



SLOVENSKI STANDARD
SIST EN 500-1:2007+A1:2010
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Mobile road construction machinery - Safety - Part 1: Common requirements

Bewegliche Straßenbaumaschinen - Sicherheit - Teil 1: Gemeinsame Anforderungen

Machines mobiles pour la construction de routes - Sécurité - Partie 1: Prescriptions communes

Machines mobiles pour la construction de routes - Sécurité - Partie 1: Prescriptions communes

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- Partie 1: Prescriptions communesBewegliche Straßenbaumaschinen - Sicherheit - Teil 1:
Gemeinsame Anforderungen

This European Standard was approved by CEN on 17 August 2006 and includes Amendment 1 approved by CEN on 1 November 2009.

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EN 500-1:2006+A1:2009 (E)**Foreword**

This document (EN 500-1:2006+A1:2009) has been prepared by Technical Committee CEN/TC 151 "Construction equipment and building material machines — 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of an identical text or by endorsement, at the latest by June 2010, and conflicting national standards shall be withdrawn at the latest by June 2010.

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 includes Amendment 1, approved by CEN on 2009-11-01.

This document supersedes ^{A1} EN 500-1:2006 ^{A1}.

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}

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EN 500 "Mobile road construction machinery — Safety" comprises the following parts:

- Part 1: Common requirements; <https://standards.iteh.ai/catalog/standards/sist/d8aaaa20-2d4c-4f7b-8e51-41a564fba68/sist-en-500-1-2007a1-2010>
- Part 2: Specific requirements for road-milling machines;
- Part 3: Specific requirements for soil-stabilising machines and recycling machines;
- Part 4: Specific requirements for compaction machines;
- Part 6: Specific requirements for paver-finishers.

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

This European Standard is a type C standard as stated in EN ISO 12100-1.

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

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EN 500-1:2006+A1:2009 (E)**1 Scope**

1.1 This part of EN 500 specifies the common safety requirements for mobile road construction machinery¹⁾. The EN 500 series is applicable to mobile road construction machinery as listed in Annex A. When no specific standard exists, EN 500-1 applies.

It specifies common requirements for the design and construction of mobile road construction machinery in order to protect workers from accidents and health hazards which could occur during operation, loading, transport and maintenance.

Additional specific requirements for certain types of mobile road construction machinery are given in parts 2 to 4 and 6 of this standard.

This part of this standard gives safety requirements for all types of mobile road construction machinery and shall be used in conjunction with one of the parts 2 to 4 and 6. These machine-specific parts do not repeat the requirements from part 1 but add to or replace the requirements for the type of mobile road construction machinery in question.

Machine-specific requirements in parts 2 to 4 and 6 take precedence over the respective requirements of this standard.

For types of mobile road construction machinery not dealt with in parts 2 to 4 and 6, EN 500-1 applies **A1)** and if for those machinery additional derived risks may arise, these risks have to be taken into consideration **A1)**.

1.2 This European Standard deals with all significant hazards, hazardous situations and events relevant to mobile road construction machinery, when they are used as intended and under conditions of misuse which are reasonably foreseeable (see Clause 4).

This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards as specified in Clause 4.

1.3 This European Standard applies to machines which are manufactured after the date of publication of this European Standard by CEN.

1) For travelling on traffic roads, the national traffic regulations apply.

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.

CR 1030-1:1995, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

EN 3-7:2004, *Portable fire extinguishers — Part 7: Characteristics, performance requirements and test methods*

EN 286-2:1992, *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*

Ⓐ1 deleted text Ⓐ1

EN 1050:1996, *Safety of machinery — Principles for risk assessment*

EN 12643:1997, *Earth-moving machinery — Rubber-tyred machines — Steering requirements (ISO 5010:1992 modified)*

EN 13309:2000, *Construction machinery — Electromagnetic compatibility of machines with internal electrical power supply*

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

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

Ⓐ1 EN 61310-1:2008 Ⓐ1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals* Ⓐ1 (IEC 61310-1:2007) Ⓐ1

Ⓐ1 EN ISO 2860:2008 Ⓐ1, *Earth-moving machinery — Minimum access dimensions (ISO 2860:1992)*

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

Ⓐ1 EN ISO 3411:2007, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope (ISO 3411:2007) Ⓐ1*

Ⓐ1 EN ISO 3457:2008 Ⓐ1, *Earth-moving machinery — Guards — Definitions and requirements (ISO 3457:2003)*

Ⓐ1 deleted text Ⓐ1

Ⓐ1 EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996) Ⓐ1*

EN ISO 5353:1998, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point (ISO 5353:1995)*

Ⓐ1 EN ISO 6682:2008 Ⓐ1, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1986 including Amendment 1:1989)*

Ⓐ1 deleted text Ⓐ1

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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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)*

EN ISO 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

IEC 60364-4-41:2001, *Low-voltage electrical installations — Part 4- 41: Protection for safety — Protection against electric shock*

IEC 60364-5-55:2001, *Electrical installations of buildings — Part 5-55: Selection and erection of electrical equipment — Other equipment*

ISO 3795:1989, *Road vehicles and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 5006-1:1991, *Earth-moving machinery — Operator's field of view — Part 1: Test method*

ISO 6405-1:2004, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 6750:2005, *Earth-moving machinery — Operator's manual — Content and format*

ISO 9244:1995, *Earth-moving machinery — Safety signs and hazard pictorials — General principles*

ISO 9533:1989, *Earth-moving machinery — Machine-mounted forward and reverse audible warning alarm — Sound test method*

ISO 10261:2002, *Earth-moving machinery — Product identification numbering system*

ISO 10570:2004, *Earth-moving machinery — Articulated frame lock — Performance requirements*

ISO 11112:1995, *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 11862:1993, *Earth-moving machinery — Auxiliary starting aid electrical connector*

ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 12509:2004, *Earth-moving machinery — Lighting, signalling and marking lights, and reflex-reflector devices*

ISO 13333:1994, *Earth-moving machinery — Dumper body support and operator's cab tilt support devices*

ISO 14396:2002, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

ECE R34, *Annex 5, Uniform provisions concerning the approval of vehicles with regard to the prevention of fire risks. Testing of fuel tanks of a plastic material*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

3.1

mobile road construction machinery

machine intended for construction, maintenance and marking of roads

NOTE The machines are listed in Annex A.

3.2

machine mass

3.2.1

operating mass

mass of the base machine with all standard equipment, with or without cab, with or without ROPS etc., with operator (75 kg) plus half full fuel tank and all fluid systems, when applicable, with sprinkler water tank half full

3.2.2

maximum mass

operating mass with all components required for their attachment to the base machine (e.g. ballast and all combinable options), and full sprinkler water tank

3.3

hold-to-run control

device by which the operating function is only carried out as long as the control is actuated. The operation is automatically reset into hazardless conditions as the control is released

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3.4

pedestrian-controlled machine

self-propelled mobile road construction machine where the control of the machine is undertaken by an attending operator or by remote control

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4 List of significant hazards

This clause contains all significant hazards, as far as they are treated in the set of standards for mobile road construction machinery, identified by risk assessment as significant for mobile road construction machinery defined in 1.1 and which require action to eliminate or reduce risk.

The risks arising from the hazards listed in Annex F are eliminated or minimised by combining the technical measures given in Clause 5 and those given in the machine-specific parts.

5 Safety requirements and/or protective measures

5.1 General

Mobile road construction machinery shall comply with the safety requirements and/or protective measures of this clause.

In addition, the machines shall be designed according to the principles of EN ISO 12100 for hazards relevant but not significant which are not dealt with by this European Standard (e.g. sharp edges).

EN 500-1:2006+A1:2009 (E)**5.2 Lighting, signalling and marking lights and reflex-reflector devices**

Self-propelled mobile road construction machines for ride-on operators shall be fitted with working lights.

Lighting, signalling and marking lights and reflex-reflector devices shall comply with the appropriate clauses of ISO 12509.

[A1] An electric socket (e.g. cigarette lighter) intended for the connection of a lighting device for service and maintenance use shall be provided on the machine and shall be easily accessible. The design of the sockets shall prevent incorrect connection. **[A1]**

5.3 Operation and handling**5.3.1 Uncontrolled motion**

Machine-, equipment- or attachment-movement from the holding position (except for setting controls by the operator), e.g. due to drifting and/or creeping (e.g. caused by leakage of oil) shall only be possible in such a way that these do not create a hazard to exposed persons. For additional requirements, see machine-specific parts of EN 500.

5.3.2 Retrieval, transportation, lifting and towing**5.3.2.1 General**

The devices for retrieval, tie-down, lifting and towing may be the same if allowed by the configuration of the machine.

[A1] NOTE ISO/FDIS 15818 is under preparation and should be checked for reference. **[A1]**

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5.3.2.2 Lifting (slinging) points for lifting and loading

Appropriate lifting points (e.g. lugs, lifting-eyes or -lugs) shall be fitted to ensure safe loading, retrieval and transportation.

The attachments shall facilitate reliable fitting of the lifting tackles and be arranged in such a way as to contribute to safe anchoring of the machine during lifting and recovery.

For mobile road construction machinery with an operating mass less or equal to 40 kg, such lifting points can have the form of a handle.

The method of lifting heavy attachments, components and machines which are transported in parts shall be described in the instruction handbook.

Lifting points shall to be easily identified on the machine, e.g. marked by symbol 7.23 of ISO 6405-1:2004, and described in the instruction handbook.

5.3.2.3 Tie-down points

Appropriate tie-down points shall be provided for the safe transportation of the machines.

Tie down points shall to be easily identified on the machine, e.g. marked by symbol 7.27 of ISO 6405-1:2004, and described in the instruction handbook.

5.3.2.4 Towing points

Mobile road construction machinery with an operating mass greater than 2 000 kg shall be equipped with towing points (hooks, rings, ears) to allow slow towing and retrieval out of possible danger-zone. Their location, permissible forces, the procedure of towing as well as the maximum towing speed shall be clearly described in the instruction handbook.

5.3.2.5 Fixing of movable elements

Means shall be available to prevent moving of movable parts which could exceed the permissible transport width during transport (e.g. hydraulic or mechanical devices).

5.3.3 Pedestrian-controlled machinery

The maximum travel speed of mobile road construction machinery controlled by an attending operator shall be limited to 6 km/h. If the controls are located at the rear of the machine, the reverse speed shall be limited to 2,5 km/h.

When operating downhill at the maximum gradeability, the travel speed of the machine shall not increase more than 2 m/min with the speed selector in its pre-set position.

5.3.4 Steering system

Mobile road construction machinery shall be provided with a steering system that ensures safe steering with consideration to the rated speed of the machine and its stopping capability. Rubber-tyred mobile road construction machinery with a ride-on operator, having a speed capability exceeding 20 km/h, shall be equipped with a steering system that conforms to EN 12643. The steering shall be such that the movement of the steering control corresponds to the intended direction of steering.

5.3.5 Tyres and rims

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Rims shall be easily identified (see e.g. ISO 4250-3). Instructions regarding safety rules, pressure, inflation and checking shall be provided in the operation manual.

Special precautions shall be taken when ballasted tyres are used and warnings shall be specified in the instruction handbook.

5.3.6 Storage facilities

Easily accessible storage facilities for the instruction handbook and for any special tools supplied shall be provided.

5.4 A1 Operator stations A1

5.4.1 General

The operator's station shall meet the following minimum requirements:

- operator's space envelope shall conform to A1 EN ISO 3411 A1;
- edges shall be shaped in accordance with ISO 12508;
- the engine exhaust system shall A1 release A1 the exhaust gas away from the operator and of the air inlet into the cab;
- floor material shall be slip-resistant (see 5.9);
- mobile road construction machines shall be designed so that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine that are necessary for the intended use of the machine;

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- if the requirements cannot be met by direct view and through rear view mirrors and where hazards due to restricted visibility exist, indirect visibility with, preferably CCTV or detecting systems, e.g. ultra-sonic warning device, can additionally be provided.

NOTE 1 Those devices (e.g. CCTV, detecting systems) should comply with ISO 16001. ^(A1)

NOTE 2 For visibility tests and evaluation ISO 5006 should be used. ^(A1)

5.4.2 Operator's station with cab

Mobile road construction machinery with an operating mass > 4 500 kg shall be so designed that an operator's cab can be fitted. Cabs shall meet the following minimum requirements:

- the operator shall be protected against foreseeable environmental and extreme climatic conditions. Provisions shall be made for installation of the following systems: adjustable heating and ventilation, defrosting and pressurisation, if required;
- enclosure openings shall meet the requirements of EN ISO 2867;
- it shall be possible to keep doors, windows and hoods opened or closed. Uncontrolled self-acting and movement shall not occur. In the case of horizontally divided doors, the locking devices shall be rigid and located at the inner side of the upper door. The locking devices shall be able to be safely operated from the related operator's place;
- doors and windows latched in open positions shall not extend beyond the main outer dimensions of the machine, when the machine is in intended operation;
- an easily accessible emergency exit shall be provided and marked if the cab is provided with only one access door. The marking shall be in accordance with EN 61310-1. Roof windows can also be used as an emergency exit. If the emergency exit shall be insured by a hammer pane breaker, it shall be provided and stored in the cabin, at the hand of the operator;
- front windows shall be provided with motor-driven wipers, washers and a demister. This requirement shall apply for all directions of travel considered in the design of the machine;
- inner lighting shall be provided (capable to function with the engine stopped);
- if a heating and ventilation system is fitted, it shall:
 - either comply with ISO 10263-4;
 - or have a capacity of increasing the temperature of the air inside the cab and maintain a temperature of + 18°C at expected ambient temperature. The capacity of the heating system shall have a ΔT of + 28 K within 30 min.

Measurement of the heating system capacity shall be made at three points. The three points shall be located in a vertical plane through the SIP and parallel to the longitudinal axis of the machine as follows (see Figure 1):

- a filament position centre-point as defined in ISO 5006-1;
- at the SIP as defined in EN ISO 5353;
- 100 mm above floor plate and 600 mm in front of SIP.

Dimensions in millimetres

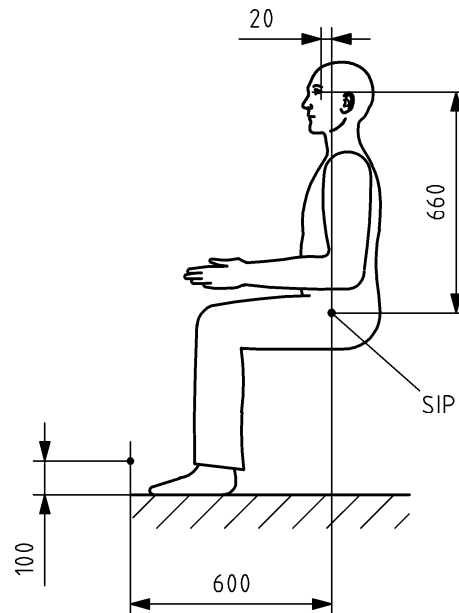


Figure 1 — Location of measuring points

Alternatively the heating capacity can be determined by calculation.

The ventilation system shall be capable of providing the cab with fresh air at the minimum of 20 m³/h. If a filter is required due to operating environment conditions, it should be tested according to ISO 10263-2.

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NOTE The filter element selection depends on the operating environment conditions.

- windows including roof windows shall be made of safety glass or other material which provides similar performance (see e.g. ECE R43). Roof windows do not need to fulfil additional safety requirements;
- if the cab needs to be tilted for maintenance and service, it shall be equipped with a tilt support device according to ISO 13333.

5.5 Operator's seat

Machinery with provision for a seated operator shall be fitted with an adjustable seat to support the operator in a position that allows the operator to control the machine under all expected operating conditions.

Dimensions and adjustment of the seat shall comply with ISO 11112.

If a suspension system is fitted, it shall be adjustable to the operator's weight of at least from 55 kg to 110 kg.

5.6 Controls and indicators

5.6.1 General

The main controls and indicators (hand levers, pedals, switches etc.) shall be designed and arranged so that:

- a) they are of easy access in accordance with EN ISO 2860, EN ISO 6682 and A_1 EN ISO 3411 A_1 ;
- b) their function is clearly identified (see ISO 6405-1) in the operator's station and explained in the instruction handbook (see Clause 6);