



SLOVENSKI STANDARD

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Stroji za podzemne rudnike - Mobilni stroji za podzemne rudnike - Varnost - 1. del: Vozila z gumijastimi kolesi

Machines for underground mines - Mobile machines working underground - Safety - Part
1: Rubber tyred vehicles

Maschinen für den Bergbau unter Tage - Anforderungen an bewegliche Maschinen für
die Verwendung unter Tage - Sicherheit - Teil 1: Gummibereifte Gleislosfahrzeuge für
den Bergbau unter Tage

Machines pour l'exploitation de mines souterraines - Machines mobiles souterraines -
Sécurité - Partie 1: Véhicules sur roues équipés de pneumatiques

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Machines for underground mines - Mobile machines working underground - Safety - Part 1: Rubber tyred vehicles

Machines pour l'exploitation de mines souterraines -
Machines mobiles souterraines - Sécurité - Partie 1:
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den Bergbau unter Tage

This European Standard was approved by CEN on 16 June 2011.

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

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Foreword

This document (EN 1889-1:2011) has been prepared by Technical Committee CEN/TC 196 “Machines for underground mines - Safety”, 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of an identical text or by endorsement, at the latest by January 2012, and conflicting national standards shall be withdrawn at the latest by January 2012.

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 1889-1:2003.

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.

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

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EN 1889-1:2011 (E)**Introduction**

This European Standard is a type C standard as stated in EN ISO 12100:2010.

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

The standard takes into account the current state of the art and technical facilities to use in order to exclude or prevent, as far as possible, hazards when rubber tyred vehicles are used underground.

After approval by CEN this document will be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by DAV + 6 months and conflicting national standards shall be withdrawn.

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

When compiling this standard it has been assumed that:

- a) components are:
- 1) designed in accordance with the good engineering practice and calculation codes, taking account of shocks and vibration, including all failure modes;
 - 2) made of materials with adequate strength and of suitable quality; and
 - 3) free of defects;
- b) harmful materials, such as asbestos are not used;
- c) components are kept in good repair and working order, so that the required dimensions remain fulfilled despite wear.

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1 Scope

1.1 This European Standard specifies the safety requirements and tests for self-propelled rubber tyred vehicles as defined in 3.1 intended primarily for use in underground mining (i.e. as mine vehicles) and other underground workings (e.g. as tunnelling vehicles). The electrical supply voltage is limited to 1100 A.C. and 1500 D.C.

1.2 This European Standard deals with all significant hazards, hazardous situations and hazardous events, applying to self-propelled, rubber-tyred vehicles, subject to being used according to their intended purpose and prevailing manufacturer's conditions and within the scope of foreseeable misuse. This European Standard describes appropriate action to be taken to avoid or minimize the risk of significant hazards.

1.3 This European Standard does not include rubber tyred drilling rigs, which are covered by EN 791, or earth-moving machinery not intended primarily for use in underground mines, which are covered by EN 474 (all parts). This European Standard does not take account of specific hazards associated with special-purpose vehicles, e.g. tankers, explosives vehicles.

This standard does not cover the use and operation of rubber-tyred vehicles being remotely controlled or operation in potentially explosive atmospheres.

1.4 This European Standard applies to vehicles which are manufactured after the date of issue of this standard.

2 Normative references

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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 286-2, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 2: Pressure vessels for air braking and auxiliary systems for motor vehicles and their trailers*

EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 547-1, *Safety of machinery — Human body measurements — Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

EN 547-2, *Safety of machinery — Human body measurements — Part 2: Principles for determining the dimensions required for access openings*

EN 547-3, *Safety of machinery — Human body measurements — Part 3: Anthropometric data*

EN 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN ISO 4413, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN 1679-1, *Reciprocating internal combustion engines — Safety — Part 1: Compression ignition engines*

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EN 1837, *Safety of machinery — Integral lighting of machines*

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

EN 12254, *Screens for laser working places — Safety requirements and testing*

EN 13309, *Construction machinery — Electromagnetic compatibility of machines with internal power supply*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60332-1-1, *Tests on electric and optical fibre cables under fire conditions — Part 1-1: Test for vertical flame propagation for a single insulated wire or cable — Apparatus (IEC 60332-1-1:2004)*

EN 60332-1-2, *Tests on electric and optical fibre cables under fire conditions — Part 1-2: Test for vertical flame propagation for a single insulated wire or cable — Procedure for 1 kW pre-mixed flame (IEC 60332-1-2:2004)*

EN 60332-2-1, *Tests on electric and optical fibre cables under fire conditions — Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable — Apparatus (IEC 60332-2-1:2004)*

EN 60332-2-2, *Tests on electric and optical fibre cables under fire conditions — Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable — Procedure for diffusion flame (IEC 60332-2-2:2004)*

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

EN 60825-4, *Safety of laser products — Part 4: Laser guards (IEC 60825-4:2006)*

EN ISO 2860, *Earth-moving machinery — Minimum access dimensions (ISO 2860:1992)*

EN ISO 2867, *Earth-moving machinery — Access systems (ISO 2867:2006, including Cor 1:2008)*

EN ISO 3411:2007, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope (ISO 3411:2007)*

EN ISO 3449, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements (ISO 3449:2005)*

EN ISO 3450:2008, *Earth-moving machinery — Braking systems of rubber-tyred machines — Systems and performance requirements and test procedures (ISO 3450:1996)*

EN ISO 3471, *Earth moving machinery — Roll-over protective structures — Laboratory tests and performance requirements (ISO 3471:2008)*

EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1986, including Amd 1:1989)*

EN ISO 6683, *Earth-moving machinery — Seat belts and seat belt anchorages — Performance requirements and tests (ISO 6683:2005)*

EN ISO 7096:2008, *Earth-moving machinery — Laboratory evaluation of operator seat vibration (ISO 7096:2000)*

- EN ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731:2003)*
- EN ISO 8030, *Rubber and plastics hoses — Method of test for flammability (ISO 8030:1995)*
- EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*
- EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*
- EN ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*
- EN ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*
- EN ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*
- 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 3864-4, *Graphical symbols — Safety colours and safety signs — Part 4: Colorimetric and photometric properties of safety sign materials*
- ISO 5006:2006, *Earth-moving machinery — Operator's field of view — Test method and performance criteria*
- ISO 5010, *Earth-moving machinery — Rubber-tyred machines — Steering requirements*
- ISO 6393, *Earth-moving machinery — Determination of sound power level — Stationary test conditions*
- ISO 6396:2008, *Earth-moving machinery — Determination of emission sound pressure level at operator's position — Dynamic test conditions*
- ISO 6405-1, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*
- ISO 6405-2, *Earth-moving machinery — Symbols for operator controls and other displays — Part 2: Specific symbols for machines, equipment and accessories*
- ISO 6805, *Rubber hoses and hose assemblies for underground mining — Wire-reinforced hydraulic types for coal mining — Specification*
- ISO 7745, *Hydraulic fluid power — Fire-resistant (FR) fluids — Requirements and guidelines for use*
- ISO 9244, *Earth-moving machinery — Machine safety labels — General principles*
- ISO 9533, *Earth-moving machinery — Machine-mounted audible travel alarms and forward horns — Test methods and performance criteria*
- ISO 10533, *Earth-moving machinery — Lift-arm support devices*
- ISO 10570, *Earth-moving machinery — Articulated frame lock — Performance requirements*
- ISO 11112:1995, *Earth-moving machinery — Operator's seat — Dimensions and requirements*
- ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

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ISO 13333, *Earth-moving machinery — Dumper body support and operator's cab tilt support devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

3.1 vehicle

self-propelled rubber tyred machine running on the mine floor, designed for carrying persons, carrying or loading material or mineral, or with attached equipment designed to be used in mining operations

NOTE 1 Examples of such vehicles are: loader, trucks, supplies/materials vehicles, service vehicles and personnel carriers.

NOTE 2 Vehicles covered by this standard are designed to operate in mines which have restricted widths and heights, therefore the machines are more compact so as to safely negotiate the mine roadways.

3.2 driver

designated person, suitably trained and qualified by knowledge and practical experience and provided with the necessary instructions to ensure safe travelling of the vehicle

3.3 braking systems

elements which combine together to brake and hold the vehicle

NOTE Such systems consist of a control, means of power transmission and the brake itself.

3.3.1 service braking system

primary system used for stopping and holding the vehicle

3.3.2 secondary braking system

braking system that can be applied manually or automatically to stop the vehicle

3.3.3 parking braking system

system used to hold a stopped vehicle in the stationary condition

3.4 service weight

operating weight of the vehicle without payload and driver

3.5 maximum vehicle weight

operating weight of the fully laden vehicle (i.e. with payload according to the volume times specific weight of the bulk material) which includes the heaviest combination of cab, canopy, ROPS or FOPS with all their components and mountings, and equipment intended by the manufacturer of the vehicle, a driver of 80 kg and full fuel tank and full lubricating, hydraulic and cooling systems

3.6 mid-point switch disconnecter

device designed to disconnect the power of a traction battery at a place where the voltage between the positive take-off lead and the mid-point switch disconnecter is approximately equal to that between the mid-point switch disconnecter and the negative take-off lead

4 List of significant hazards

Table 1 contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment according to EN ISO 12100 as significant for this type of machinery and which require action to eliminate or reduce the risk.

Table 1 — List of significant hazards with associated requirements

Nr	Significant hazards	Relevant clause/subclause of this standard
4.1	Mechanical hazards due to:	
4.1.1	— machine parts or workpieces, e.g.: a) shape; b) relative location; c) mass and stability; d) inadequacy of mechanical strength	5.1, 5.2, 5.3, 5.12
4.1.2	Crushing hazard	5.1.2, 5.1.5, 5.3, 5.12
4.1.3	Shearing hazard	5.1.2, 5.1.5, 5.3, 5.12
4.1.4	Cutting or severing hazard	5.1.2, 5.1.5, 5.12
4.1.5	Entanglement hazard	5.1.2, 5.12
4.1.6	Drawing-in or trapping hazard	5.1.2, 5.12
4.1.7	Impact hazard	5.1.2, 5.1.5, 5.3, 5.12
4.1.8	Stabbing or puncture hazard	5.1.2, 5.1.5, 5.12
4.1.9	Friction or abrasion hazard	5.1.2, 5.12
4.1.10	High pressure fluid injection hazard	5.4.1
4.1.11	Collision hazard	5.8, 5.12.4.5
4.2	Electrical hazard due to:	
4.2.1	Contact of person with live parts (direct contact)	5.5
4.2.2	Contact of person with parts which have become live under faulty conditions (indirect contact)	5.5
4.2.3	Electrostatic phenomena	5.5.1

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Nr	Significant hazards	Relevant clause/subclause of this standard
4.3	Thermal hazards , resulting in:	
4.3.1	Burns and scalds by contact with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	5.1.1, 5.1.6, 5.4.1, 5.4.2, 5.13
4.3.2	Damage to health by hot or cold working environment	5.12
4.4	Noise hazards	5.14
4.5	Vibration hazards:	5.12.4
4.6	Radiation hazards:	5.15
4.7	Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery	
4.7.1	Hazards from contact with or inhalation of harmful fluid, gases, mists, fumes and dusts	5.4.1, 5.4.2, 5.6
4.7.2	Fire or explosion hazard	5.4.1, 5.4.2, 5.5, 5.6, 5.7, 5.13
4.8	Hazards generated by neglecting ergonomic principles in machinery design, e.g. hazards from:	
4.8.1	Unhealthy postures or excessive effort	5.11, 5.12
4.8.2	Inadequate consideration of hand-arm or foot-leg anatomy	5.12
4.8.4	Inadequate area lighting	5.8
4.8.5	Mental overload and underload, stress	5.11
4.8.6	Human error	5.11
4.9	Unexpected start-up/over-run/over-speed (or any similar malfunction) from:	
4.9.1	Failure/disorder of the control system	5.4, 5.5, 5.10, 5.11
4.9.2	Impossibility of stopping the machine in the best possible conditions	5.10, 5.11
4.10	Failure of the power supply	5.4, 5.5, 5.6, 5.10, 5.11,
4.11	Failure of the control circuit	5.4, 5.5, 5.10, 5.11

Nr	Significant hazards	Relevant clause/subclause of this standard
4.12	Errors of fitting	7
4.13	Falling or ejected objects or fluids	5.4
4.14	Loss of stability/overturning of machinery	5.1.4, 5.2, 5.3, 5.12
4.15	Relating to the travelling function:	
4.15.1	Movement when starting the engine	5.10
4.15.2	Movement without a driver at the driving position	5.10.4
4.15.3	Movement without all parts in a safe position	5.11.1.2
4.15.5	Excessive oscillations when moving	5.1.4
4.15.6	Insufficient ability of machinery to be slowed down, stopped and immobilised	5.10, 5.11
4.16	Linked to the work position (inc. driving station) on machine:	
4.16.1	Fall of persons during access to (or at/from) the work position	5.12
4.16.2	Exhaust gases/lack of oxygen at the work position	5.6.1, 5.6.2, 5.6.3
4.16.3	Fire (flammability of the cab, lack of extinguishing means)	5.12, 5.13
4.16.4	Mechanical hazards at the work position: a) rollover; b) fall of objects, penetration by objects;	5.12 5.12
4.16.5	Insufficient visibility from the work positions	5.12
4.16.6	Inadequate lighting	5.8
4.16.7	Inadequate seating	5.12.4
4.17	Due to the control system:	
4.17.1	Inadequate location of manual controls	5.11
4.17.2	Inadequate design of manual controls and their mode of operation	5.11
4.18	From handling the machine (lack of	5.1.4