

Classification of environmental conditions —

Part 2: Environmental conditions appearing in nature —

Section 2.6 Earthquake vibration and shock

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Electrotechnical Standards Policy Committee (GEL/-) to Technical Committee GEL/15, upon which the following bodies were represented:

- Directorate of Telecommunications
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electronic Components Industry Federation
- Ministry of Defence
- National Supervising Inspectorate
- Society of Environmental Engineers
- Society of Motor Manufacturers and Traders Limited

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The following BSI references relate to the work on this standard:
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National foreword

This Section of BS 7527 has been prepared under the direction of the General Electrotechnical Standards Policy Committee. It is identical with IEC Publication 721-2-6:1990 “*Classification of environmental conditions — Part 2: Environmental conditions appearing in nature. Earthquake vibration and shock*”, published by the International Electrotechnical Commission (IEC).

For the purposes of this British Standard, any references to IEC page numbers in the text should be ignored.

Other Parts of this British Standard are as follows.

- *Part 1: Environmental parameters and their severities;*
- *Part 2: Environmental conditions appearing in nature;*
- *Section 2.1: Temperature and humidity;*
- *Section 2.2: Precipitation and wind;*
- *Section 2.3: Air pressure;*
- *Section 2.4: Solar radiation and temperature;*
- *Section 2.5: Dust, sand, salt mist;*
- *Section 2.7: Fauna and flora;*
- *Part 3: Classification of groups of environmental parameters and their severities;*
- *Section 3.0: Introduction;*
- *Section 3.1: Storage;*
- *Section 3.2: Transportation;*
- *Section 3.3: Stationary use at weatherprotected locations;*
- *Section 3.4: Stationary use at non-weatherprotected locations;*
- *Section 3.5: Ground vehicle installations;*
- *Section 3.6: Ship environment;*
- *Section 3.7: Portable arid non-stationary use.*

Cross references

International Standard	Corresponding British Standard
IEC 721-1:1990	BS 7527 <i>Classification of environmental conditions</i> Part 1:1991 <i>Environmental parameters and their severities</i> (Identical)

The Technical Committee has reviewed the provisions of ISO 6258:1985, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

This part of IEC 721 is intended to be used as background material when selecting appropriate severities of parameters relating to earthquakes for product application. Severities given in IEC 721-1 should be applied.

More detailed information may be obtained from specialist documentation, some of which is given in the bibliography in ISO 6258:1985, Nuclear power plants — Design against seismic hazards.

1 Scope and object

This part of IEC 721 deals with environmental conditions appearing in nature, and in particular related to earthquake vibration and shock.

Its object is to define some fundamental properties and quantities for characterization of earthquakes as background material for the severities to which products are liable to be exposed during storage and use. Accelerations given are for ground surface conditions only. Conditions related to structures are referred to but restricted to general case descriptions.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of IEC 721. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of IEC 721 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 721-1:1990, *Classification of environmental conditions — Part 1: Environmental parameters and their severities*.

3 General

Influences from earthquakes are vibrations which may be modelled as stochastic processes, and can affect products and provide stress in many ways.

This clause is intended to provide information on earthquake behaviour, and on the dynamic performance of products during earthquakes. Numerical values given are typical and illustrative but should not be considered as standard.

3.1 Earthquake origin and propagation

An earthquake occurs when stresses have accumulated to such a degree that they cause the breaking of the earth's crust. These instabilities are located in areas known as active seismic zones, in connection with a series of geological accidents such as troughs, oceanic ridges, mountain ranges, volcanoes, ocean trenches, tectonic faults.

The sudden breaking releases potential energy deformation which will spread from the hypocentre in the form of three typical basic waves with different speeds:

- longitudinal volume waves which compress and expand the rock in the propagation direction;
- transversal waves which shear the rock by distortion, perpendicular to the propagation;
- surface waves which are a combination of the two previous ones and subject to surface limit conditions.

3.2 Earthquake behaviour

Earthquakes produce random ground motions which are characterized by simultaneous but statistically independent horizontal and vertical components. A moderate earthquake may persist for 15 s to 30 s; a severe earthquake for 60 s to 120 s. In general, the strong part with the highest ground acceleration may last up to 10 s. The typical broadband random motion has its maximum energy over a frequency range from 1 Hz to 35 Hz, and produces more damaging effects from 1 Hz to 10 Hz. Usually the vertical component of the ground motion is assumed to be between 67 % and 100 % of the horizontal below 3,5 Hz and equal to the horizontal above 3,5 Hz.

NOTE Maximum acceleration is commonly used in design to reflect earthquake "strength" at a particular site.

3.3 Products on foundations

The typical broadband spectra which describe the ground motion indicate that multiple frequency excitation predominates. The vibration nature of the ground motion (both horizontal and vertical) can be magnified in foundation-mounted products. For any given ground motion, the magnification depends on the characteristic frequencies of vibration of the system (soil, foundation and product) and on the mechanism of damping.