



SLOVENSKI STANDARD

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Aircraft ground support equipment - General requirements - Part 2: Stability and strength requirements, calculations and test methods

Aircraft ground support equipment - General requirements - Part 2: Stability and strength requirements, calculations and test methods

Luftfahrt-Bodengeräte - Allgemeine Anforderungen - Teil 2: Standsicherheits- und Festigkeitsanforderungen, Berechnungen und Prüfverfahren

Matériels au sol pour aéronefs - Exigences générales - Partie 2: Exigences de stabilité et de résistance mécanique, calculs et méthodes d'essai

Ta slovenski standard je istoveten z: EN 1915-2:2001

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49.100	Oprema za servis in vzdrževanje na tleh	Ground service and maintenance equipment
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English version

Aircraft ground support equipment - General requirements - Part
2: Stability and strength requirements, calculations and test
methods

Matériel au sol pour aéronefs - Exigences générales -
Partie 2: Prescriptions de stabilité et de résistance
mécanique, calculs et méthodes d'essai

Luftfahrt-Bodengeräte - Allgemeine Anforderungen - Teil 2:
Stand sicherheits- und Festigkeitsanforderungen,
Berechnungen und Prüfverfahren

This European Standard was approved by CEN on 6 January 2001.

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

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by September 2001, and conflicting national standards shall be withdrawn at the latest by September 2001.

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

For relationship with EC Directive(s), see informative Annex Z, which is an integral part of this standard.

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
- Part 4: Noise measurement methods.

This is the first edition of this Part of EN 1915.

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

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

0 Introduction

The abbreviation GSE means a complete item of aircraft ground support equipment in the context of this European Standard.

When compiling this European Standard it was assumed that:

- components without specific requirements are:
 - a) designed in accordance with the usual engineering practices, welding and calculation codes including all failure modes;
 - b) made of materials with adequate strength and of suitable quality;
 - c) made of materials free of defects;
- components are kept in good repair and working order, so that the required characteristics remain despite wear;
- by design of the load bearing elements, a safe operation of the machine is assured for loading ranges from zero to 100 % of the rated possibilities and during tests;
- a negotiation took place between the user and the manufacturer concerning particular conditions for the use and places of use of the GSE;
- the place of operation allows a safe use of GSE.

The extent to which hazards are covered is indicated in the scope of this European Standard.

The minimum essential criteria are considered to be of primary importance in providing safe, economical and usable GSE. Deviation from the recommended methods and conditions should occur only after careful consideration, extensive testing and thorough in service evaluation have shown alternative methods or conditions to be satisfactory.

This European Standard is a Type C standard as defined in EN 1070 : 1998.

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1 Scope

This Part of EN 1915 specifies the conditions to be taken into consideration when calculating the strength and the stability of GSE according to EN 1915-1 : 2001 and the EN 12312 series under intended use conditions. It also specifies general test methods.

NOTE The methods given in this standard demonstrate one way of achieving an acceptable safety level. Methods that produce comparable results may be used.

This Part of EN 1915 does not establish additional requirements for the following:

- operation elsewhere than in an airport environment;
- operation in severe conditions, e.g. ambient temperature below -20 °C or over 50 °C, tropical or saturated salty atmospheric environment;
- hazards caused by wind velocity in excess of the figures given in this European Standard;
- earthquake, flood, landslide, lightning and more generally any natural catastrophe.

This Part of EN 1915 is not applicable to GSE which are manufactured before the date of publication by CEN of this Standard.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-1 : 1991

Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology

EN 292-2 : 1991/A1 : 1995

Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications

EN 729-1

Quality requirements for welding - Fusion welding of metallic materials - Part 1: Guidelines for selection and use

EN 729-2

Quality requirements for welding - Fusion welding of metallic materials - Part 2: Comprehensive quality requirements

EN 729-3

Quality requirements for welding - Fusion welding of metallic materials - Part 3: Standard quality requirements

EN 729-4

Quality requirements for welding - Fusion welding of metallic materials - Part 4: Elementary quality requirements

EN 1070 : 1998

Safety of machinery - Terminology

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EN 1915-1 : 2001

Aircraft ground support equipment – General requirements – Part 1: Basic safety requirements

EN 25817

Arc-welded joints in steel; guidance on quality levels for imperfections (ISO 5817:1992)

ISO 2408 : 1985

Steel wire ropes for general purposes – Characteristics

ISO 8625-1 : 1993

Aerospace – Fluid systems – Vocabulary – Part 1: General terms and definitions relating to pressure

3 Terms and definitions

For the purposes of this Part of EN 1915 the terms and definitions of EN 1070 : 1998 and EN 1915-1 : 2001 apply. Additional terms and definitions are:

3.1

component mass

mass of that part of the GSE, for which the strength is to be calculated

3.2

rated load

maximum mass (including persons) a GSE or a part of it is intended to carry

3.3

local loads

loads derived from the rated load for the calculation of the strength of particular parts of the GSE

3.4

snow load

maximum mass of snow or ice the GSE is intended to carry

3.5

static test load

test load or combination of test, used to simulate operational loading

3.6

dynamic forces

forces resulting from acceleration of a mass (e. g. acceleration forces, retardation forces, centrifugal forces)

3.7

secondary dynamic forces

forces caused by the movement of persons. These forces act horizontally at the centre of gravity of the body of a person. The centre of gravity of persons is assumed to be 1,1 m above the standing area

3.8

retardation forces

forces on particular parts of GSE caused by the maximum deceleration of the GSE. These forces act at the centre of gravity of the particular part in the direction of motion

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3.9

spring reaction force

force in the suspension under the condition of loading

3.10

wind load

force acting on a GSE or part of it due to wind pressure. This force acts horizontally at the geometric centre of the body of the GSE

3.11

tipping edge

those part(s) of the GSE in contact with the ground, located farthest out on the most heavily loaded side

3.12

tipping moment

total of the products of those forces which tend to tip the GSE, and their distance normal to the tipping edge

3.13

bursting pressure

pressure at which a component bursts or shows excessive leakage due to structural failure [ISO 8625-1 : 1993]

3.14

maximum working pressure

highest pressure at which the system is to operate

4 List of hazards

In addition to the hazards dealt with in EN 1915-1 : 2001 and in the specific product standards of the EN 12312 series this Part of EN 1915 deals with the following:

- mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);
- inadequacy of mechanical strength;
- break-up during operation;
- loss of stability / tipping of GSE.

5 Safety requirements and/or measures

5.1 General

GSE shall conform to the safety requirements and/or measures of clause 5. In addition, GSE shall be designed according to the principles of EN 292 for hazards relevant but not significant which are not dealt with by this European Standard, EN 1915-1 : 2001 and/or the specific product standard of the EN 12312 series.

NOTE Where a standard automotive chassis is used, the manufacturer of the GSE should pay attention to and appropriate gross mass rating for the intended use.

5.2 Requirements for the strength calculation of steel constructions

5.2.1 General remarks

The method of calculation shall take into account the complexity of each individual type of GSE. The pertinence of the method of calculation shall be stated in the technical file.

Calculations shall be performed in accordance with either

- recognized engineering design methods and engineering codes;
- finite elements analysis;
- actual stress measurements

or combinations of these.

NOTE Information about load geometry is given in annex A.

The source of the design methods and engineering codes, if generally accessible, shall be stated in the case of any unusual formulae or calculation methods. Otherwise only formulae or calculation methods which can be easily verified shall be used.

The general stress analysis shall be carried out to ensure safe levels of stress in relation to the yield stress of the material used.

Safe levels of stress related to the loading conditions shall be demonstrated for all supporting structures. The principal dimensions, cross sections, materials and fastening means shall be stated.

Significant effects of elastic deflection including results of tests (see 5.4.3) shall be considered in the stress analysis.

The analysis of the load case combinations intended by the manufacturer shall be carried out to ensure that the severest individual load ratings can be identified.

Design strength shall be proven for components under compression which may be susceptible to buckling or bulging using a verifiable method.

Consideration shall be given to high dynamic forces which can be caused by the operation of a safety device for the prevention of unintentional movements if there is an escape of fluid in a piping system or a rope, chain, nut or gear fails.

The design of mechanical restraint devices shall take into account all loads and forces occurring during blocking.

Where a system has two or more lifting elements in parallel, design shall ensure the loads resulting from the failure of one element shall not have effects jeopardising safety.

NOTE For calculation purposes, this situation corresponds to an exceptional loading.

5.2.2 Loads and load combinations

5.2.2.1 The following loads or worse combinations thereof shall be taken into account:

- component mass;
- rated load;
- local loads;
- snow load;
- dynamic forces;
- secondary dynamic forces;
- wind load.

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NOTE Load combinations are given in 5.4.5. [c](https://standards.iteh.ai/catalog/standards/sist/73fae82-07ee-4b16-b84e-cdb308af7a7/sist-en-1915-2-2002)

5.2.2.2 Loads shall be used in the calculation of the strength of the elements concerned at the most unfavourable positions, values and directions.

5.2.2.3 The rated load shall be stated by the manufacturer, and shall be not less than 3000 N/m². Where the intended use of the GSE is to carry persons, the rated load shall be calculated on the basis of four persons per m², each person at 80 kg. For the calculation of floors, local loads of a single person placed on a surface of 200 mm × 200 mm shall be taken into account.

5.2.2.4 Dynamic forces effective at the same time shall be measured under intended use conditions or be calculated. For GSE not designed to be driven during operation, as a general rule (see also EN 12312 series), vertical dynamic forces may be considered to be at least 10 % of the component mass and rated load, subject to assessment by the manufacturer.

5.2.2.5 For simplification of the calculation, secondary dynamic forces are introduced into the calculation as static forces by the formula:

$$F_s = 200 N \times \Sigma (1/i)$$

i.e. $F_s = 200 N (1/1+1/2+1/3+\dots+1/i)$

where:

i is the number of persons on the entire GSE.

5.2.2.6 The snow load shall be stated by the manufacturer.

NOTE The snow load is depending on the geographical area of use of the GSE and may be agreed between manufacturer and user (see clause 0 – negotiation).

5.2.2.7 The wind force is generally calculated by the formula:

$$W = c q A$$

where:

c is the shape factor;

A is the surface area in square metres;

q is the dynamic wind pressure in Pascals.

The dynamic wind pressure is calculated by the formula:

$$q = \frac{\rho v^2}{2}$$

where:

v is the wind velocity, in metres per second;

ρ is the density of air at +15 °C = 1,225 kilograms per cubic metre.

The maximum wind velocity shall be stated by the manufacturer. A minimum constant wind velocity of 20,58 m/s (40 knots) shall be considered.

NOTE The operating conditions to resist higher wind gust velocities may be agreed between manufacturer and user (see clause 0 – negotiation).

For simplification, the wind velocity shall be assumed to be constant over the height of the GSE.

The shape factors c are given in annex B.

5.2.3 Materials

Type, grade, chemical composition, weldability and mechanical characteristics (e. g. yield strength, modulus of elasticity, shear modulus) of materials used shall be stated in the technical file.