SLOVENSKI STANDARD

SIST EN 15433-5:2008

01-februar-2008

Obremenitve pri transportu - Merjenje in analiza dinamiļ no mehanskih obremenitev - 5. del: Izpeljava specifikacij preskuġanja

Transportation loads - Measurement and evaluation of dynamic-mechanical loads - Part 5: Derivation of Test Specifications

Transportbelastungen - Messen und Auswerten von mechanisch-dynamischen Belastungen - Teil 5: Ableitung von Prüfvorschriften

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Charges de transport - Mesurage et évaluation des charges mécaniques dynamiques - Partie 5 : Dérivation des spécifications d'essai

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55.180.01

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15433-5

December 2007

ICS 55.180.01

English Version

Transportation loads - Measurement and evaluation of dynamic mechanical loads - Part 5: Derivation of Test Specifications

Charges de transport - Mesurage et analyse des charges mécaniques dynamiques - Partie 5: Dérivation des spécifications d'essai

Transportbelastungen - Messen und Auswerten von mechanisch-dynamischen Belastungen - Teil 5: Ableitung von Prüfvorschriften

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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 Management Centre has the same status as the official versions.

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Foreword

This document (EN 15433-5:2007) 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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

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

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Introduction

This standard was originally prepared by working group NAVp-1.4, Requirements and Testing, of the German Standardization Institute (DIN). It is part of a complete normative concept to acquire and describe the loads acting on goods and influencing them during transport, handling and storage.

This standard becomes significant when related to the realisation of the European Directive on Packaging and Packaging Waste (Directive 94/62 EC, 20 December 1994). 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.

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

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— This series of standards consists of the following parts:

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— 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.

1 Scope

This standard gives guidelines for the derivation of test specifications from data acquired according to EN 15433-2, EN 15433-3 and EN 15433-4.

NOTE To simulate transportation loads, it is helpful to work with standardized load assumptions that are based on the actual loads acquired according to EN 15433-2 up to EN 15433-4. The derivation of test specifications is based fundamentally on considerations concerning the reproduction of damage, whereby time compressed fatigue simulation in particular has to be considered for the determination of the test intensity.

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.

Not applicable

3 Derivation of test conditions

The ideal way to simulate transportation loads is to use actual measured transportation loads. These are usually represented as acceleration-time functions and contain the overall dynamic mechanical load profile of the transport process. The duration of the simulation corresponds with the duration of the actual transportation.

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NOTE In practice, however, tests have to be performed by test laboratories, which do not have measured values for that particular case available. In such cases, a standard load should be used. If transport processes are to be time-compressed because the actual transport duration is too long, then the assumption concerning the time compression should comply with the state of the art. The time compression factor should be mentioned in the test report.

4 Parameters for the derivation of test conditions

For each derivation of a test condition, the following parameters can have an influence on the derived result:

— transportation means;

— transportation route;

— duration of transportation;

— transportation conditions;

— viewed aspect of damage;

— dynamic mechanical particularities;

— other boundary conditions.

NOTE For more details reference should be made to EN 24178:1992 Complete, filled transport packages - Distribution trials - Information to be recorded

For each derivation, the parameters that have been taken into consideration should be recorded, along with the cases for which they are valid. The derivation procedure chosen should also be recorded.

5 Derivation procedure

From the measured transportation loads, the required simulation and test conditions are then derived by various procedures. These procedures should be based on the state of the art.

NOTE 1 It is assumed that these procedures will continue to develop following publication of this standard.

Clause 6 shows an example procedure that aims to break down the material through forced or fatigue rupture.

NOTE 2 Any expert can perform the derivation of a test spectrum.

Derivations of test spectra should comply with the corresponding state of the art. In order to derive relevant test spectra, the measured acceleration-time signals should be analysed and evaluated according to EN 15433-2, EN 15433-3 and EN 15433-4.

6 Derivation of test spectra for failure mechanisms

6.1 General

Transportation damage due to material failure is usually based on forced or fatigue rupture. Standardised load profiles should be made available for such situations.

In most cases, the acquired data are not suitable for testing purposes, since they represent only the momentary value of the load as it appears at any time during transport. Furthermore, due to cost reasons, the test duration has to be much shorter than the actual transportation duration. The guidelines given in this standard should therefore be used to derive a test specification.

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Before deriving a test specification from analysed data, it should be ascertained that all power spectral density (PSD) plots are analysed according to EN 15433-4 and originate from that particular location of the load platform on the transportation means, producing at any time the severest load on the transported item. The longitudinal and lateral loads acting on the transported item should also be considered.

In general, the spectra for the foreseen test specifications should be of no other transportation means, but those used to transport that particular item. This is because larger or smaller vehicles can show marked differences compared to the one used for the actual transport.

If a transportation route is unknown, and if the transported item is to be transported as a single item on different transportation means, then the spectra of the transportation means creating the most severe load should be used to simulate the transportation load.

If large quantities of a specific product have to be transported over long distances, it is essential to know the transportation route, the transportation means, the transportation speed, and the load factor (as a percentage of the maximum permissible payload). From these parameters the load spectrum can be derived, which will result in a suitable transportation test and therefore also result in suitable transportation packing.

An optimal simulation of the transportation load can be achieved if, besides the transportation means, the road sections are also considered. This means that for a specific road transportation, the load spectra of a particular vehicle on different road categories, the driving duration on these same road categories, and the load factor of that particular vehicle are known.

If sea transportation is performed, then the ship size and category, as well as load factor, and the state of the sea and the time spent under those conditions, should be known.

Hence it can be shown that a complete simulation is to be split proportionally into part simulations.

A possible procedure is described in this clause for the derivation of test spectra for road transportation purposes. The procedure is representative for all transportation types.

Figure 1 shows the most important steps required to derive a test specification from analysed spectra.

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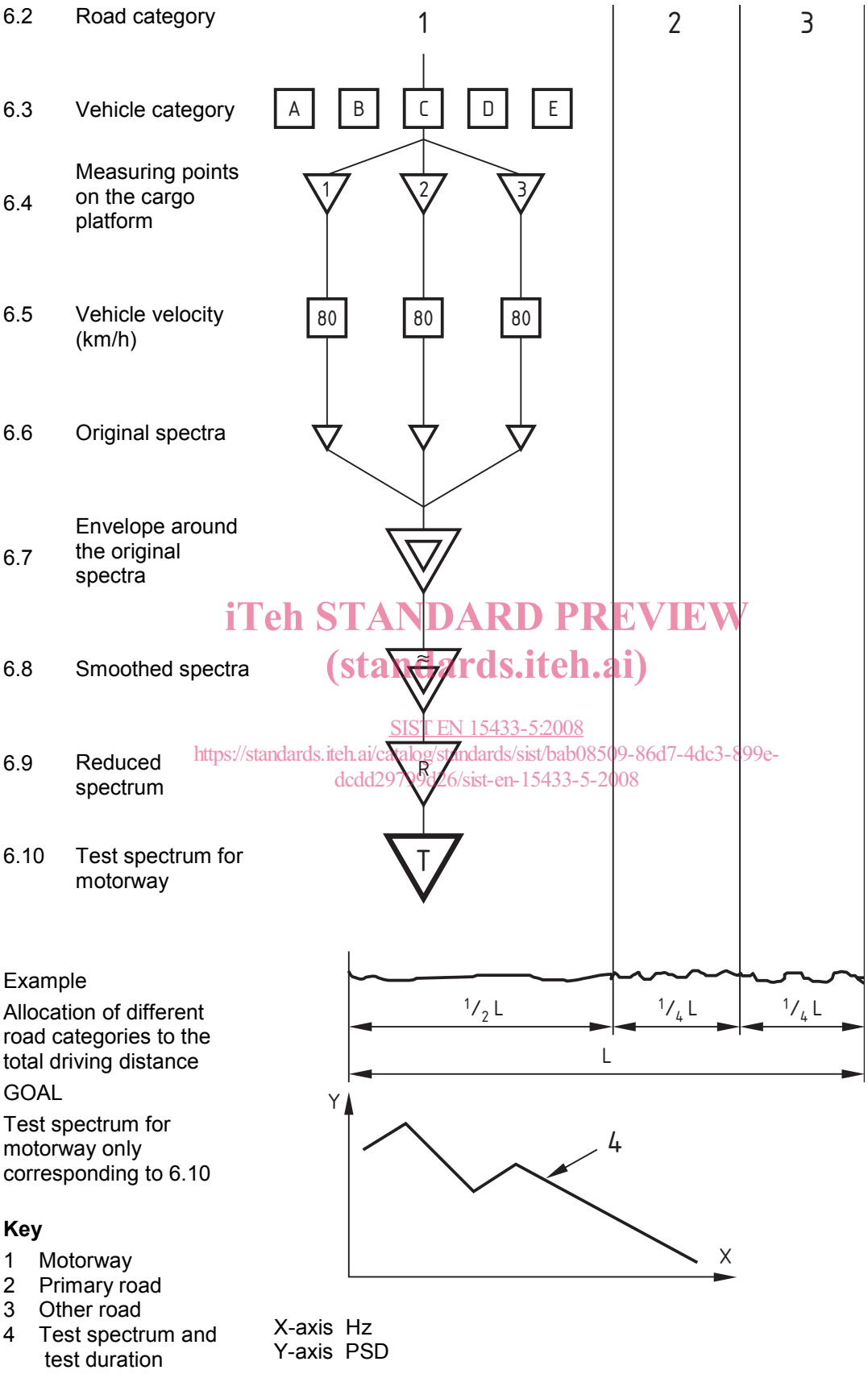

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Figure 1 — Road transportation; derivation of a test spectrum (example)

6.2 Road categories

Road categories and conditions exercise an essential influence on the transport load.

Unsuitable test results can be caused by averaging the various transport loads over a complete transportation route on which the transport has passed. To prevent this, the transportation route should be split into different road categories, as shown in Figure 1.

For testing purposes, the intensity as well as the duration at which such intensity occurs on that particular road category, are relevant.

NOTE Current road maps give sufficient information concerning the road categories that have to be travelled on, from the producer to the end-user of the transported item. From this information, the driving speed and duration of the transport, as well as the expected load on the transported item, can be estimated.

Sites of roadworks and the additional loads resulting from these are not shown on these maps. However, since these road sections commonly are very short compared to the total driving distance, the resulting additional loads can be neglected.

If for testing purposes a testing spectrum is used that is derived from the site of the roadworks, then either the transported equipment should be redesigned to withstand the additional load, or the packing should be re-dimensioned. In both cases this leads to increased costs.

If the test is too weak due to an averaged spectrum, then more damage to the transported item should be expected.

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6.3 Vehicle categories

The transportation load also depends on the selection of a suitable vehicle category, its suspension, and its load factor; e.g. insufficiently loaded vehicles cause higher transportation loads.

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Load spectra should be acquired from all vehicles involved in the transportation, since great deviations of magnitude and frequency may exist between the various vehicle categories.

NOTE Transportation loads occurring on trailers are often higher than those on trucks. The transportation load can be reduced when selecting a vehicle with appropriate suspension. For example, the load on a vehicle with air suspension will be less than on a vehicle with leaf springs.

Cost evaluations show that when excessively high transportation loads are considered for test purposes, this will cause additional costs for the manufacture of packing. Unnecessary packing increases the transportation volume and additional disposal costs.

6.4 Measuring points on the cargo platform

In order to determine a test spectrum, it is essential to find the one with the greatest possible load spectrum occurring on the cargo platform, since it cannot be warranted that an item is always transported on the least damaging location of the cargo platform. One way of finding the worst-case location is to arrange the measuring points on the cargo platform as suggested in Figure 2.

The measuring points should be located, whenever possible, on the bottom side of the cargo platform in order not to interfere with the loading and unloading operations.