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### Stroji za komprimiranje in glajenje betona - Varnost

Concrete compactors and smoothing machines - Safety

Maschinen zum Verdichten und Glätten von Beton - Sicherheitsanforderungen

Compacteurs à béton et talocheuses - Prescriptions de sécurité

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EUROPEAN STANDARD

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## Concrete compactors and smoothing machines - Safety

Compacteurs à béton et talocheuses - Prescriptions de  
sécuritéMaschinen zum Verdichten und Glätten von Beton -  
Sicherheitsanforderungen

This European Standard was approved by CEN on 21 March 2008.

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## Foreword

This document (EN 12649:2008) 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of an identical text or by endorsement, at the latest by December 2008, and conflicting national standards shall be withdrawn at the latest by December 2008.

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 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 98/37/EC. For relationship with EU Directive(s), see informative Annex ZA and ZB, which are integral parts of this document.

This is the first edition of this European Standard.

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 the United Kingdom.

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## Introduction

This document is a type C standard as stated in EN ISO 12100-1:2003.

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.

In this standard it is assumed that:

- only competent persons operate the machine;
- components without specific requirements are:
  - a) designed in accordance with good engineering practice and calculation codes, including all failure modes;
  - b) of sound mechanical and electrical construction according to the state of the art;
  - c) made of materials with adequate strength and of suitable quality;
  - d) made of no harmful materials, such as asbestos;
- components are kept in good repair and working order, so that the required characteristics remain despite wear;
- installation allows for safe use of the machine;
- negotiation occurs between the manufacturer and the user/purchaser concerning particular conditions of use and the places (e.g. ground and local safety conditions) of use of the machinery.

NOTE "Manufacturer" is to be understood within the European Union as intended in the Machinery Directive.

## 1 Scope

**1.1** This document applies to concrete compactors and smoothing machines as defined in Clause 3 and illustrated in Annex A and Annex B.

This standard also applies for hand-held motor-operated concrete vibrators as defined in EN 60745-2-12:2003, but with the additional safety requirements for electronically controlled systems as defined in this standard (see 5.2.1.2).

**1.2** This document does not deal with auxiliary equipment which provides the energy for internal and external vibrators, e.g. air compressors, hydraulic power sources and voltage transformers. This document does not apply to remote-controlled or portable smoothing machines and self-acting (robotic) smoothing machines.

**1.3** This document deals with all significant hazards, hazardous situations and events relevant to concrete compactors and smoothing machines, when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4). This document specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

This standard also includes measures to consider reasonably foreseeable misuse.

**1.4** This document is not applicable to machines which are manufactured before the date of publication of this document by CEN.

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## 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 294:1992, *Safety of machinery — Safety distance to prevent danger zones from being reached by the upper limbs*

EN 500-1:2006, *Mobile road construction machinery — Safety — Part 1: Common requirements*

EN 574:1996, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

EN 614-1:2006, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 811:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

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

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

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

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- EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*
- EN 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes — Part 1: General requirements (IEC 60309-1:1999)*
- EN 60309-2:1999, *Plugs, socket-outlets and couplers for industrial purposes — Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories (IEC 60309-2:1999)*
- EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*
- EN 60745-2-12:2003, *Hand-held motor operated electric tools - Safety - Part 2-12: Particular for concrete vibrators (IEC 60745-2-12:2003)*
- EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*
- EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*
- EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995)*
- 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)*
- 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 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732:2006)*
- EN ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*
- EN ISO 20643:2005, *Mechanical vibration — Hand-held and hand-guided machinery — Principles for evaluation of vibration emission (ISO 20643:2005)*
- ISO 3795:1989, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*
- ISO 6405-1:2004, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*
- CR 1030-1:1995, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*
- HD 22.4 S4:2004, *Cables of rated voltages up to and including 450/750 V and having crosslinked insulation — Part 4: Cords and flexible cables*
- HD 384.4.41 S2:1996, *Electrical installations of buildings — Part 4: Protection for safety — Chapter 41: Protection against electric shock (IEC 60364-4-41:1992, modified)*



### 3 Terms and definitions

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

#### 3.1

##### **concrete compactor**

machine which compacts concrete by transmitting vibration for the compaction process, the vibration is produced by internal and/or external vibrators

NOTE Internal vibrators, external vibrators and vibrating beams are concrete compactors.

#### 3.2

##### **internal vibrator**

equipment to produce mechanical vibrations, the vibrators powered by electrical, pneumatic or hydraulic energy transmit vibrations while immersed in the concrete in order to compact it

NOTE Internal vibrators include eccentric weight, rotating mass and an internal power source transmitter to turn the eccentric weight shaft.

#### 3.3

##### **external vibrator**

equipment to produce mechanical vibrations, it transmits the vibration to the form area and into the concrete in order to compact the concrete

NOTE The external vibrators can be fixed on tables, grates, forms, plates or beams.

#### 3.4

##### **vibrating beam**

equipment to produce mechanical vibrations, the frame is placed on the concrete and transmits the vibrations into the concrete

NOTE The vibrating beams that are described in this standard include frames, vibrators and pull equipment for continuous working.

#### 3.5

##### **smoothing machine**

motor-powered equipment with rotating tools in order to smooth the unhardened concrete, the machine is pedestrian-controlled or ride-on-operated

NOTE Cabins are not included in the equipment of smoothing machines.

#### 3.6

##### **portable smoothing machine**

motor-powered smaller equipment with rotating tools in order to smooth unhardened mortar especially on vertical surface, they are hand-held during operation

#### 3.7

##### **self-acting (robotic) smoothing machine**

smoothing machine that is adjusted for specific operation before starting to work, afterwards it operates automatically without control by a person

### 4 List of significant hazards

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

Table 1 — List of significant hazards

	Hazards	Locations/circumstances/ consequences	See Clause
<b>4.1</b>	<b>List of hazards for internal vibrators</b>		
4.1.1	Mechanical hazards		
4.1.1.1	Drawing-in hazard	Unguarded transmission parts Other rotating parts	5.2.1.1
4.1.2	Electrical hazards		
4.1.2.1	Electrical contact of persons with lifeparts	Direct contact Indirect contact	5.2.1.2
4.1.2.2	External influences on electrical equipment	Damage to electrical equipment Dust/wetness	5.2.1.2
4.1.3	Thermal hazards		
4.1.3.1	Burns by possible contact with hot parts	Combustion engine, hot parts	5.2.1.3
4.1.4	Hazards generated by noise		
4.1.4.1	Hearing loss, interference with speech communications and acoustic signals	Noise of the engines Noise by vibrating parts	5.1.1
4.1.5	Hazards generated by hand-arm-vibration	Eccentric vibrations of the rotating mass	5.1.2
4.1.6	Hazards caused by missing and/or incorrectly positioned safety related measures/means		
4.1.6.1	Safety related devices	Holds, lifting and tie-down devices and towing eyes	5.2.1.7
<b>4.2</b>	<b>List of hazards for external vibrators</b>		
4.2.1	Mechanical hazards		5.2.2.1
4.2.1.1	Drawing-in hazard	Uncovered power source	5.2.2.1
4.2.1.2	Loss of stability	Loosening of the vibrator	5.2.2.1
4.2.2	Electrical hazards		
4.2.2.1	Electrical contact of persons with lifeparts	Direct contact Indirect contact	5.2.2.2
4.2.2.2	External influences on electrical equipment	Damage to electrical equipment Dust/wetness	5.2.2.2
4.2.3	Hazards generated by noise		5.1.2
4.2.3.1	Hearing loss, interference with speech communications and acoustic signals	Noise by vibrating parts	5.1.2
4.2.4	Hazards caused by missing and/or incorrectly positioned safety related measures/means		5.2.2.4
4.2.4.1	Safety related devices	Holds, lifting and tie-down devices and towing eyes	5.2.2.4

Table 1 (continued)

	Hazards	Locations/circumstances/ consequences	See Clause
<b>4.3</b>	<b>List of hazards for vibrating beams</b>		
4.3.1	Mechanical hazards		5.2.3.1
4.3.1.1	Drawing-in hazard	Unguarded transmission parts Rotating parts	5.2.3.1
4.3.1.2	Loss of stability	Loosening of the vibrator	4.2.1.2
4.3.2	Electrical hazards		
4.3.2.1	Electrical contact of persons with lifeparts	Direct contact Indirect contact	5.2.3.2
4.3.2.2	External influences on electrical equipment	Damage to electrical equipment Dust/wetness	5.2.3.2
4.3.3	Thermal hazard		
4.3.3.1	Burns by possible contact with hot parts	Combustion engine, hot parts	5.2.3.3
4.3.4	Hazards generated by noise		5.1.1
4.3.4.1	Hearing loss, interference with speech communications and acoustic signals	Noise of the engines Noise by vibrating beams	5.1.1
4.3.5	Hazards generated by hand-arm vibration	Eccentric vibrations of the rotating mass	5.1.2
4.3.6	Hazards generated by material and substances processed or used by machinery.		
4.3.6.1	Hazards from inhalation of harmful gases	Inhalation of harmful exhausted gases from combustion engines	5.2.3.6
4.3.7	Hazards caused by missing and/or incorrectly positioned safety related measures/means		
4.3.7.1	Safety related devices	Holds, lifting and tie-down devices and towing eyes	5.2.3.7
<b>4.4</b>	<b>List of hazards for smoothing machines</b>		
4.4.1	Mechanical hazard		5.2.4.1
4.4.1.1	Cutting or severing hazard	Rotating smoothing blades	5.2.4.1
4.4.1.2	Drawing-in hazard	Unguarded transmission parts Other rotating parts	5.2.4.1
4.4.1.3	Impact hazard	Rotation of the pole after becoming loose	5.2.4.1
4.4.1.4	Loss of stability	Collapse of machinery parts during transportation Loosening of the pole or parts of the pole	5.2.4.1

Table 1 (continued)

	Hazards	Locations/circumstances/ consequences	See Clause
4.4.1.5	Slip, trip and fall	Hazard related to the rotating smoothing blades running into firm objects Running into other persons Smoothing machine with driving seat gets out of control of the driver Unintentional starting of the smoothing tools on smoothing machines with driving seats	5.2.4.1
4.4.2	Electrical hazards		
4.4.2.1	Electrical contact of persons with lifeparts	Direct contact Indirect contact	5.2.4.2
4.4.2.2	External influences on electrical equipment	Damage to electrical equipment Dust/wetness	5.2.4.2
4.4.3	Thermal hazards		
4.4.3.1	Burns by possible contact with hot parts	Combustion engine, hot parts	5.2.4.3
4.4.4	Hazards generated by noise		5.1.1
4.4.4.1	Hearing loss, interference with speech communications and acoustic signals	Noise of the engine(s)	5.1.1
4.4.5	Hazards generated by whole-body and hand-arm vibration	Vibrations from the engine(s) and smoothing blades	5.1.2
4.4.6	Hazards generated by material and substances processed or used by machinery.		5.2.4.6
4.4.6.1	Hazards from inhalation of harmful gases	Inhalation of harmful exhausted gases from combustion engines	5.2.4.6
4.4.7	Hazards caused by missing and/or incorrectly positioned safety related measures/means		
4.4.7.1	Safety related devices	Holds, lifting and tie-down devices and towing eyes	5.2.4.7
4.4.7.2	Starting devices	Backswing of the hand-starting device of combustion engines Side-slip of the rope during pull-starting Uncontrolled movement of the machine	5.2.4.8
4.4.8	Hazards caused by failure of energy supply		
4.4.8.1	Failure of energy supply	Unintentional starting by switching-on after interruption of energy supply	5.2.4.1

## 5 Safety requirements and/or protective measures

Machinery shall comply with the safety requirements and/or protective measures of this standard.

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