SIST

SLOVENSKI STANDARD
SIST EN 60721-2-9:2014

01-julij-2014

Klasifikacija okoljskih pogojev - 2-9. del: Okoljski pogoji v naravi - Opredelitev opisovanja okolja na podlagi izmerjenih podatkov o udarcih in tresljajih: med hrambo, prevozom in uporabo

Classification of environmental conditions - Part 2-9: Environmental conditions appearing in nature - Defining an environmental description from measured shock and vibration data: Storage, transportation and in-use

Classification des conditions d’environnement - Partie 2-9: Conditions d’environnement présentes dans la nature – Définition d’une description de l’environnement à partir des données de chocs et de vibrations mesurées: Stockage, transport et utilisation

Ta slovenski standard je istoveten z: **EN 60721-2-9:2014**

ICS:

19.040	Preskušanje v zvezi z okoljem	Environmental testing

SIST EN 60721-2-9:2014 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60721-2-9

May 2014

ICS 19.040

English Version

Classification of environmental conditions - Part 2-9: Environmental conditions appearing in nature - Measured shock and vibration data - Storage, transportation and in-use (IEC 60721-2-9:2014)

Classification des conditions d'environnement - Partie 2-9: Conditions d'environnement présentes dans la nature - Données de chocs et de vibrations mesurées - Stockage, transport et utilisation (CEI 60721-2-9:2014)

Klassifizierung von Umgebungsbedingungen - Teil 2-9: Natürliche Einflüsse - Beschreibung von Umgebungsbedingungen aus gemessenen Stoß- und Schwingungsdaten - Lagerung, Transport und Im-Betrieb (IEC 60721-2-9:2014)

This European Standard was approved by CENELEC on 2014-04-10. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 104/630/FDIS, future edition 1 of IEC 60721-2-9, prepared by IEC TC 104 "Environmental conditions, classification and methods of test" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60721-2-9:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-01-10
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-04-10

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

Endorsement notice

The text of the International Standard IEC 60721-2-9:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-2 (Series)	NOTE	Harmonized as EN 60068-2 (Series).
IEC 60721-3 (Series)	NOTE	Harmonized as EN 60721-3 (Series).
IEC 60068-2-6:2007	NOTE	Harmonized as EN 60068-2-6:2008.
IEC 60721-1	NOTE	Harmonized as EN 60721-1.

IEC 60721-2-9

Edition 1.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Classification of environmental conditions – Part 2-9: Environmental conditions appearing in nature – Measured shock and vibration data – Storage, transportation and in-use

Classification des conditions d'environnement – Partie 2-9: Conditions d'environnement présentes dans la nature – Données de chocs et de vibrations mesurées – Stockage, transport et utilisation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX
R

ICS 19.040

ISBN 978-2-8322-1446-6

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 2-9: Environmental conditions appearing in nature – Measured shock and vibration data – Storage, transportation and in-use

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60721-2-9 has been prepared by IEC technical committee 104: Classification of environmental conditions.

The text of this standard is based on the following documents:

FDIS	Report on voting
104/630/FDIS	104/632/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60721 series, published under the general title *Classification of environmental conditions,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 60721 is intended as part of the strategy for defining an environmental description from measured data acquired at multiple locations whilst a product is either in storage, being transported or in-use at weather or non-weather protected locations. This measured data is normally in the form of acceleration versus time records. This, in turn, will then allow appropriate severities to be chosen from the IEC 60068-2 series [1] [1] of shock and vibration test methods. Environmental levels given in IEC 60721-3 [2] should then be applied, having been updated based upon the strategy described in this standard.

More detailed information may be obtained from specialist documentation, some of which is given in the bibliography.

1 Numbers in square brackets refer to the Bibliography.

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 2-9: Environmental conditions appearing in nature – Measured shock and vibration data – Storage, transportation and in-use

1 Scope and object

This part of IEC 60721 is intended to be used to define the strategy for arriving at an environmental description from measured data when related to a product's life cycle.

Its object is to define fundamental properties and quantities for characterization of storage, transportation and in-use shock and vibration data as background material for the severities to which products are liable to be exposed during those phases of their lifecycle.

2 Normative references

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

None.

3 General

3.1 Introductory remarks

Shock and vibrations measured in storage, transportation platforms and in-use locations can vary considerably from a basic sinusoidal character to pure random, which itself may or may not be normally distributed. If it is the latter, it can be reasonably assumed that the process is a sum of normally distributed random waves of differing amplitudes mixed in a complex manner.

Rarely can a real world environment be classified purely as a sinusoidal vibration and is normally associated with a discrete excitation mechanism such as rotating machinery, aero engines, propellers and is normally mixed with an associated random vibration process. It is then necessary for the specification writer to decide whether to conduct a random vibration test only or to perform one of the mixed mode tests.

Associated with the vibration environment for each life-cycle stage is, potentially, a shock environment which may produce much higher acceleration levels in certain circumstances. Generally speaking, the frequency content for these shocks is contained within the 0 Hz to 200 Hz bandwidth for, say, transportation, assuming that the packaged product is firmly secured to the transport platform base and is not therefore ‘bouncing around’. However, much higher frequencies, maybe in the kHz range, may be present in the in-use stage, again dependent upon the real world scenario.

The process described below is for a random vibration environment, since it is probably the most common form of test conducted. Any statement made therefore about the random process should be interpreted as applying to the alternative process. However, it can equally be applied to the shock environment by calculating the shock response spectrum and conducting the same process on this spectrum as for an acceleration spectral density (ASD)

spectrum. It is also equally applicable to sinusoidal data in the form of acceleration versus frequency. However, special attention may be required for this data dependent upon the initial process involved, that is, the acceleration involved, the r.m.s. value or the discrete value at the frequency in question.

Other factors to be considered in this process include:

a) factoring for the random spectra, which may depend upon the eventual purpose of the test programme, for example, robustness, qualification etc.;

b) statistical properties of the environment;

c) statistical properties of the product;

d) time – life cycle profile.

This clause looks at some of the general characteristics that can be expected from the storage, transportation and use of a product.

3.2 Storage

During storage, the product is placed at a certain site for long periods, but not intended for use during these periods. The storage location may be weather-protected, either totally or partially, or non-weather-protected. In any case, in the storage environment the product will undergo handling, thus it may be subjected to severe shock and vibration levels depending on the type of handling devices and storage racks. As a consequence, the product may be subjected to very benign, insignificant shock and vibration levels through to significant levels, such as those transmitted from machines or passing vehicles, and maybe even higher levels of shock and vibration such as that seen when stored close to heavy machines and conveyor belts.

3.3 Transportation

3.3.1 Road

A shock and vibration environment is experienced any time a product is transported by road. The main factors affecting the magnitude and frequency of such an environment are

– the design of the carrying vehicle,

– the velocity of the vehicle,

– the road profile,

– the position of the product in the vehicle,

– the reference axis for the vibration measurements with respect to the vehicle axis, generally a vertical axis is the worst,

– the product itself may influence the vehicle response,

– the payload on the vehicle.

Historically, the road transport environment was simulated in the laboratory using sinusoidal vibration. Today, it is more usual to use random vibration and the strategy defined in this standard applies to that technique. It is also normal practice to include both road transport and handling shocks in a test regime as the content can be very different. The relevant specification will need to specify if this is a requirement.

3.3.2 Rail

Rail environments depend upon the suspension design which, in modern trains, is air based. Nevertheless, not all trains are modern, especially when dealing with freight transportation, thus high level and wide frequency range environments extending to high values can be anticipated. The air-based suspension system provides a very smooth, therefore generally low level, low frequency environment. Shunting shocks may produce significantly higher