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Stroji in oprema za pripravo betona in malte - Varnostne zahteve

Machinery and plants for the preparation of concrete and mortar - Safety requirements

Maschinen und Anlagen zur Bereitung von Beton und Mörtel - Sicherheitsanforderungen

Machines et centrales pour la préparation du béton et du mortier - Prescriptions de sécurité

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Foreword

This document (EN 12151:2007) 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of an identical text or by endorsement, at the latest by May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

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 and Annex ZB, which are an integral part of this document.

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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.

The road traffic law for each country remains unaffected by this standard.

1 Scope

1.1 This document applies for machinery and plants for the preparation of concrete and mortar as defined in 3.1.

This document specifies the requirements for the design of:

a) batching and mixing installations for concrete and mortar;

b) powered mixers for concrete and mortar, including for storage and handling;

c) waste fresh concrete reprocessing plant.

It does not include requirements relevant to truck mixers.

The machinery may be static or it may be capable of being moved to an alternative position.

1.2 This document deals with all significant hazards, hazardous situations and events relevant to machinery and plant for the preparation of concrete and mortar, when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4). The exceptions are explosion hazards when using flammable or explosive materials that are significant but not dealt with. This document specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards. Maintenance is dealt with but not noise during maintenance.

1.3 This document is not applicable to machinery and plants which are manufactured before the date of publication of this document by CEN.

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 distances to prevent danger zones being reached by the upper limbs*

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 360:2002, *Personal protective equipment against falls from a height — Retractable type fall arresters*

EN 361:2002, *Personal protective equipment against falls from a height — Full body harnesses*

EN 363:2002, *Personal protective equipment against falls from a height — Fall arrest systems*

EN 547-1:1996, *Safety of machinery — Human body measurements — Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

EN 547-2:1996, *Safety of machinery — Human body measurements — Part 2: Principles for determining the dimensions required for access openings*

EN 547-3:1996, *Safety of machinery — Human body measurements — Part 3: Anthropometric data*

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 617:2001, *Continuous handling equipment and systems — Safety and EMC requirements for the equipment for the storage of bulk materials in silos, bunkers, bins and hoppers*

EN 618:2002, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors*

EN 620:2002, *Continuous handling equipment and systems — Safety and EMC requirements for fixed belt conveyors for bulk materials*

EN 795:1996, *Protection against falls from a height — Anchor devices — Requirements and testing*

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

EN 894-1:1997, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

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

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

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 999:1998, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*

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

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 12198-1:2000, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 1: General principles*

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

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

EN 60204-32:1998, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:1998)*

EN 60335-1:2002, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN 60335-2-69:2003, *Household and similar electrical appliances — Safety — Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use (IEC 60335-2-69:2002, modified)*

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

EN 62262:1995, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)*

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 13732-1:2006)*

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

EN ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

EN ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

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

ISO 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

IEC 60364-4-41:2005, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock (IEC 60364-4- 41:2005, modified)*

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.

NOTE Schematic figures of the different types of machinery and plant are shown in Annex B.

3.1
machinery and plant for the preparation of concrete and mortar
collection of equipment including those used for storage, conveying, batching, dosing, mixing and discharging

3.2
batching plant
equipment which prepares all necessary raw materials using dosing equipment (see Figures B.3, B.9 and B.12)

3.3
mixing plant
equipment, where the necessary raw materials are mixed with or without the addition of water or additives (see Figures B.3 and B.12)

3.4
proportioning equipment
device used to proportion constituents of the mix by means of valves, gates, weighers and volumetric mechanisms (see Figure B.12, Key numbers 3, 4 and 5)

3.5
mobile mixing plant
installation which may be transported by road or may be on site and involves all the components required for mixing and batching (see Figure B.13)

3.6
mixer
machine used to prepare concrete and mortar. It may be operated intermittently or constantly

3.6.1
gravity mixer
mixer where the materials are mixed and emptied using gravity (see Figures B.1, B.2, B.14, B.15, B.16 and B.17)

3.6.2
tipping drum mixer
mixer where the mixing drum axle can tilt (see Figure B.14)

3.6.3
small mobile tipping drum mixer
mixer which can be moved from one place to another on the construction site by hand and without mechanical assistances (see Figures B.1)

3.6.4
chute discharge mixer
mixer which is emptied using a chute, preventing the need to tilt the drum (see Figure B.15)

3.6.5
reversing drum mixer
mixer which is emptied using an internal screw system and reversing the drum (see Figure B.16)

3.6.6
trough mixer
mixer which may be loaded from the top and have a single or double shaft to achieve the mixing action within a static trough. The trough may be discharged by doors in the underside or by tilting (see Figure B.17)

3.6.7
pan mixer
mixer which may have a fixed or rotating pan that is aligned in the vertical axis and which may have fixed and rotating paddles inside the pan. The mixer is loaded from above (see Figures B.12, Key number 2 and B.18)

3.6.8
through-flow mixer
mixer which may be inclined or horizontal and comprises a cylinder with an internal screw or screws which allow materials to progress through the mixer (see Figure B.23)

3.7
silo
enclosed device for storing materials. It is charged from the top and discharged from one or more outlets at the bottom or either side (see Figure B.12, Key number 8)

3.8
storage equipment
equipment used to store raw materials (e.g. sand, aggregates, cement) (see Figure B.12, Key numbers 7 and 8)

3.9
ground tipping system
hopper which may be set into the ground or supplied with a ramp in order that vehicles may tip raw material directly into it. A conveyor removes the materials from below the hopper and delivers them to subsequent processes (see Figure B.7)

3.10
materials hopper
open-topped device which stores and directs the flow of materials. It is charged from the top and discharged from one or more outlets at the bottom or either side (see Figure B.12, Key numbers 3 and 8)

3.11
conveying equipment
equipment used to transport materials from the storage area to the batching and/or mixing equipment, e.g. bucket elevator (see Figure B.3, Key number 6)

3.12
dragline scraper
aggregate collection system where a bucket is thrown by a jib crane and then drawn back scraping the raw material to the storage (see Figure B.2, Key numbers 15 and 16)

3.13
skip hoist system
involves a skip which may be filled with raw materials and is then moved using a runway and winch or tilted by hydraulic power to the mixer where the skip may be discharged (see Figure B.8)

3.14
material distribution system
mechanism to transport aggregates from the ground tipping system to the storage to the mixing area (see Figure B.10)

3.15
scraper
power operated machine used for loosening, collecting and conveying gravel, sand, pumice and similar material. Operation is manually or automatically sequenced (see Figure B.3, Key number 6)

3.16
discharge system
device to remove the contents of the mixer

3.17
concrete and mortar
homogeneous blends of raw material, cement, water and optional additives

3.18
additives
materials which may be added to the concrete or mortar to modify appearance or working characteristics

3.19
waste concrete reprocessing plant
plant which permits the separation of raw material from water and cement to allow their reuse (see Figures B.20, B.21 and B.22)

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 document, 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	EN 12151
4.1	Mechanical hazards (according to EN ISO 12100-1:2003, 4.2)		
4.1.1	Crushing	Access to drive pinions Access between mixer body and lid when lid is open Access to fixed and moving parts of mixer plant	5.1.3, 5.1.4, 5.1.8, 5.2.3.1, 5.2.3.2, 5.2.3.3, 5.2.3.4, 5.2.3.5, 5.2.3.6, 5.2.3.7, 5.2.4.1, 5.2.4.2, 5.2.5.1, 5.2.5.2, 5.2.5.3, 5.2.6.3, 5.2.6.4, 5.2.6.5, 5.2.7.5, 5.2.8, 5.2.10.1, 5.2.10.2, 5.2.10.5
4.1.2	Shearing	Access to the fixed and moving parts inside the mixer from either the inlet, discharge or any other access position Access to the inside of the mixer for making additions or for sampling Access to fixed and moving parts external to the mixer Access to the fixed chassis through the wheel of the drum tilting mechanism	5.1.3, 5.1.4, 5.1.9, 5.2.2.4, 5.2.3.1, 5.2.3.2, 5.2.3.5, 5.2.5.1, 5.2.6.2, 5.2.6.4, 5.2.7.1, 5.2.7.4, 5.2.7.5, 5.2.10.1, 5.2.10.2, 5.2.10.5
4.1.3	Cutting and severing	Cutting and severing action of the discharge door and fixed parts	5.1.3, 5.1.4, 5.1.9, 5.2.2.1, 5.2.5.1
4.1.4	Entanglement	Access to external moving drive units	5.1.3, 5.1.4, 5.1.9, 5.2.7.1, 5.2.7.4, 5.2.10.1
4.1.5	Drawing-in or trapping hazard	Access to drive pinions Access to all rotating parts where the risk of drawing-in is given Access to protruding parts on rotating mixer body Access to the in running nips of V-Belt drives or chain sprocket drives	5.1.3, 5.1.4, 5.1.9, 5.2.2.1, 5.2.2.2, 5.2.2.3, 5.2.2.4, 5.2.3.1, 5.2.3.3, 5.2.3.4, 5.2.5.2, 5.2.5.3, 5.2.6.1, 5.2.6.4, 5.2.7.1, 5.2.7.2, 5.2.7.3, 5.2.7.4, 5.2.7.5, 5.2.9, 5.2.10.1

Table 1 (*continued*)

	Hazards	Locations/circumstances/consequences	EN 12151
4.1.6	Impact	Access to protruding parts on the outside of the rotating mixer body Access to the discharge doors Access to the inside of the mixer to make additions or for sampling	5.1.3, 5.1.4, 5.1.9, 5.2.2.1, 5.2.5.1, 5.2.6.4, 5.2.7.5
4.1.7	Friction or abrasion	Access to mixer drive shafts or power take off units	5.1.3, 5.1.4, 5.1.9
4.1.8	High pressure fluid ejection	Access to hydraulic systems	5.1.1
4.1.9	Ejection of parts or material	Proximity to hoppers fed with materials	5.2.7.5
4.1.10	Loss of stability	Instability of mixer and/or equipment	5.2.2.5, 5.2.5.4, 5.2.10.4
4.1.11	Slips, trips and falls	Access to areas where slips, trips and falls are possible	5.2.4.1, 5.2.4.2, 5.2.4.3, 5.2.7.6, 5.2.8, 5.2.10.3, 5.2.10.5
4.2	Electrical hazards (according to EN ISO 12001-1:2003, 4.3)	Electrocution, electric shocks or burns	5.1.2, 5.2.2.1, 5.2.2.5, 5.2.3.8, 5.2.9
4.3	Thermal hazards (according to EN ISO 12100-1:2003, 4.4)	Steam ejection Access to hot machinery parts (e.g. combustion engine, exhaust pipe)	5.1.5
4.4	Hazardous generated by noise (according to EN ISO 12100-1:2003, 4.5)	Hearing loss and other physiological damage. Impaired oral communication and perception of warning signals	5.1.6
4.5	Hazardous generated by vibration (according to EN ISO 12100-1:2003, 4.6)	Blood circulation disorder due to the use of vibratory equipment	Not relevant for this type of machines
4.6	Hazards generated by radiation (according to EN ISO 12100-1:2003, 4.7)	Level gauges and other radiation instrumentation Radiation anti static devices	5.2.7.5
4.7	Hazards generated by material and substances processed, used or exhausted by machinery (according to EN ISO 12100-1:2003, 4.8)	Contact, inhalation or ingestion of harmful fluids, gases, fumes, dusts or aerosols, including use in an enclosed space Inhalation of exhaust gases	Not applicable
4.8	Hazards generated by neglecting ergonomic principles in machine design (according to EN ISO 12100-1:2003, 4.9)	Personnel injury due to poor design of ergonomic principles Working environment - comfort of the working station: temperature, lighting, postures, ventilation etc.	5.1.7, 5.2.3.8
4.9	Failure of electrical installation and control systems	Power supply failure	5.1.2, 5.1.9, 5.2.7.5
4.10	Hazards generated by fire	Burns and fire	5.1.10
4.11	Hazards caused by assembly/disassembly	Loss of stability	5.1.11
4.12	Hazards caused by EMC	Unexpected malfunctions	5.1.12