, such as

- hand-transmitted vibration (see ISO 5349-1),
- whole-body vibration (see ISO 2631-1, ISO 2631-2, ISO 2631-4), and
- low-frequency whole-body vibration in the frequency range from 0,1 Hz to 0,5 Hz (see ISO 2631-1).

Vibration instruments can be designed for measurement according to one or more of the frequency weightings defined within each of these applications.

Three levels of performance testing are defined in this International Standard:

- a) pattern evaluation, i.e. a full test of the instrument against the specifications defined in this International Standard;
- b) periodic verification, i.e. an intermediate set of tests designed to ensure that an instrument remains within the required performance specification, and
- c) *in-situ* checks, i.e. a minimum level of testing required to indicate that an instrument is likely to be functioning within the required performance specification.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2041, *Vibration and shock — Vocabulary*

ISO 2631-1, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

ISO 2631-2, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)*

ISO 2631-4, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems*

ISO 5347 (all parts), *Methods for the calibration of vibration and shock pick-ups*

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

ISO 5349-1:2001, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements*

ISO 16063 (all parts), *Methods for the calibration of vibration and shock transducers*

IEC 61000-4-2:2001, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-6-2:1999, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments*

CISPR 22:2003, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement*

GUM, *Guide to the expression of uncertainty in measurement*. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 1993

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041, together with the following, apply.

3.1.1

vibration acceleration

component of acceleration, where the axis of measurement is specified by application standards

3.1.2

band-limiting frequency weighting

component of a frequency weighting defined by the high and low pass band-limiting filters

3.1.3

band-limited frequency range

frequency range defined by the band-limited component of a frequency weighting

3.1.4

nominal frequency range

frequency range of interest, as defined in the relevant measurement standard

3.1.5 Frequency-weighted values

3.1.5.1

time-averaged weighted acceleration value

frequency-weighted r.m.s. vibration acceleration value in a specified axis, a_w , in metres per second squared or radians per second squared, as defined by the expression:

$$a_w = \left(\frac{1}{T} \int_0^T a_w^2(\xi) d\xi \right)^{1/2} \quad (1)$$