SLOVENSKI STANDARD
SIST EN 1915-3:2005+A1:2009

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Podporna oprema na tleh za letalski promet - Splošne zahteve - 3. del: Metode merjenja in zmanjševanje vibracij

Aircraft ground support equipment - General requirements - Part 3: Vibration measurement methods and reduction

Luftfahrtbodengeräte - Allgemeine Anforderungen - Teil 3: Schwingungsmessverfahren und -minderung

Matériel au sol pour aéronefs - Exigences générales - Partie 3: Vibrations, réduction et méthodes de mesure

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17.160	Vibracije, meritve udarcev in vibracij	Vibrations, shock and vibration measurements
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English Version

Aircraft ground support equipment - General requirements - Part 3: Vibration measurement methods and reduction

Matériel au sol pour aéronefs - Exigences générales - Partie 3: Vibrations, réduction et méthodes de mesure

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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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Contents

Foreword

This document (EN 1915-3:2004+A1:2009) has been prepared by Technical Committee CEN/TC 274 “Aircraft ground support equipment”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2009-02-15.

This document supersedes EN 1915-3:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

⟨A1⟩ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

EN 1915 “Aircraft ground support equipment — General requirements” consists of:

Part 1: Basic safety requirements
Part 2: Stability and strength requirements, calculations and test methods
Part 3: Vibration measurement methods and reduction
Part 4: Noise measurement methods and reduction

A further European Standard (EN 12312) in several parts covering specific requirements for different aircraft ground support equipment is in preparation.

The parts of EN 12312 “Aircraft ground support equipment — Specific requirements” are:

Part 1: Passenger stairs
Part 2: Catering vehicles
Part 3: Conveyor belt vehicles
Part 4: Passenger boarding bridges
Part 5: Aircraft fuelling equipment
Part 6: Deicers and deicing/antiicing equipment
Part 7: Aircraft movement equipment
Part 8: Maintenance stairs and platforms
Part 9: Container/Pallet loaders
Part 10: Container/Pallet transfer transporters
Part 11: Container/Pallet dollies and loose load trailers
Part 12: Potable water service equipment
Part 13: Lavatory service equipment
Part 14: Disabled/Incapacitated passenger boarding equipment
Part 15: Baggage and equipment tractors
Part 16: Air start equipment
Part 17: Air conditioning equipment
Part 18: Nitrogen or Oxygen units
Part 19: Aircraft jacks, axle jacks and hydraulic tail stanchions
Part 20: Ground power equipment

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.

Introduction

The aim of this European Standard is to deal with vibration as a hazard and to provide methods for the measurement and reduction of vibration emission transmitted to the whole body of drivers of GSE, when driving. For determining whole body vibrations under stationary operating conditions and hand-arm vibrations EN 1032:2003 is used.

It is intended that the results obtained can also be used to compare GSE of the same category or a given GSE when equipped with different seats or tyres, etc.

Fitting different seats, changing the tyre specification, etc. can lead to different vibration values. Due to the specific operation of GSE, however, EN 1032:2003 cannot be applied directly for whole body vibration under driving conditions, and therefore, the preparation of this European Standard for GSE has become necessary.

This European Standard cannot be used for field measurements to determine the daily exposure of the driver to vibration.

This European Standard is a Type C standard as stated in ⟨A1⟩ EN ISO 12100 ⟨A1⟩.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

[A1] This European Standard deals with whole body vibration as a significant hazard. [A1] It also specifies the methods for determining the vibration emission transmitted to the whole body of drivers standing and/or seated on freely moveable GSE, when driving for purposes of type evaluation, declaration and methods of verifying vibration emission.

The test results are not applicable to the determination of whole body vibration exposure of persons.

[A1] This European Standard is intended to be used in conjunction with the other parts of EN 1915, and with the relevant part of EN 12312. [A1]

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.

EN 1032:2003, *Mechanical vibration — Testing of mobile machinery in order to determine the vibration emission value*

[A1] *deleted text* [A1]

EN 1915-1:2001, *Aircraft ground support equipment — General requirements — Part 1: Basic safety requirements*

EN 12096:1997, *Mechanical vibration — Declaration and verification of vibration emission values*

[A1] EN ISO 12100-1:2003, *Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles (ISO 12100-2:2003)* [A1]

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

ISO 5805:1997, *Mechanical vibration and shock — Human exposure — Vocabulary*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in [A1] EN ISO 12100-1:2003 and EN ISO 12100-2:2003 [A1], EN 1915-1:2001, ISO 2041:1990 and ISO 5805:1997 and the following apply.

3.1
wheel diameter
arithmetic mean of each of the outside diameters of the load bearing wheels e.g.: if the first wheel of the GSE has the diameter D_1, the second wheel diameter D_2 etc., the wheel mean diameter equals

$$\frac{D_1 + D_2 + ... + D_n}{n}$$

where n is the total number of wheels

NOTE The outside diameter D, is the maximum in service diameter specified by the tyre's manufacturer.

3.2
seat pan
seat surface on which the driver is seated

4 Vibration reduction

Vibration emission is a significant hazard, which shall be reduced to the lowest level taking into account the technical progress and the available technical measures for vibration control.

The main source causing whole body vibration is the interaction between the machine and the surface of the ground.

Measures for reducing the vibrations can be:

— pneumatic instead of solid tyres;

— suspension;

— vibration isolated cabin;

— suspension seat;

— shock absorbers.

After taking at design and manufacturing all possible general technical measures for vibration reduction the instruction handbook shall, when appropriate, identify any additional vibration reduction measures, which can be taken by the user. Furthermore, it shall, where appropriate, recommend organisational measures such as the use of low-vibration operating modes, and/or limited time of operation.

5 Quantities to be measured

The quantities to be measured are as follows:

a) The root mean square (r.m.s.) acceleration ($\bar{a}_{wz}$) of whole body vertical frequency — weighted vibration in accordance with EN 1032:2003.

Measurements shall be made in the vertical (z) direction. If there are substantial vibration components as defined in EN 1032:2003, Clause 6 in the horizontal directions, the summation a_w shall be measured, calculated and declared according to EN 1032:2003.

— Standing driver

$\bar{a}_{wzF}$ Mean value of n root-mean-square frequency weighted vertical acceleration values of a valid test series measured on the floor of the driving position with one standing driver.

— Seated driver

$\bar{a}_{wzS}$ Average of acceleration mean values obtained for each of the two drivers for a valid test series measured on the seat base under the seated driver.

NOTE 1 The symbols F and S designate “Floor” and “Seat”;

b) The mean GSE speed when travelling on the test track. This may be determined from the time taken to drive along the test track or by means of the measuring instruments specified in 6.5;

c) Pneumatic tyre pressures (see also 8.2.2);

d) Ambient air temperature.

NOTE 2 If a standard vehicle is used for the GSE, and declaration data for vibration are given by the manufacturer, these values may form the basis for the vibration declaration for the GSE provided that the application of the standard chassis to the use as airport GSE does not imply changes in design or construction which affect the vibration characteristics.

6 Instrumentation

6.1 General

The specifications for the instrumentation given in EN 1032:2003 apply.

6.2 Transducers

General requirements for mounting of vibration transducers are given in 7.2 of EN 1032:2003.

On a seat pan, the transducer shall be mounted in a semi rigid disc as described in 7.2 of EN 1032:2003.

On the floor, the transducer shall be firmly fixed to rigid parts of the GSE, e.g. by means of a magnet or adhesive, etc.

NOTE In the case of stand on GSE, it is convenient to mount the transducers on a light rigid plate upon which the driver can place both feet.

6.3 Frequency weighting

Frequency weighting and band limiting characteristics shall be in accordance with 7.3 of EN 1032:2003.

6.4 Integration time

For each run, the r.m.s. acceleration shall be a linearly integrated average over one complete test run (see 9.2).

6.5 Speed

The speed on the test track shall be measured using instruments measuring the average speed with an accuracy of ± 5 %.

7 Measurement location

Where the exposed persons are sitting, the transducer mounted in a semi rigid disc shall be placed on the seat pan such that the transducer is located midway between the ischial tuberosities of the seated person. For comfort reasons, it is acceptable if the centre of the disc is located slightly in front (up to 50 mm) of the ischial tuberosities.

Where the exposed persons are standing, the transducer shall be located (see 6.2) at a point immediately adjacent to the feet of the standing operator (preferably between the feet).

8 Set up and equipment

8.1 Test track

The test track shall be straight, 25 m long and consist of a level (± 2 % slope deviation) smooth surface with two rigid obstacles, each 150 mm wide of rectangular cross section, e.g. hard wood, metal, etc., to drive over. The deflection of the obstacle material shall be negligible.

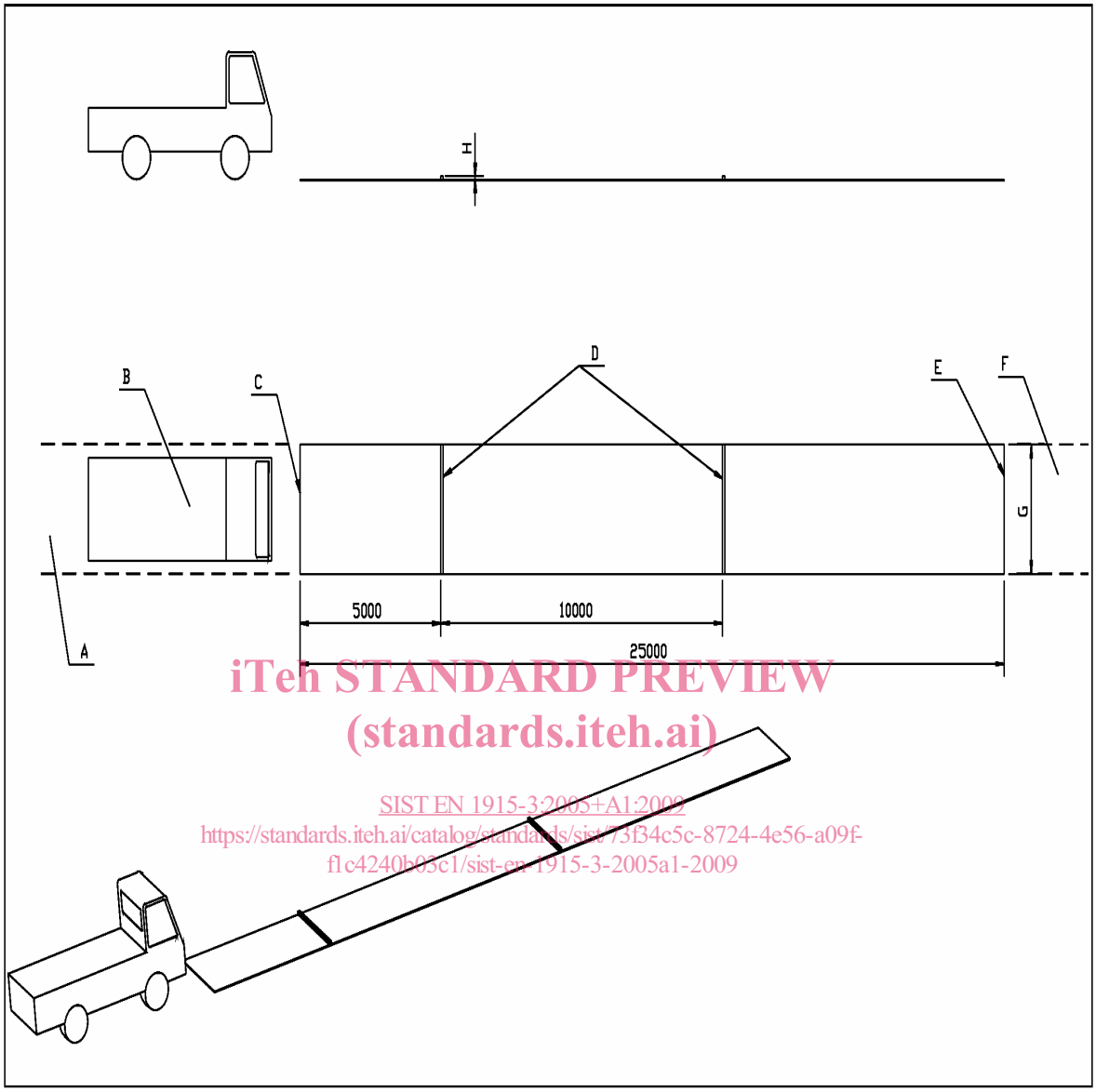
Figure 1 illustrates the test track and obstacles. The height of the two obstacles shall be chosen from Table 1. The total length of test track shall permit the GSE to build up to the required speed at the actual start of the run and to slow down and turn at the end of the run.

The test track surface shall be made of hard material, e.g. tarmac, concrete, etc. The smoothness of the surface shall be such, that the r.m.s. acceleration of the frequency weighted vertical vibration (a_{wz}) measured at the seat base, or foot plate, when the GSE is travelling over the test track without the obstacles, is less than 50 % of the value measured at the same location when the GSE is travelling over the test track with the obstacles.

The conditions for the measurements made without obstacles shall be the same as with the obstacles. Before starting the measurements the test surface shall be clear of any loose chipping, etc.

NOTE A single appropriately designed track (e.g. with different markings) can be used for both measurements (vibration and noise) according to EN 1915-3 and EN 1915-4.

Dimensions in millimetres



Key

A Distance to establish the speed
B Vehicle to be tested. Front wheels shall pass obstacles at the same time. Likewise with rear wheels
C Start line
D Obstacles
E Finish line
F Distance to slow down
G Width of test track to be wider than vehicle tested
H Height of obstacle

NOTE 1 The obstacles should be fastened to the test track surface so that they cannot move.

NOTE 2 If the vibration measured at the seat pan or foot plate with obstacles is less than 0,5 m/s^2, the 50 % criterion can be ignored.

Figure 1 – Test track