INTERNATIONAL STANDARD

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Mechanical vibration and shock — Measurement and evaluation of shock and vibration effects on sensitive equipment in buildings

Vibrations et chocs mécaniques — Mesurage et évaluation des effets des chocs et des vibrations sur les équipements sensibles dans les bâtiments

Reference number
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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.

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.

International Standard ISO 8569 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock,* Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures.*

This second edition cancels and replaces the first edition (ISO 8569:1989), which has been technically revised.

Annexes A to C of this International Standard are for information only.

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Mechanical vibration and shock — Measurement and evaluation of shock and vibration effects on sensitive equipment in buildings

1 Scope

This International Standard defines methods of measuring and reporting shock and vibration data for shock- and vibration-sensitive equipment (in operating and non-operating modes) in buildings. The shock and vibration data obtained are used to establish a database.

To facilitate comparison of data (e.g. comparison of shock and vibration levels measured in different countries on equipment from different manufacturers), a database reporting system is discussed. The reporting system presented will aid in the establishment of limiting values for specific equipment and also for classification of their environmental conditions.

The types of shock and vibration considered in this International Standard are those transmitted from floors, tables, walls, ceilings or the isolation system to a unit of equipment. The vibration and shock response of individual mechanical or electronic parts inside the unit are not considered.

The classification system of environmental conditions established from the database should serve as a guide for those who construct, manufacture and use shock- and vibration-sensitive equipment and for building contractors. The types of sensitive equipment envisaged include:

a) stationary computer systems (including the peripherals);

b) stationary telecommunication equipment;

c) stationary laboratory instruments, such as electron microscopes, mass spectrometers, gas chromatographs, lasers and X-ray apparatus of general character;

d) mechanical high-precision instruments (tools), such as equipment for microelectronic production;

e) optical high-precision instruments, photo-reproduction instruments and E-beams;

f) electromechanical systems in train traffic control centres;

g) security equipment (fire detection) and equipment for access control.

The types of shock and vibration considered in this International Standard can be generated by:

a) external sources (e.g. traffic or building and construction activities such as blasting, piling and vibratory compaction); the vibration response to sonic booms and acoustic excitations is also included;

b) equipment for indoor use, such as punch presses, forging hammers, rotary equipment (e.g. air compressors, air-conditioner pumps) and heavy equipment transported or operated inside a building;

c) human activities in connection with the service or operation of the equipment;

d) natural sources, such as earthquakes, water and wind;

e) internal sources; i.e. vibration generated by the equipment itself.

The frequency range of interest is 0,5 Hz to 250 Hz. (The frequency range of interest for earthquake-induced vibration is 0,5 Hz to 35 Hz.) Normally the dominant frequencies are less than 100 Hz, because

they represent the response of the elements of the building.

The vibration amplitude and duration depend mainly upon the source, its distance from the sensitive equipment and the response of the elements of the building supporting the sensitive equipment. Expressed in terms of particle velocity, which is the parameter used currently in building vibration evaluation, the values are in the range of 10^{-4} m/s to 2×10^{-2} m/s.

The vibration values of interest for transient and continuous vibration from different sources are given for information in annex B.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2041:1990, *Vibration and shock — Vocabulary.*

ISO 4866:1990, *Mechanical vibration and shock — Vibration of buildings — Guidelines for the measurement of vibrations and evaluation of their effects on buildings.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 2041 apply.

4 Measurement methods

4.1 Field survey

A field survey should be made in order to assess the vibration severity, often in comparison with values specified by manufacturers or regulatory authorities. The minimum requirement for measurement is that the shock or vibration is characterized by continuous registration of the peak particle velocity values and/or the peak acceleration values, with the assumption that the base frequency content can be determined.

4.2 Engineering analysis

In order to determine the vibration and shock conditions to which equipment may be exposed, accurate and comprehensive measurements in the field shall be made. The time history should be recorded and analysed in three orthogonal axes. Measurements should be made with the shock- and vibration-sensitive equipment in place, or with a dummy having the same mass and similar dynamic behaviour as those of the equipment under consideration. The effective mass of the equipment on raised floors or tables may significantly change the response levels and frequencies. If the mass of the equipment is very small, it has no influence on the behaviour of the floor.

For ultrasensitive equipment (e.g. E-beams), measurements should be carried out whenever possible on the sensitive equipment, on its isolation system and on the floor nearby in order to define the transfer function and the effect of the isolation system.

The equipment itself may generate vibration which produces excitation in other units in the immediate area. Vibration can also arise from ventilation equipment and from persons walking, especially on raised floors.

Whenever possible it is recommended that the vibration and shock be measured with the sensitive equipment in both operating and non-operating modes in order to distinguish between the various possible sources.

For a comparison of target source vibration with limiting values given by the manufacturer, references can be obtained by measuring the environmental vibration under normal working conditions.

4.3 Pick-up positions and mounting

The pick-ups should be mounted as close as possible to the points of contact of the equipment or its support with a floor or a wall (less than 0,2 m away). If there is a soft covering (e.g. a rug) on the floor, the pick-up should be mounted on the floor under the covering whenever possible. When the floor is not rigid enough to transmit the frequency under consideration without significant attenuation, the mounting should be on the equipment itself.

In order to define the transfer function between the source and the sensitive equipment, pick-ups shall be mounted in positions situated approximately on the same vertical line of the floor, raised floor, the isolation system and the equipment itself.

The pick-ups and cables should be mounted in such a way that accurate results are obtained over the total frequency range of interest.