SLOVENSKI STANDARD
SIST EN 1755:2016

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Nadomešča:
SIST EN 1755:2001+A2:2013

Varnost vozil za talni transport - Obratovanje v potencialno eksplozivnih atmosferah - Uporaba v območju vnetljivega plina, pare, megle in prahu

Safety of industrial trucks - Operation in potentially explosive atmospheres - Use in flammable gas, vapour, mist and dust

Sicherheit von Flurförderzeugen - Einsatz in explosionsgefährdeten Bereichen - Verwendung in Bereichen mit brennbaren Gasen, Dämpfen, Nebeln oder Stäuben

Sécurité des chariots de manutention - Fonctionnement en atmosphères explosibles - Utilisation dans des atmosphères inflammables dues à la présence de gaz, de vapeurs, brouillards ou poussières inflammables

Ta slovenski standard je istoveten z: **EN 1755:2015**

ICS:

13.230	Varstvo pred eksplozijo	Explosion protection
53.060	Industrijski tovornjaki	Industrial trucks

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EUROPEAN STANDARD
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English Version

Industrial Trucks - Safety requirements and verification - Supplementary requirements for operation in potentially explosive atmospheres

Chariots de manutention - Prescriptions de sécurité et vérification - Prescriptions supplémentaires pour le fonctionnement en atmosphères explosibles

Sicherheit von Flurförderzeugen - Einsatz in explosionsgefährdeten Bereichen - Verwendung in Bereichen mit brennbaren Gasen, Dämpfen, Nebeln oder Stäuben

This European Standard was approved by CEN on 24 July 2015.

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European foreword

This document (EN 1755:2015) has been prepared by Technical Committee CEN/TC 150 “Industrial Trucks - Safety”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by November 2017.

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

This document supersedes EN 1755:2000+A2:2013.

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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Informative Annex F provides details of significant technical changes between this document and the previous edition: EN 1755:2000+A2:2013.

This document is one of a series of European Standards for the safety of industrial trucks which are listed in 4.1 and in the Bibliography.

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, 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 is a type-C standard as stated in EN ISO 12100.

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

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 in accordance with the provisions of this type C standard.

This standard (EN 1755:2015) covers safety requirements and their verification for industrial trucks as defined in ISO 5053-1 that are not covered exhaustively by:

— EN 1459;

— EN 1526;

— EN 1757-3;

— EN ISO 3691-1;

— EN ISO 3691-5;

— EN ISO 3691-6;

NOTE The above-mentioned standards are listed in the Bibliography or in Clause 2.

Assessment of hazards

The industrial truck needs to be designed in such a way that it is fit for its purpose or function and can be adjusted and maintained without putting persons at risk when used under the conditions foreseen (e.g. explosive atmospheres) by the manufacturer.

In order to properly design an industrial truck and to cover all specific safety requirements, the manufacturer will have to identify the hazards that apply to the industrial truck and carry out a risk assessment. The manufacturer will then need to design and construct the industrial truck taking this assessment into account.

The aim of this procedure is to eliminate the risk of accidents throughout the foreseeable lifetime of the machinery, including the phases of assembling and dismantling where risks of accidents could also arise from foreseeable abnormal situations.

In selecting the most appropriate methods, the manufacturer will need to apply the following principles, in the order given here:

— eliminate or reduce risks as far as possible by design (inherently safe machinery design and construction);

— take the necessary protective measures in relation to risks that cannot be eliminated by design;

— inform users of any shortcoming of the protective measures adopted;

— indicate whether any particular training is required;

— specify any need to provide personal protection equipment;

— refer to the appropriate user's document for proper operating instructions.

Industrial trucks need to be designed to prevent foreseeable misuse wherever possible, if such would engender risk. In other cases, the instructions will need to draw the user's attention to ways shown by experience in which the machinery ought not to be used.

This standard (EN 1755:2015) does not repeat all the technical rules which are state-of-the art and which are applicable to the material used to construct the industrial truck. Reference will also need to be made to EN ISO 12100.

1 Scope

This European Standard applies to self-propelled and pedestrian propelled manual and semi-manual industrial trucks as defined in ISO 5053-1 including their load handling devices and attachments (hereafter referred to as trucks) intended for use in potentially explosive atmospheres.

NOTE 1 Attachments mounted on the load carrier or on fork arms which are removable by the user are not considered to be a part of the truck.

This European Standard specifies supplementary technical requirements for the prevention of the ignition of an explosive atmosphere of flammable gases, vapours, mists or dusts by industrial trucks of equipment group II and equipment category 2G, 3G, 2D or 3D.

NOTE 2 The relationship between an equipment category (hereafter referred to as category) and the corresponding zone (area classification) is shown in informative Annex B.

This European Standard does not include:

— trucks of equipment group I;

— trucks of equipment group II, equipment category 1;

— trucks intended for use in potentially explosive atmospheres with hybrid mixtures;

— protective systems.

This European Standard is not applicable to trucks intended for use in potentially explosive atmospheres of carbon disulphide (CS_2), carbon monoxide (CO) and/or ethylene oxide (C_2H_4O) due to the special properties of these gases.

This standard is applicable to trucks intended for use in atmospheres with an ambient temperature range of - 20 °C to +40 °C, i.e. trucks built in accordance with this European Standard will be satisfactory to any service conditions within this range unless otherwise specified.

NOTE 3 The ambient temperature range -20 °C to +40 °C is in line with EN ISO 3691-1.

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 1127-1:2011, *Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology*

EN 1149-5, *Protective clothing - Electrostatic properties - Part 5: Material performance and design requirements*

EN 1175-1:1998+A1:2010, *Safety of industrial trucks - Electrical requirements - Part 1: General requirements for battery powered trucks*

EN 1175-2, *Safety of industrial trucks — Part 2: Electrical requirements for internal combustion engine powered trucks*

EN 1175-3, *Safety of industrial trucks — Part 3: Electrical requirements for the electric power transmission systems of internal combustion engine powered trucks*

EN 1459, *Safety of industrial trucks — Self-propelled variable reach trucks*

EN 1525, *Safety of industrial trucks - Driverless trucks and their systems*

EN 1757-3, *Safety of industrial trucks - Pedestrian controlled manual and semi-manual trucks - Part 3: Platform trucks*

EN 1834-1:2000, *Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres - Part 1: Group II engines for use in flammable gas and vapour atmospheres*

EN 1834-3, *Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres - Part 3: Group II engines for use in flammable dust atmospheres*

EN 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements*

EN 13463-3, *Non-electrical equipment for use in potentially explosive atmospheres - Part 3: Protection by flameproof enclosure 'd'*

EN 13463-5:2011, *Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'*

EN 13463-8, *Non-electrical equipment for potentially explosive atmospheres - Part 8: Protection by liquid immersion 'k'*

EN 14986, *Design of fans working in potentially explosive atmospheres*

EN 50271, *Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen - Requirements and tests for apparatus using software and/or digital technologies*

EN 60079-0:2012, *Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0:2011, modified)*

EN 60079-7, *Explosive atmospheres - Part 7: Equipment protection by increased safety "e" (IEC 60079-7)*

EN 60079-14:2014, *Explosive atmospheres - Part 14: Electrical installations design, selection and erection (IEC 60079-14:2012)*

EN 60079-15:2010, *Explosive atmospheres - Part 15: Equipment protection by type of protection "n" (IEC 60079 15:2010)*

EN 60079-17, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance (IEC 60079-17)*

EN 60079-29-1:2007, *Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases (IEC 60079-29-1:2007)*

EN 60079-29-2, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen (IEC 60079-29-2)*

EN 60079-31, *Explosive atmospheres — Equipment dust ignition protection by enclosure "t" (IEC 60079-31)*

CLC/TR 60079-32-1, *Explosive atmospheres - Part 32-1: Electrostatic hazards, guidance*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1)*

EN 61508-6, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3 (IEC 61508-6)*

EN ISO 3691-1, *Industrial trucks - Safety requirements and verification - Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks (ISO 3691-1:2011)*

EN ISO 13849-1, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1)*

EN ISO 20344, *Personal protective equipment - Test methods for footwear (ISO 20344)*

ISO 284, *Conveyor belts — Electrical conductivity — Specification and test method*

ISO 1813, *Belt drives — V-ribbed belts, joined V-belts and V-belts including wide section belts and hexagonal belts — Electrical conductivity of antistatic belts: Characteristics and methods of test*

ISO 9563, *Belt drives — Electrical conductivity of antistatic endless synchronous belts — Characteristics and test method*

ISO 15870, *Powered industrial trucks — Safety signs and hazard pictorials — General principles*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1
explosive atmosphere
mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture

[SOURCE: EN 13237:2012, 3.28]

3.2
potentially explosive atmosphere
atmosphere which could become explosive due to local and operational conditions

[SOURCE: EN 13237:2012, 3.28.2]

3.3
hybrid mixture
mixture of flammable substances with air in different physical states

[SOURCE: EN 13237:2012, 3.40]

3.4
auto ignition temperature
lowest temperature (of a hot surface) at which under specified test conditions an ignition of a flammable gas or flammable vapour in mixture with air or air/inert gas occurs

[SOURCE: EN 13237:2012, 3.45]

3.5
minimum ignition temperature of a dust cloud
lowest temperature of a hot surface on which the most ignitable mixture of the dust with air is ignited under specified test conditions

[SOURCE: EN 13237:2012, 3.45.1]

3.6
minimum ignition temperature of a dust layer
lowest temperature of a hot surface at which ignition occurs in a dust layer under specified test conditions

[SOURCE: EN 13237:2012, 3.45.2]

3.7
service temperature
maximum or minimum temperature reached at specific points of the equipment when the equipment is operating at rated conditions, including ambient temperature and any external sources of heating or cooling

[SOURCE: EN 60079-0:2012, 3.50]

Note 1 to entry: Each equipment may reach different service temperatures in different parts.

Note 2 to entry: This definition applies to both electrical and non-electrical equipment and components.

3.8
maximum surface temperature
temperature used for marking of the equipment which is the highest temperature that can be attained in service under the most adverse operating conditions (but within the recognized tolerance) by any part or surface of equipment or protective system or component which can produce an ignition of the surrounding explosive atmosphere with an appropriate safety margin

[SOURCE: EN 13463-1:2009, 3.9]

Note 1 to entry: The manufacturer will prescribe the product standard and also in his particular design he should take into account the following other conditions:

a) fault conditions specified in the standard for the type of protection concerned;

b) all operating conditions specified in any other standard specified by him including recognized overloads; any other operating condition specified by him.

Note 2 to entry: The relevant surface temperature may be internal or external depending upon the type of protection concerned.

Note 3 to entry: For equipment intended for use in explosive dust atmospheres, the surface temperature is determined without any deposited dust on the equipment. See EN 13463-1:2009, 6.2.3.

3.9
wheel
circular structure able to rotate on an axle, either directly or with the use of bearing(s), with the external part in contact with the ground

[SOURCE: ISO 22877:2004, 1.1.1]

3.10
castor
assembly comprising a housing, one or more wheels, an axle and, if required, accessories

[SOURCE: ISO 22877:2004, 3.1]

3.11
tyre
outer part of a wheel, produced from different material from the wheel centre

[SOURCE: ISO 22877:2004, 1.1.6]

3.12
service brake
brake system allowing the operator to control, directly or indirectly, the speed of the truck or to bring the truck to a halt

EXAMPLE The brake can be electrical, hydraulic or mechanical or a combination of the three.

[SOURCE: ISO 6292:2008, 3.12, modified: "braking system" replaced with "brake", addition of an example]

3.13
restricted breathing enclosure "nR"
enclosure that is designed to restrict the entry of gases, vapours and mists

[SOURCE: EN 60079-15:2010, 3.7.3]

3.14
safety function
function to be implemented by a safety device, which is intended to achieve or maintain a safe state for the equipment under control (EUC), in respect of ignition hazards

Note 1 to entry: See EN 50495 for the definitions of "safety device", "safe state" and "equipment under control".

[SOURCE: EN 50495:2010, 3.7, modified, addition of Note 1 to entry]

3.15
safety shutdown
shutdown of a truck or a piece of equipment activated by a safety function to prevent potential ignition sources from becoming effective

3.16
normal operation
situation when the equipment, protective systems, and components are operating for their intended use within their design parameters

[SOURCE: EN 13463-1:2009, 3.7]

3.17
malfunction
equipment, protective systems and components do not perform the intended function

[SOURCE: EN 13463-1:2009, 3.8]

3.18
expected malfunction
disturbances or equipment faults which are known to occur in practice

[SOURCE: EN 13463-1:2009, 3.8.1]

3.19
rare malfunction
type of malfunction which may happen only in rare instances

[SOURCE: EN 13463-1:2009, 3.8.2]

3.20
earthing strap
strap made of conductive or dissipative material strong enough to withstand mechanical and chemical influences and installed to achieve potential equalization between truck chassis and the floor/ground

3.21
controlled stop
condition in which the truck is in a safe stationary state

3.22
highly efficient electrostatic charge generating mechanism
process that generates a higher rate of electrostatic charge than simple operations

Note 1 to entry: For more information, see EN 13463-1:2009, 6.7.3.

EXAMPLE 1 Rubbing, cleaning with a dry cloth, raising from a seat, walking, wiping of clothes are examples of simple operations.

EXAMPLE 2 The flow of insulating liquids or powders, high voltage spray charging, running of transmission belts are examples of highly efficient electrostatic charge generating mechanisms.

4 Safety requirements and/or protective measures

4.1 General

Trucks for use in potentially explosive atmospheres shall comply with the additional requirements given in 4.1 up to and including 4.11.

Where the additional hazards specified in normative Annex A could occur, an ignition hazard assessment in accordance with EN 1127-1 and EN 13463-1 shall be carried out, taking into consideration these hazards and the additional requirements contained in EN 13463-1 and if relevant supplemented by the specific parts of EN 13463 for other types of protection.

Trucks of Group II shall be subdivided according to the explosive gas atmosphere for which they are intended. See EN 60079-0:2012, 4.2.

Group II subdivisions:

a) IIA;

b) IIB;

c) IIB + H_2;

d) IIB + C_2H_2;

e) IIB + H_2 + C_2H_2.

NOTE 1 Trucks marked IIB are also suitable for IIA applications.

NOTE 2 Trucks marked IIB+H_2, IIB+C_2H_2 or IIB+H_2+C_2H_2 are also suitable for IIA or IIB applications.

NOTE 3 Trucks equipped with a gas detection system are specifically marked in accordance with 6.3.3 e).

NOTE 4 H_2 is the chemical formula for hydrogen and C_2H_2 for acetylene.

Trucks of Group III shall be subdivided according to the explosive dust atmosphere for which they are intended. See EN 60079-0:2012, 4.3.

Group III subdivisions:

f) IIIA: combustible flyings;

g) IIIB: non-conductive dusts;

h) IIIC: conductive dusts.

Equipment shall be selected taking into consideration any service temperatures measured during the temperature tests described in 5.1.

4.2 Hot surfaces

4.2.1 General

For category 3G and 2G trucks the maximum surface temperature of any part of the truck shall not exceed the temperature class or maximum surface temperature defined on the truck marking plate.

For category 3D and 2D trucks the maximum surface temperature of any part of the truck which can come into contact with dust clouds or dust layers shall not exceed the maximum surface temperature defined on the truck marking plate.

Maximum surface temperatures shall be determined in accordance with 5.1.

Reduction of surface temperatures by means of thermal insulation is not permitted.

NOTE 1 The relationship between the maximum surface temperature of the equipment and the minimum ignition temperature of dust layers and dust clouds is given in EN 1127-1:2011, 6.4.2 and EN 60079-14, 5.6.3.3.

NOTE 2 The possible insulation effects of a dust layer on the surface temperatures are taken into account by the safety margin to the minimum ignition temperature of a dust layer specified in EN 1127-1:2011, 6.4. and EN 60079-14, 5.6.3.3.

4.2.2 Temperature monitoring

Surface temperatures may be limited by the use of a temperature monitoring and control system which provides a safety shutdown in accordance with 4.3 if limiting values are exceeded.

For both category 3 and category 2 trucks, the electrical temperature monitoring and control system shall fulfil the performance level PL_r=c in accordance with EN ISO 13849-1 or SIL 1 in accordance with EN 61508-1.

4.2.3 Temperature classification

Trucks shall be classified:

a) with a temperature class in accordance with Table 1 for category 3G or 2G,

or

b) by the maximum surface temperature for category 3G, 2G, 3D or 2D.

Table 1 — Classification of maximum surface temperatures for trucks of category 3G or 2G

Temperature Class	Maximum surface temperature (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

4.3 Safety shutdown

The requirements of this subclause apply to the following safety (monitoring) functions:

a) hot surfaces in accordance with 4.2;

b) concentration of the flammable gas in the atmosphere surrounding the truck in accordance with 4.10.2.5;

c) insulation monitoring in accordance with 4.5.4.

A safety shutdown shall be clearly indicated by a visual alarm prior to the effective shutdown of the truck to enable the operator to bring the truck safely to a controlled stop. It is permitted to have a time delay between the alarm and shutdown up to a maximum of 30 s. During this time interval the critical operating functions of the truck shall be available.

The requirements of 4.2.1, 4.10.2.5 and 4.5.4 shall not be compromised during the time delay and/or after shutdown.

EXAMPLE Exceeding of the maximum surface temperature after shutdown due to heat soak is an example of compromising safety.

Reset of a safety monitoring function by the operator is not permitted except for shutdown caused by over temperature.

NOTE Additional organizational measures including plant safety procedures can be included in the safety shutdown reset procedure.

4.4 Mechanically generated sparks

4.4.1 Load handling devices

All surfaces of load handling devices which have or may have ground or load frictional contact shall be clad with copper, copper zinc, zinc, or non-metallic material for example rubber, thermoplastic fluoropolymer or plastic.

Alternatively in the case of combustible gas/air-mixtures of Group IIA and IIB and for combustible dust/air-mixtures, load handling devices made of stainless steel or load handling devices clad with stainless steel are permitted. Stainless steel shall have a mass percentage of at least 16,5 % chromium.