SLOVENSKI STANDARD
SIST EN 15433-6:2017

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Obremenitve pri transportu - Merjenje in vrednotenje dinamično mehanskih obremenitev - 6. del: Sistemi za avtomatsko beleženje pri merjenju naključnih sunkov, ki se pojavljajo med spremljanjem transporta

Transportation loads - Measurement and evaluation of dynamic-mechanical loads - Part 6: Automatic recording systems for measuring randomly occurring shock during monitoring of transports

Transportbelastungen - Messen und Auswerten von mechanisch-dynamischen Belastungen - Teil 6: Transportüberwachung mit automatischen Aufzeichnungsgeräten zur Messung stochastisch auftretender Stöße

Charges de transport - Mesurage et analyse des charges mécaniques dynamiques - Partie 6 : Systèmes d'enregistrement automatiques pour la mesure de choc aléatoire intervenant durant le suivi de transports

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55.180.01	Distribucija blaga s prevozom na splošno	Freight distribution of goods in general

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EUROPEAN STANDARD

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English Version

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This European Standard was approved by CEN on 12 June 2016.

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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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 15433-6:2016) has been prepared by Technical Committee CEN/TC 261 “Packaging”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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

This document supersedes EN 15433-6:2007.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This standard becomes significant when related to the realization of the European Directive on Packaging and Packaging Waste (Directive 94/62 EC, 20th December 1994), as amended by the Directive 2005/20/EC of 9th March 2005. This directive specifies requirements on the avoidance or reduction of packaging waste, and requires that the amount of packaging material is adjusted to the expected transportation load, in order to protect the transportation item adequately. However, this presumes some knowledge of the transportation loads occurring during shipment.

At present, basic standards, based on scientifically confirmed values, which can adequately describe and characterize the magnitudes of transportation loads, especially in the domain of dynamic mechanical loads do not exist nationally or internationally. Reasons for this are mainly the absence of published data, insufficient description of the measurements or restrictions on the dissemination of this information.

This standard will enable the measurement and analysis of dynamic mechanical transportation loads, thus enabling the achievement of standardized and adequately documented load values.

This series of standards consists of the following parts:

— Part 1: General requirements;

— Part 2: Data acquisition and general requirements for measuring equipment;

— Part 3: Data validity check and data editing for evaluation;

— Part 4: Data evaluation;

— Part 5: Derivation of Test Specifications;

— Part 6: Automatic recording systems for measuring randomly occurring shock during monitoring of transports.

This standard defines requirements that should be observed when automatic recording systems are being used for the purpose of a transportation survey. In this, it deviates from the characteristics of the other parts of the series, as in this case the prime concern is not the need for scientifically based and generally applicable data, which are to be used for standardization purposes, but to assist users of “shock recorders“. Such automatic and computer-based recording systems have gone through remarkable developments, particularly in relation to their storage capacity and analysis capability. This, together with falling prices, has meant they are increasingly used for surveying specific transportations, especially inside packing. In general they do not reach the efficiency of a measuring chain such as used for test drives, especially in view of the storage capacity needed to measure unfiltered dynamic data during transportation.

1 Scope

This European Standard specifies the technical and functional properties of automatic recording equipment used to determine randomly appearing shocks during transportation.

Such automatic recording equipment can be used to:

— determine mechanical shock loads on individual transportations;

— monitor the transportation means to observe the limits of the shock parameters;

— determine the shock loads on the transported item.

This standard defines the sensors to be attached to the device, and specifies the minimum requirements for the parameters to be adjusted. It also defines the minimum requirements for the data analysis, as well as the data presentation.

This standard covers the complete recording equipment, including its accelerometers and the data analysis in an external data processing unit. The accelerometers can be integrated into the device or separately mounted from it (external sensors).

This standard also applies to the routine monitoring of individual transportations

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.

EN 13011, *Transportation services - Good transport chains - System for declaration of performance conditions*

EN 15433-2, *Transportation loads - Measurement and evaluation of dynamic mechanical loads - Part 2: Data acquisition and general requirements for measuring equipment*

EN 61000-6-1, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments*

EN 61000-6-3, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply

3.1
sensor axes *x, y, z*
three Cartesian spatial axes that lie parallel to the measuring directions of the accelerometer

3.2
peak acceleration value
greatest positive or negative acceleration occurring during a shock event in a spatial axis or in a spatial vector: $\hat{a}_x$, $\hat{a}_y$, $\hat{a}_z$, $\hat{a}_\mathrm{R}$

3.3
main axis *xyz* (max.)
spatial axis that shows the biggest peak acceleration value

Note 1 to entry: Correspondingly $a_{xyz(max)}$ is the temporal course of the acceleration of the main axis and $\hat{a}_{xyz(\max)}$ is the peak acceleration of the main axis.

3.4
value of the spatial vector a_R
acceleration value of a randomly oriented spatial acceleration vector of a shock event

$$a_R = \sqrt{a_x^2 + a_y^2 + a_z^2} \quad (1)$$

3.5
shock duration T_{shock}
time at which the value of the acceleration of the main axis is equal to or greater than 10 % of the peak acceleration value of this axis

Note 1 to entry: See 4.3.1.

3.6
frequency limit of the device
frequency at which the recorded signal level has dropped to a value of $1/\sqrt{2}$ compared to the mid-band frequency; this information is compulsory to ensure that measured values of different devices are comparable

3.7
threshold values
magnitudes of the acquired measured values which when exceeded initiate the recording of an event: $a_{threshold}$, $T_{shock(min)}$

3.8
values to be set
sum of all adjustments made to a recording equipment prior to a measuring event (e.g. measuring range, frequency limit, threshold values, storing modes, time modes, recording type or mail box content)

3.9
mailbox
device able to store data in an alphanumeric order, e.g. tracing program, order of transport, transport information, or mounting location of recording equipment

3.10
data memory
all data memory of a recording equipment in which measured and computed values as well as acquisition time span and set values are stored

3.11
acquisition time span
continuous time span during which the recording equipment is active; the set values must be documented

Note 1 to entry: The beginning and end of an acquisition time span can be caused by switching on and off, set time modes, changing the set values, dropout of power supply, battery change, data evaluation or hardware errors.

3.12
time stamp
date and time of an event, minimum resolution in seconds

3.13
sampling rate
number of digital measuring values produced for each time unit and for each sensor axis

3.14
GPS value
location coordinates in the satellite-assisted Global Positioning System

3.15
tilt value
static measured value indicating the position of the transported item in relation to the axis of the earth

Note 1 to entry: The measured value can be indicated as an angle or an acceleration value. Any dynamic components caused by shocks or vibrations shall be filtered out.

3.16
shock intensity
equivalent velocity change
time integral over all measured acceleration values of one spatial axis or of the spatial vector within the shock duration T_{shock}

Note 1 to entry: See 4.3.1.

3.17
main shock direction
indication of a spatial axis with the greatest shock amplitude

Note 1 to entry: See 4.3.1.

4 Requirements for automatic recording devices

4.1 Accelerometers

Automatic shock recording equipment shall be equipped with three accelerometers arranged in a system of Cartesian axes, in order to record the acceleration acting in any direction.

Internal sensors are arranged inside the housing of the recording equipment.

External sensors shall be connected to the recording equipment by means of cables, such that no falsification of the measured values can occur.

The sensor axes shall be parallel or perpendicular to the edge of the recorder housing or the external sensor. The positive directions of the sensor axes shall be uniquely defined by arrows as well as by the designations *x, y, z*. When connecting external sensors, care shall be taken that no exchange of the axes or the direction of the measurement can occur.