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

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National foreword

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Maschinen und Anlagen zur Bereitung von Beton und Mörtel - Sicherheitsanforderungen

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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of an identical text or by endorsement, at the latest by May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.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

5 Safety requirements and/or protective measures

5.1 Common requirements for all groups of machines

5.1.1 High pressure fluid injection hazard from hydraulic or pneumatic systems

The systems and their components of the equipment shall fulfil the requirements of EN 982:1996 and EN 983:1996.

5.1.2 Electrical hazards

The equipment shall fulfil the requirements of EN 60204-1:2006.

Machinery and plant for the preparation of concrete and mortar using low voltage equipment (not exceeding 1 kV a.c. or 1,5 kV d.c.), shall comply with EN 60204-1:2006.

5.1.3 Main switches and control panels

5.1.3.1 Main switches

Mixing plant shall be equipped with a switch according to 5.3 of EN 60204-1:2006.

In addition to the main switch which is lockable with a lock or a key, the plant shall be equipped with additional lockable switches for the following parts of the plant, if applicable one for the mixer and positioned at the mixer area;

— one for the skip hoist system and positioned at its electrical equipment;

— one for the distribution chute and positioned at the chute area;

— one for the scraper and positioned at its electrical equipment;

— one for the remaining equipment and positioned at the control panel.

5.1.3.2 Control stand/panels

If a mixing plant has different control panels each of these panels shall be according to 9.2.7.5 of EN 60204-1:2006.

Each of the following parts of a plant shall be equipped with a switch for stop and protection for unintended start according to 5.3 and 5.4 of EN 60204-1:2006:

— each of the mixers;

— each of the skip hoist systems;

— scraper;

— conveyor transporting the aggregates to the silos;

— equipment for discharging and distribution the aggregates and cement.

The control stand shall be designed to ergonomic principles as defined in EN 614-1:2006.

The operator shall have good visibility to the discharge area.

5.1.4 Emergency stop

Mixing plants shall be provided with emergency stop(s) based on the risk assessment at each level.

The emergency stop shall be in accordance with EN ISO 13850:2006. The emergency stop shall be good accessible and shall stop all relevant hazardous functions of the machine.

5.1.5 Thermal hazard

Where the risk of contact with hot surfaces of parts of the equipment is given the following measures shall be taken:

— temperatures of hot surfaces shall be limited to the value according to EN ISO 13732-1:2006;

— if this is not possible, contact with high temperature surfaces shall be prevented by protections (e.g. by screens of fixed distance guards).

5.1.6 Hazard generated by noise

5.1.6.1 Noise reduction at source at the design stage

Main noise sources are the mixers and the conveying, batching, dosing and discharging equipment and the main drive which can be diesel driven or electrically driven.

When designing the machine, the available information and technical measures to control noise at source at the design stage shall be taken into account, in particular EN ISO 11688-1:1998.

NOTE EN ISO 11688-2:2000 gives useful information on noise generation mechanisms in machinery.

Noise reduction is possible e.g. with the choice of low-noise components, reduction of vibration transmitted from drive to other parts of construction and design of the construction that prevents the arising of resonance.

5.1.6.2 Noise reduction by protective devices

If noise reduction at the source is not sufficient, noise can be reduced for example by encapsulation of single parts, e.g. drive, conveying system, loading system, or the whole machinery.

5.1.6.3 Noise reduction by information

Information on residual risk after technical measures to control noise emission have been implemented shall be given by the manufacturer, see Clause 7.

5.1.7 Ergonomic design

Ergonomic design for handling shall be designed in accordance with the requirements of EN 614-1:2006, EN 894-1:1997 and EN 894-2:1997.

5.1.8 Weather conditions

Weather conditions shall be taken into account in the design of the machinery or plant in order to reduce the risk of hazard and health. Plant design and the conditions of use shall minimize the exposure of personnel to bad weather conditions.

5.1.9 Permanent means of access

Permanent means of access shall comply with EN ISO 14122-1:2001, EN ISO 14122-2:2001, EN ISO 14122-3:2001.

5.1.10 Fire protection

On operator's places where flammable materials are used, the burning rate shall not exceed 200 mm/min, tested in accordance with ISO 3795:1889.

On mixing plants provisions shall be made for the installation of fire protection devices.

5.1.11 Assembly

Mixing plants shall be designed so that safe and easy assembly/disassembly is possible.

Instruction shall be provided in the information for use.

5.1.12 Electrical Magnetic Compatibility (EMC) of machines

The electrical equipment of machinery and plants shall comply with EN 13309:2000.

5.1.13 Further requirements

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

The machine shall be designed according to the principles of EN ISO 12100-1:2003 and EN ISO 12100-2:2003 for hazards relevant but not significant which are not dealt with by this document (e.g. sharp edges).

For the application of EN 294:1992, EN 349:1993, EN 547-1:1996, EN 547-2:1996, EN 547-3:1996, EN 574:1996, EN 614-1:2006, EN 617:2001, EN 618:2002, EN 620:2002, EN 795:1996, EN 953:1997, EN 954-1:1996, EN 982:1996, EN 983:1996, EN 999:1998, EN 1050:1996, EN 1088:1995, EN 60204-1:2006, EN 60335-1:2002, EN 60335-2-69:2003, EN 60529:1991, EN 62262:1995, EN ISO 12100-1:2003, EN ISO 13732-1:2006, EN ISO 13850:2006, EN ISO 14122-1:2001, EN ISO 14122-2:2001, EN ISO 14122-3:2001, the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary.

NOTE This specific risk assessment is part of the general risk assessment relating to the hazards not covered by this C standard.

5.2 Specific requirements relating to different types of machines

5.2.1 General

This part of the standard is organized by machinery type/machinery group(s).

Machinery Group:

5.2.2 Small mobile tipping drum mixers for domestic and industrial use (see Annex B)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.2.1 **Electrical motor and combustion engine**	Mechanical	Drawing–in or trapping — from drive belt; — from cooling fan belt	4.2.1	A fixed guard shall be fitted, according to EN 953:1997.
		Impact from rotating fan blade	4.2.1	A fixed guard shall be fitted, according to EN 953:1997.
		Cutting and severing from motor housing or door falling	4.2.1	The motor housing or door shall be secured in the open position and prevented from unintentional closing by a positive locking latch, except where it is hinged to open in a downwards direction.
	Electrical	Electric shock or burns	4.3	Protection against indirect contact. Mixers shall be protected in accordance with EN 60204-1:2006. The mechanical resist shall comply with IP 44 of EN 62262:1995. Mixers below 0,9 kW absorbed motor rating shall be protected with class II equipment (double insulation), according to EN 60204-1:2006, according to EN 60335-1:2002 and for the mechanical strength according to EN 60335-2-69:2003 chapter 21.101 or with a safety low voltage system powered by a transformer with safety low voltage. These mixers shall be permanently identified by the symbol "protective insulation" according to ISO 7000:2004. An easily detectable indication plate good legible and indelible shall be fixed on the exterior enclosure of the mixer; it shall read as follows: "Disconnect electrical power supply before opening the enclosure. Operation is permitted only if the enclosure is fully closed". The following indication shall be given permanently and indelible on the interior of a class II mixer and in the corresponding operation instructions: "Warning! Class II equipment. To ensure adequate protection, use original insulation material for repair and maintain insulation distances." Class II mixers shall at least afford the degree of protection IP 44 in accordance with EN 60529:1991.
	Exhausted gases	Inhalation		The exhaust pipe shall not be directed towards the operator's place.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.2.2 **Drive pinions**	Mechanical	Drawing-in or trapping from the junction of the drive pinions;	4.2.1	Gaps between drive pinions and the crown wheel of the drum shall be covered. Fixed guards shall be fitted in accordance with EN 953:1997.
5.2.2.3 **Drum**	Mechanical	Drawing-in or trapping access to blades on the rotating drums interior	4.2.1	NOTE As this type of machinery is designed to be filled while rotating, the present state of the art does not generally permit a fixed guard. Small mobile tipping-type mixers be filled while rotation. Warning signs shall be fixed to the machine and instruction shall be given to ensure that a safety distance is given while filling and discharging. Where a guard-system is fitted the principles of EN 953:1997 and EN 1088:1995 shall apply.
		due to the outside surface of the rotation drum		The external surfaces of the drum shall be free from any projections which cause trapping.
5.2.2.4 **Tilting mechanism**	Mechanical	Shearing (hand shearing) between the chassis and the tilting framework	4.2.1	NOTE With the current state of the art, it is not possible to prevent this hazard by guards. To minimize the risk, the distance between chassis and tilting framework shall not be less than 2,5 cm in accordance with Table 1 of EN 349:1993 for fingers. The tipping mechanism shall be so designed that the operation requires the use of both hands. The force needed to tilt the filled drum shall require both hands at the tipping mechanism. If the tipping mechanism is power-operated, the operator shall be protected against contact with moving hazardous parts. A two-hand control device shall be used. If a hold-to-run device is used a sufficient distance to moving hazardous parts shall be provided based on the principles of EN 294:1992.
		Drawing- in or trapping between the tilting framework and the rotating drum	4.2.1	To minimize the risk of trapping the distance between the tilting framework and the rotating drum shall not be less than 2,5 cm in accordance with EN 349:1993 for fingers.
		Drawing- in or trapping between the tilting framework and the drum mounting boss	4.2.1	The minimum gap between the mounting boss and the tilting framework shall not be less than 2,5 cm in accordance with EN 349:1993 for fingers. In addition, the trapping hazard shall be minimized by removing the protruding parts.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.2.5 **Whole machine**	Mechanical	Loss of stability From machine falling over	4.2.1	Small mobile tipping drum mixers shall not tip-over when tested in accordance with the following procedure: The power-supply shall be shut-off and the mixer shall be places on a test surface with the tipping line as defined in Figures A.3.1 and A.3.2 perpendicular to the inclining surface. The inclining angle shall be 10°. The drum is filled with water up to the maximum mixing capacity and the opening of the drum is adjusted upwards in the direction of the vertical axis of the mixer. The mixer shall not tip-over. A warning sign shall be permanently and indelible affixed to the machine which advises the user to place the machine on a solid, stable and even ground.
	Electrical	Electric shock		A warning sign shall be permanently and indelible affixed to the mobile machine to advice the user of the correct connection to the electrical power supply: "Do not connect to household socket! Use only with an RCD (residual current device) protected supply." Also instructions shall be included in the information for use.

Machinery Group:

5.2.3 All other mixers, e.g. tipping drum mixers (stationary), trough-, pan-, through-flow mixers (see Annex B)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.3.1 **Mixing vessel**	Mechanical	Crushing and shearing Between turning mixing blades and — mixing vessel or — mixing tube	4.2.1	Filling and discharge openings For all mixers where the risk of reaching the filling and discharge openings with the upper limbs is given, see EN 294:1992, Table 4, guard, which comply EN 953:1997, shall be fitted. If the grille-bar clearance specified in EN 294:1992 is too narrow for the material concerned, e.g. due to wet or coarse-grained material, the grille-bar clearance can be increased. The mesh width shall be at maximum 60 mm and the distance between grille-bar and crushing point shall be at least 120 mm. When access to a hopper is provided without using tools, the access shall be protected by an interlocking device which meets the requirements of EN 1088:1995. Coverings The access to the rotating agitating blades shall not be possible. Enclosures which can be opened and where the risk of crushing or shearing is given shall be fitted with an interlocking device which automatically stops any hazardous movement of components inside the enclosure before the enclosure is accessible. The interlocking device shall meet the requirements of EN 1088:1995, 4.1.2. Coverings shall meet the requirements of EN 953:1997 considering EN 294:1992. Deviating from this for mobile mixers automatic control interlocking may be used, according to EN 1088:1995, 4.1.1. Where once a day or more often access is needed via tool-operated openings, power-interlocking systems shall be required in any case, according to EN 1088:1995.
		— between covering an mixing vessel		In addition, coverings which are folded up shall be arranged or equipped in such a way that in the open position they cannot close unintentionally.
		Drawing in because of the closing movement of the power-operated coverings	4.2.1	Gear transmissions (pinion, gear and rim) of mixer vessels shall be completely covered. Access openings shall comply with the requirements defined above.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
			4.2.1	Controls for the opening and closing of enclosures should be of a hold-to-run type or two-hand controlled. The controls shall meet the requirements of EN 574:1996 and 9.2 of EN 60204-1:2006. All hazardous movement inside the enclosure shall be stopped soon after control activation and before access is possible. The controls shall be so located that reaching of the covers whiles opening or moving parts is not possible. Reaching criteria shall be according to EN 294:1992, EN 811:1996 and EN 999:1998.
		Drawing-in because of turning mixing blades	4.2.1	For all mixers the filling openings and feeding containers shall be guarded by grids in accordance with EN 953:1997 and the openings with Table 4 of EN 294:1992. For all mixers with the exception of through-flow mixers, the outlet openings shall be a) guarded by a vertical hopper and at the bottom of these shall be installed a grid as follows: The maximum mesh width shall be 70 mm (resp. 40 mm) when distance between grid and crushing points are at least 150 mm (resp. 120 mm). Interpolations are possible, or b) access to this place shall be avoided. The outlet openings of through-flow mixers shall be c) safeguarded by a hopper. The maximum opening width shall be 85 mm (resp. 95 mm) and the distance from the outlet to the rotating parts shall be at least 120 mm (resp. 150 mm). The outlet opening shall be directed vertically downward (see Figure B.23). The distance from the outlet of the hopper to the ground shall not exceed 900 mm, or d) access to this place shall be avoided. The following warning sign shall be affixed clearly recognizable and of permanent nature near the outlet opening: "Do not reach into the outlet opening." NOTE 1 The reasons for non-compliance with EN 294:1992 distance criteria is because if the mesh size allows compliance, the materials will not pass through the discharge opening. NOTE 2 The values are the result of experience, testing and agreement. Inspection openings for mixers Maintenance and inspection openings shall be guarded whiles operation guards shall meet the requirements of EN 953:1997 considering the safety distances and openings as defined in EN 294:1992.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
				Access to maintenance and inspection areas and openings shall only be possible when all hazardous movements are stopped. Guards shall be fitted with interlocking devices meeting the requirements of EN 1088:1995, considering that the access is only possible after the stop. For maintenance work, where the movement, e.g. of mixer blade and/or pan, into a defined position is required, and the movement force exceeds 0,25 kN, a separate hold-to-run control is accepted; if it is ensured that a slow, stepwise movement up to 10° per control-impulse is only be possible or a two-hand hold-to-run control, which will stop the moving within 20°, if one hand is leaving the switch. It shall have a self-acting reset and it shall be lockable. The control actuating device shall be fixed in such a way that: — it cannot be operated from operating position of the mixer vessel and — mixer blades can be seen during operation. Access openings and maintenance guards shall be arranged and affixed in the open position, so that they cannot be closed unintentionally (and be locked). Clear recognizable warning signs of a permanent nature shall be attached in front of maintenance work. They shall explain the drawing-in dangers and the precautions to be adopted. These signs shall also be attached next to the control device if it is not readable from the openings.
5.2.3.2 **Discharge system**	Mechanical	Crushing and shearing access to powered discharge door mechanism	4.2.1	The discharge chute shall be enclosed and of sufficient depth to prevent access to the powered door mechanism, according to Tables 2, 4 and 6 of EN 294:1992.
5.2.3.3 **Rotating mixing vessel**	Mechanical	Crushing and drawing-in between rotating mixing vessel and metal frame	4.2.1	There shall be a power-interlocking guard around the whole vessel according to EN 1088:1995. Where the risk of drawing-in or crushing between the rotating mixer vessel and metal frame of the structure is given, the distance between the frame and other fixing components and the rotating vessel shall be in accordance with Table 4 of EN 294:1992. If this distance is not possible or where there are projections on the outside of the vessel, a guard in compliance with EN 953:1997 and EN 294:1992 to meet the openings according to Table 4 of EN 294:1992 shall be fitted with a power locking device which meets the requirements of EN 1088:1995.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.3.4 **Slewable mixer blades**	Mechanical	Crushing between moveable covering and mixing vessels and drawing in from turning mixer blade	4.2.1	Where the risk of crushing or drawing in is given when the mixer blades are slewed or lowered into the mixing vessel the open area of the vessel shall be guarded meeting the requirements of EN 953:1997 and EN 1088:1995. Start up of movements of the covering shall only be possible during operator's visibility or by monitoring. The minimum requirement to the interlocking device shall be Category 2 of EN 954-1:1996.
5.2.3.5 **Mixing vessel transport track**	Mechanical	Crushing and shearing between moving vessels and metal frame	4.2.1	The tracks of feeding mixing vessels shall be secured with fencing to ensure that reaching the hazardous area is not possible. Openings shall comply with EN 294:1992, Tables 3 and 4. Fencing shall have at least one access. The access shall be secured with an interlocking device in accordance with EN 1088:1995. The minimum requirement to the interlocking device is Category 2 of EN 954-1:1996.
5.2.3.6 **Mixing vessel**	Mechanical	Crushing from free moving vessels	4.2.1	The vessel shall be mechanically secured (e.g. by the insertion of a pin) against free movement during maintenance.
5.2.3.7 **Winch system of climbing mixer**	Mechanical	Crushing — mixer falling due to disconnecting power supply;	4.2.1	The winch system shall be fitted with brakes which can be released by controls and automatically applied when the operator stops control actuation or when the power source fails.
	Functional disorders	— from breakage of winch rope;		The winch shall be provided with: — rope breakage detection device; the device shall incorporate a slack rope switch, which shall interrupt all movements of the mixer until corrective action has been taken by a competent person. After activation of the device, movement of the mixer shall be prevented by a mechanical means and the electrical power supply shall be stopped immediately according to a Category 0 stop function given in EN 60204-32:1998, 9.2.2. — limit devices controlling movement at each end of mixer transport. At the top-end position two mechanically-actuated position switches shall be incorporated.
		— from mixer leaving guide rails		The guides shall be arranged in such a way that mixing vessels are prevented from leaving the rail (e.g. during maintenance work) by a mechanical means independent of the means to be used for transportation (e.g. by the insertion of pins).

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.3.8 **Whole machine**	Electrical	Electric shock	4.3	No permanent electrical equipment shall be fitted inside the mixer unless it is safe voltage according to IEC 60364-4-41:2005. A warning sign shall be permanently and indelible affixed to the mobile machine to advice the user of the correct connection to the electrical power supply: "Do not connect to household socket! Use only with an RCD protected supply." Also instructions shall be included in the information for use.
	Ergonomic	Personal injury due to poor design of the maintenance openings		Access openings for maintenance work shall comply with the requirements as defined in EN 547-1:1996, EN 547-2:1996 and EN 547-3:1996. In case of access to areas where the risk of hazardous movement of the machine or parts of the machine is given, access openings shall be provided with an interlock-device which stops any hazardous movements. The device shall be secured against unintentional start-up, e.g. in case of unauthorized closing of the access opening. Restart shall only be possible by a reset action of the maintenance personal.

Machinery Group:

5.2.4 Ground tipping systems (see Annex B)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.4.1 **Tipping ramp**	Mechanical	Crushing — by vehicle falling off the ramp; — from the vehicle falling into the hopper	4.2.1	On the lateral edges of the ramp a barrier or low wall shall be provided at a height of minimum 30 cm. The tipping hopper shall be covered with a grid (see Figure B.7), strong enough to carry a fully loaded vehicle within the passable zone. If the grid is not strong enough to carry the fully loaded vehicle, there shall be a barrier or low wall at the hopper end of the ramp with a minimum height of 30 cm. An instruction shall be given to prevent the ramp effect from the spilt material and the ramp barrier shall always be free from spilt material, see 7.1.4. The wall can be moved in board of the hopper, when the grids or rods between the side of the hopper and the wall are strong enough to support the loaded vehicle.
		Slips, trips and falls from an individual falling over the edge of the ramp	4.2.3	The ramp shall be sufficiently wide enough to allow an adequate walkway on either side when the vehicle is in position. The walkways of the ramp shall be provided with guard rails if the falling height from the ramp to the ground is greater than 1 m. The guard rail height shall be 1 m.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.4.2 **Tipping hopper**	Mechanical	Crushing Ejection of aggregates over the back of the hopper which could engulf personnel	4.2.1	Protection to prevent aggregates dropping over the back of the hopper. The maximum capacity of the hopper shall be mentioned in the instruction handbook, see Clause 7.
		Slips, trips and falls from an individual falling into the hopper or slipping on the grid or rods	4.2.3	The tipping hopper shall be a) covered by a grid or rods. They shall be of a size to suit the materials being used. In any event, the gap between the rods shall not be wider than 10 cm. The covers shall not be used for regular pedestrian means of access and shall be completely fenced (see Figure B.8). The area shall be marked by warning signs. For the vehicle access removable fences are necessary in that area. A warning signal shall indicate the open fence. The vehicle access shall be immediately closed after the vehicle has left. If the height of the top of the hopper is more than 1,4 m above the ground level a grid is not necessary, or b) access to the tipping hopper shall be avoided.
5.2.4.3 **Aggregate conveying equipment**	Mechanical	Slips, trips and falls by an individual falling during maintenance and operation of the conveyor	4.2.3	For maintenance of the conveyor belts adequate access shall be provided. Walkways shall be in accordance with EN 620:2002, 5.1.6.2. For bucket elevators, stairs shall be provided and designed to meet the principle requirements as defined in EN ISO 14122-3:2001.

Machinery Group:

5.2.5 Radial scrapers and radius lift arms (see Figures B.2 to B.6)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.5.1 **Radial scrapers**	As defined in EN 618:2002, Annex A	— as defined in EN 618:2002, Annex A	4.2.1	The radial scrapers shall comply with EN 618:2002.
		— between two swivelling arms		The minimum distance between the arms shall be 0,5 m, according to EN 349:1993.
5.2.5.2 **Dragline**	Functional disorders	Crushing from breakage of winch cables		For controlling dragline operation the winch system shall comply with state-of-the-art technology.
5.2.5.3 **Radius lift arm with buckets**	Mechanical	Crushing between the bucket and the material recovery plate	4.2.1	The access to the hazardous area shall be protected by guards according to EN 953:1997. Emergency stop equipment shall be installed on both sides of the conveyor (e.g. pull cord system) according to EN 618:2002, 5.11.2.7.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
		Drawing-in or trapping — from rotating shafts at head, tail and intermediate pulleys; — from the moving bucket; — between chain and pulleys	4.2.1	A fixed guard of at least 1 m shall be a) provided to cover the buckets at the tail pulleys according to EN 294:1992 (see Figure B.6, Key number 4). Fixed guarding of the conveyor head, intermediate and tail pulleys shall be fitted according to EN 953:1997. The danger area of the radius lift arm shall be completely surrounded with mobile posts and a steel chain according to EN 14122-3:2001 (see Figures B.4, B.5 and B.6) to prevent unintentional access by persons, or b) access to radius lift arm with buckets shall be avoided. A warning sign shall be permanently and indelible affixed to the mobile parts/chain to warn of unintentional access to the danger area.
5.2.5.4 **Jib**	Mechanical	Loss of stability — due to strong wind	4.2.2	Provisions shall be made to lower the jib (see Figure B.2, Key number 16) to the ground according to EN 618:2002, 5.1.6.

Machinery Group:

5.2.6 Skip hoist system (see Figure B.8)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.6.1 **Aggregate supply**	Mechanical	Drawing-in or trapping from screen drive system	4.2.1	Fixed guards shall be fitted to the supply drive system according to EN 953:1997. Maintenance openings shall meet the requirements as defined in EN 294:1992, Table 4.
5.2.6.2 **Aggregate dosing system**	Mechanical	Shearing between weighing system and support framework	4.2.1	Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
5.2.6.3 **Aggregate conveying**	Mechanical	Crushing — between skip or skip carrier and framework while hoist is operating; — from skip moving to its charging position	4.2.1	Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required. An interlocked access guard shall be fitted to allow materials to be added by hand only when the skip is in its charging position, according to EN 1088:1995.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.6.4 **Skip hoist**	Mechanical	Drawing-in or trapping from the hoist winding gear system	4.2.1	Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings.
		Shearing between skip or skip carriage and edge or pit	4.2.1	Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		Crushing — between skip or skip carrier system and guide rails;	4.2.1	Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		— between skip or skip carrier system and base of pit;		Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		— between skip or skip carrier system and framework during discharging;		Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		— between skip door gear and skip during actuation of the door		Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		Impact — from skip carrier during discharge operation;	4.2.1	Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.
		— from skip or skip carrier systems during transport at any access point		Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.6.5 **Winch system**	Electrical Functional disorders	Crushing — skip falling due to disconnecting power supply; — from breakage of winch cable;	4.3	The winch system shall be fitted with brakes which can be released by controls and automatically applied when the operator stops control actuation or when the power source fails. The winch shall be provided with: — rope breakage detection device; the device shall incorporate a slack rope switch, which shall interrupt all movements of the skip until corrective action has been taken by a competent person. After activation of the device, movement of the skip shall be prevented by a mechanical means and the electrical power supply shall be stopped immediately according to a Category 0 stop function given in EN 60204-32:1998, 9.2.2. — limit devices controlling movement at each end of skip transport. At the top-end position two mechanically-actuated position switches shall be incorporated.
		— from skip moving or dropping during maintenance work		A provision shall ensure that the skip is mechanically secured against movement or dropping during maintenance work (e.g. by the insertion of pin(s)). Instruction shall be given in the information for use.

Machinery Group:

5.2.7 Dosing equipment (see Figure B.9 in Annex B)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.7.1 **Aggregate feed system**	Mechanical	Drawing-in trapping — from feed drive system; — from conveyor nip points on head, tail and tensioning pulleys; NOTE Possibility of reversing generates further risk. — Between skip and conveyor	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided. Fixed guards as defined in 5.2.6.2 shall be provided. Fixed guards as defined in 5.2.6.2 shall be provided.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
		Shearing between screw and body at inlet, outlet and inspection points where aggregates are fed directly to the skip	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided.
		Entanglement from exposed end of screw shaft	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided.
5.2.7.2 **Aggregate feed conveyors**	Mechanical	Drawing-in or trapping — between head pulley and conveyor belt;	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided.
		— from drive system		Fixed guards as defined in 5.2.6.2 shall be provided.
5.2.7.3 **Moisture assessment system**	Mechanical	Drawing-in or trapping from rotating parts on the cleaning system	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided.
5.2.7.4 **Cement screw**	Mechanical	Drawing-in or trapping/shearing — between screw and casing;	4.2.1	The screw, its outlet and the receiving vessel shall be totally enclosed by fixed guards. Access shall only be possible when all hazardous movements are stopped.
		— from drive system		Fixed guards as defined in 5.2.6.2 shall be provided.
		Entanglement from exposed end of screw shaft	4.2.1	Fixed guards as defined in 5.2.6.2 shall be provided.
5.2.7.5 **Materials hopper**	Mechanical	drawing-in or trapping/impact between fixed and moving parts of outlet gates	4.2.1	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992 around the moving parts. Manual control devices shall be positioned outside the enclosure. The design shall ensure that in case of loss of power supply the outlet gate closes automatically, when it is operated by electrical or pneumatic power. The system shall comply with EN 954-1:1996.
		— from counterweight rising or falling	4.9	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992 to enclose the counterweighted supported hopper system at the proportioning hopper during moving.
		Shearing — between gate and hopper edge;	4.2.1	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992 to prevent access.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
		— between moving hoppers and framework		A fixed guard shall be fitted to prevent access to hoppers while filling or emptying (counterweighted supported hoppers only), according to EN 953:1997 and according to EN 294:1992, Table 4. Where access is required, the access opening shall be fitted with an interlocking device according to EN 1088:1995.
		Crushing between fixed and moving parts of hoppers and their support structures	4.2.1	A fixed guard shall be fitted or the gaps between fixed and moving parts shall be large enough to prevent injury (counterweighted supported hoppers only) according to EN 953:1997 and EN 294:1992, Tables 3, 4 and 6. Where access is required, the access opening shall be fitted with an interlocking device according to EN 1088:1995.
	Radiation	Exposure to ionising radiation from moisture measurement or level sensing systems	4.7	Ionising radiation sources for measurement of moisture or level sensing shall be shielded according to EN 12198-1:2000 to avoid radiation during operation and maintenance.
5.2.7.6 **Proportioning equipment**	Mechanical	Slips, trips and falls from high levels	4.2.3	Working platforms and gangways and access systems around the proportioning hoppers shall comply with EN ISO 14122-1:2001, EN ISO 14122-2:2001, EN ISO 14122-3:2001.

Machinery Group:

5.2.8 Aggregate distribution chute (see Figure B.10)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
Distribution system	Mechanical	Slips, trips and falls falling into the cells	4.2.3	Stairs, platforms and walkways shall be installed for maintenance, where maintenance is necessary twice a year or more often according to EN ISO 14122-2:2001. An anchor point for personal protective equipment (PPE) according to EN 361:2002, together with an automatic locking tether system according to EN 360:2002 and EN 363:2002 shall be provided above each cell which can be reached from the walkways described above. Entrance in the cells shall only be possible with using PPE. The anchor point shall be suitably constructed, according to EN 795:1996. The access into silos for maintenance shall be suitably protected according to EN 617:2001, 5.1.4.2. Special instruction shall be made in the information for use.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
		Crushing between moving parts of the distribution system and the fixed parts	4.2.1	The access to the walkway for servicing the distribution system shall be equipped with a guard and a locking device which inhibit the movement of the conveyor or distribution chute. Fixed guards according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4, for maintenance openings. Where access is required, the access opening shall be fitted with an interlocking device in accordance with EN 1088:1995 which stops all hazardous movement. An automatic start-up shall not be possible, when closing the access opening. A reset function is required.

Machinery Group:

5.2.9 Mobile mixing plant (see figure B.13 in Annex B)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
Installation	Electrical	Electrocution, shock, burns	4.3	All electrical panels shall be capable of being locked in the closed position and being protected from unauthorised operation.
	Combined hazards	Drawing-in or trapping by conveyors drive	4.10	Emergency stop device(s) shall be fitted to each control panel(s), at the mixer and the conveyor according to EN ISO 12100-2:2003, 5.5.2 and EN ISO 13850:2006.

Machinery Group:

5.2.10 Waste concrete reprocessing plant (see Figures B.20, B.21 and B.22)

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
5.2.10.1 **Washing drum**	Mechanical	Crushing and shearing between the ground and hydraulically operated loading chute	4.2.1	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4 or the controls operating the loading chute shall be located in this way, that unintentional contact to the moving part is avoided either by a two-hand hold-to-run control or by meeting requirements of EN 294:1992. The operator shall have good visibility to the operating process.

Machinery part	Hazard Group	Hazard	Reference EN ISO 12100-1:2003	Safety measures
		Drawing-in or trapping between rotating drum and — drive or idler rollers; — framework	4.2.1	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4.
		Entanglement from the rotating drum at loading and discharge points	4.2.1	The opening shall be guarded according to EN 953:1997 and according to EN 294:1992, Tables 3, 4 and 6. The access openings to the interior of the drum shall be prevented with a locking device in accordance with EN 1088:1995.
5.2.10.2 **Buffer stock area**	Mechanical	Crushing and shearing from the feed screw	4.2.1	A fixed guard according to EN 953:1997 shall be fitted according to EN 294:1992, Table 4.
5.2.10.3 **Underground buffer stock area**	Mechanical	Slips, trips and falls in the covering grid	4.2.3	The grid or rods shall be of a size to suit the materials being used. In any event, the gap between the rods shall not be wider than 10 cm. The covers shall not be used for regular pedestrian means of access and shall be fenced. For the vehicle access removable fences are necessary. Instruction shall be given in the information for use that unauthorized access shall be avoided. Warning signs shall be at the fences to prevent unauthorized access.
5.2.10.4 **Covering of underground processing equipment**	Mechanical	Loss of stability from a vehicle driving into the area	4.2.2	The area shall be covered with a grid which is strong enough to carry the fully loaded vehicle. The grid does not need to be strong enough to carry the fully loaded vehicle, if the vehicle is prevented from driving on the grid, e.g. walls, barriers.
5.2.10.5 **Mixer basin**	Mechanical	Slips, trips and falls and Crushing and shearing	4.2.3 4.2.1	Guard-rails in accordance with EN ISO 14122-2:2001 shall be installed for protecting against falling into the mixer basin or reaching crushing and shearing points inside the basin.
	Mechanical	Crushing and shearing	4.3	Separate main switches for the operation of the mixer basin, the washing drum and the washing screw according to EN 60204-1:2006 shall be installed.

6 Verification of safety requirements and/or protective measures

It is necessary to verify that the requirements of this standard have been incorporated in the design and manufacture of machinery and plants of concrete and mortar. Either one or a combination of the following shall achieve this:

a) measurement;

The effectiveness of noise control measures implemented at the design stage shall be verified by measurement made according to Annex C.

b) visual examination;

c) as appropriate, test where a method is prescribed in the standard referred to in any particular requirement;

d) by assessment of the contents of the documentation required to be kept by manufacturer, e.g. evidence of bought-in components, have been manufactured to the required standards.

Verification of the requirements defined in Clause 5 can be made by means of inspection, calculation or testing. These shall be applied to the machine in fully commissioned condition but partial dismantling may be necessary for some checks. Such partial dismantling shall not invalidate the result of the verification.

All safety measures of Clause 5 contain self-evident criteria of acceptance.

7 Information for use

7.1 Instruction handbook

7.1.1 General

The written instructions shall be drawn up according to 5.5 of EN ISO 12100-2:2003.

The instruction handbook (and the technical documentation describing the machine) shall give the information on noise emission (noise declaration) obtained using the noise test code specified in Annex C.

NOTE Information on noise emission should also be provided in the sales literature.

The instruction handbook shall contain criteria for the periodic checks.

The instruction handbook shall contain a diagram to allow checking that fixed guards and any other safety systems are in place before operating the machine.

The instruction handbook shall, where appropriate, contain an information to indicate that the equipment shall be earthed and connected via either a residual current device or another system with an equivalent level of safety dependent on the power rating of the system, according to EN 60204-1:2006, 6.3.

If the main switch is switched off an advice shall be given to prevent remaining risks.

In addition to the requirements specified in EN ISO 12100-2:2003 the following information shall be included in the instruction handbook for the individual types of machinery and plant:

7.1.2 Small mobile tipping drum mixers for domestic and industrial use

— Instructions that the machinery shall not be operating when it is being moved;

— instructions regarding the need to position the mixer on level ground;

— instruction not to reach into the drum interior to the rotating blades;

— warning to use only the original standard of insulation material for repair and to maintain insulation distances;

— an instruction regarding the need to disconnect the mixer from power supply before opening the enclosure and not to operate it unless the enclosure is fully closed;

— warning regarding the hazard of the inhalation of fumes;

— instructions regarding hazards from materials likely to be used, especially contact, inhalation or ingestion of cement or additives;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment;

— instructions regarding the content of the warning signs which are required in 5.2.2.1 and in 5.2.2.5.

7.1.3 All other mixers, e.g. tipping drum mixers (stationary), trough mixers, pan mixers, through-flow mixers

— An instruction that discharge shall be allowed only if a receptor for the charge is in place;

— clear instructions on the safe use of a non-maintained limited-movement system, e.g. inching system or jog-system (see 5.2.3.8);

— instructions regarding the hazards of the inhalation of fumes;

— instructions regarding the hazards from materials likely to be used especially contact, inhalation or ingestion of cement or additives;

— clear instructions on connecting to the electrical supply and specifically the need to avoid connection to a household socket;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions on the warning sign which is required in 5.2.3.1 regarding protection of the outlet opening;

— instructions regarding the warning sign which is required in 5.2.3.1 regarding protection of openings for maintenance work;

— instructions regarding the warning signs which are required in 5.2.3.8;

— instructions regarding the need to use personal protective equipment;

— instructions on placing the non-stationary mixers on the ground before and during operation.

7.1.4 Ground tipping systems

— Specification of the maximum capacity of the hopper(s);

— instructions on the daily clearance of spilt material concerning the ramps effect from the spilt material;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment.

7.1.5 Scraper radius, bridge and dragline plant

— Clear instructions on the assembly of the plant and the loads which the plant shall handle;

— clear indications of the weather conditions in which the machinery shall not be operated (e.g. high wind) and the safety measures necessary to secure the machinery;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment.

7.1.6 Skip hoists

— An instruction regarding the hazard from materials likely to be used especially contact, inhalation or ingestion of cement or additives;

— an instruction regarding the hazard of the inhalation of fumes;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment.

7.1.7 Dosing equipment

— Instructions on the correct handling methods of any radiation sources used;

— an instruction regarding the hazard from materials likely to be used especially contact, inhalation or ingestion of cement or additives;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment.

7.1.8 Aggregate distribution chute

— An instruction regarding the hazard from materials likely to be used especially contact, inhalation or ingestion of cement or additives;

— instructions on the correct handling methods of any radiation sources used;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment.

7.1.9 Mobile mixing plant

— Clear instructions on the assembly/disassembly of the plant and the loads which the plant shall handle;

— clear indications of the weather conditions in which the machinery shall not be operated (e.g. high wind) and the safety measures necessary to secure the machinery;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions regarding the need to use personal protective equipment;

— safety instructions for lifting the machine, heavy parts or components of the machine and correct use of lifting points.

7.1.10 Waste concrete reprocessing plant

— Instructions for the approach of vehicles;

— instructions to the plant operator to ensure that pedestrians in the vicinity of vehicles are suitably protected or warned;

— instructions regarding the hazards from materials likely to be used especially contact, inhalation or ingestion of cement or additives;

— information on any hazardous activity necessary for operation, cleaning or maintenance including a description of a safe working practice;

— instructions for the covers shall not be used for regular pedestrian means of access and regarding the necessary fencing and warning signs shall be given, see 5.2.4.2 and 5.2.10.4;

— instructions regarding the need to use personal protective equipment.

7.1.11 Information of machine marking, see 7.2

7.1.12 Clear, unambiguous instructions for assembly, operation and disassembly shall be provided, which include information on the following:

— lifting points;

— wheel chocking arrangements or adequate solutions;

— locking and latching mechanisms for foldable parts;

— need for adequate ground stability and structure to support the load.

7.2 Marking

7.2.1 General

Each machine or plant shall bear the following minimum marking in a legible and indelible condition:

— name and address of the manufacturer;

— mandatory marking [1) 2)];

— year of construction;

— designation of series or type, if any;

— serial or identification number, if any;

— rating information (mandatory for electrotechnical products: voltage, frequency, power etc.);

— operating mass for non-stationary machines.

7.2.2 Specifically for hydraulic and pneumatic systems

— Maximum operation pressure.

---

1) For machines and their related products intended to be put on the market in EEA, CE marking as defined in the European applicable directive(s), e.g. Machinery.

2) The rules for marking of machines can also apply to interchangeable equipment in the sense of Article 1(2) of the Machinery Directive.

7.2.3 Specifically for electrical equipment

— Nominal voltage [V];

— nominal current [A];

— nominal power [kW];

— current frequency [Hz];

— protective system [IP].

7.2.4 Specifically for internal combustion engine

— Kind of fuel;

— nominal power [kW].

7.2.5 Specifically for control stations, working platforms, accesses and lifting equipment

— Description of the permissible maximum load capacity.

7.2.6 Mixer with an electrical class II motor

Mixer with an electrical class II motor shall be permanently identified by the symbol: 

An easily detectable indication plate shall be fixed on the exterior enclosure of the mixer; it shall read as follows:

"Disconnect before opening the enclosure. Operation is permitted only if the enclosure is fully closed”.

The following indication shall be given permanently on the interior of a class II mixer and in the corresponding operation instructions:

Warning! Class II equipment. To ensure adequate protection, use original insulation material for repair and maintain insulation distances.

7.2.7 Underground buffer stock area

The area shall be marked by warning signs.

Annex A
(normative)

Stability, ground surface, headroom and access requirements

A.1 Ground surface and headroom of operation areas

Control stations of mobile mixing units shall have a free area of at least 3 m^2. The headroom shall be at least 2,30 m for stationary mixing units and 2,10 m for mixing units moveable by trucks.

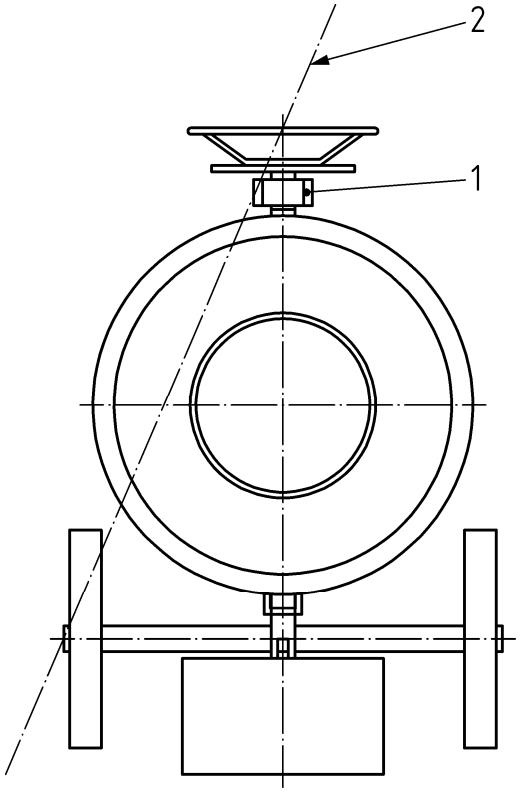
A.2 General access

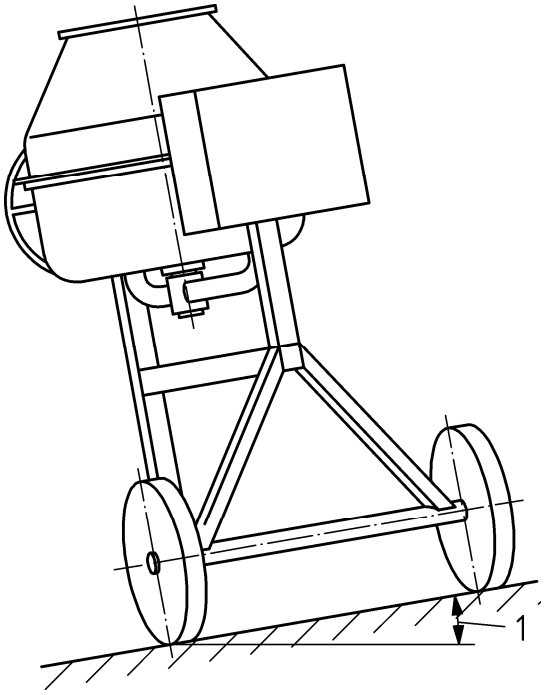
Any permanent access area where the height differs more than 0,3 m shall be provided with stairs, steps, ramps or walkways which meet the requirements of EN ISO 14122-1:2001, EN ISO 14122-2:2001 or EN ISO 14122-3:2001.

Steps installed in front of mixing and dosing plants which are used more often than once a week shall be considered as stairs.

A.3 Stability test of small mobile tipping drum mixers

Small mobile tipping drum mixer





Key

1 support leg
2 tipping line

Figure A.1 — Tipping drum mixer (plan view)

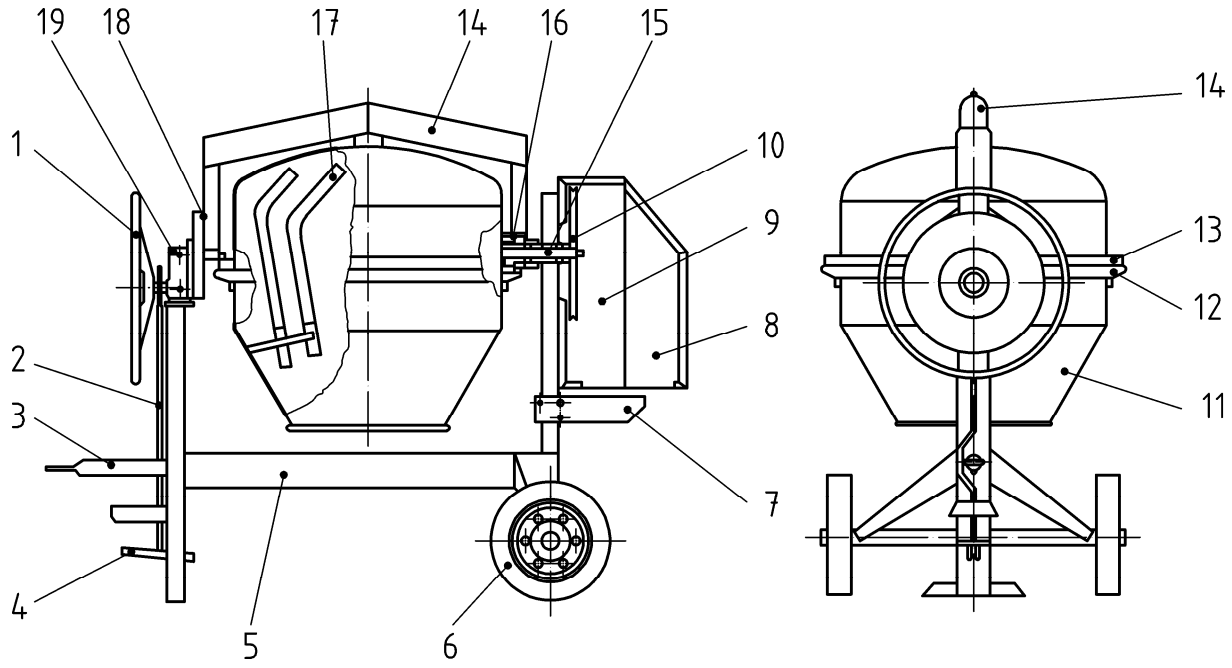
1 angle of inclination 10°

Figure A.2 — Tipping drum mixer (side view)

The deviation from the vertical not to exceed 10 °. The test procedure and requirement, see 5.2.2.5.

Annex B
(informative)

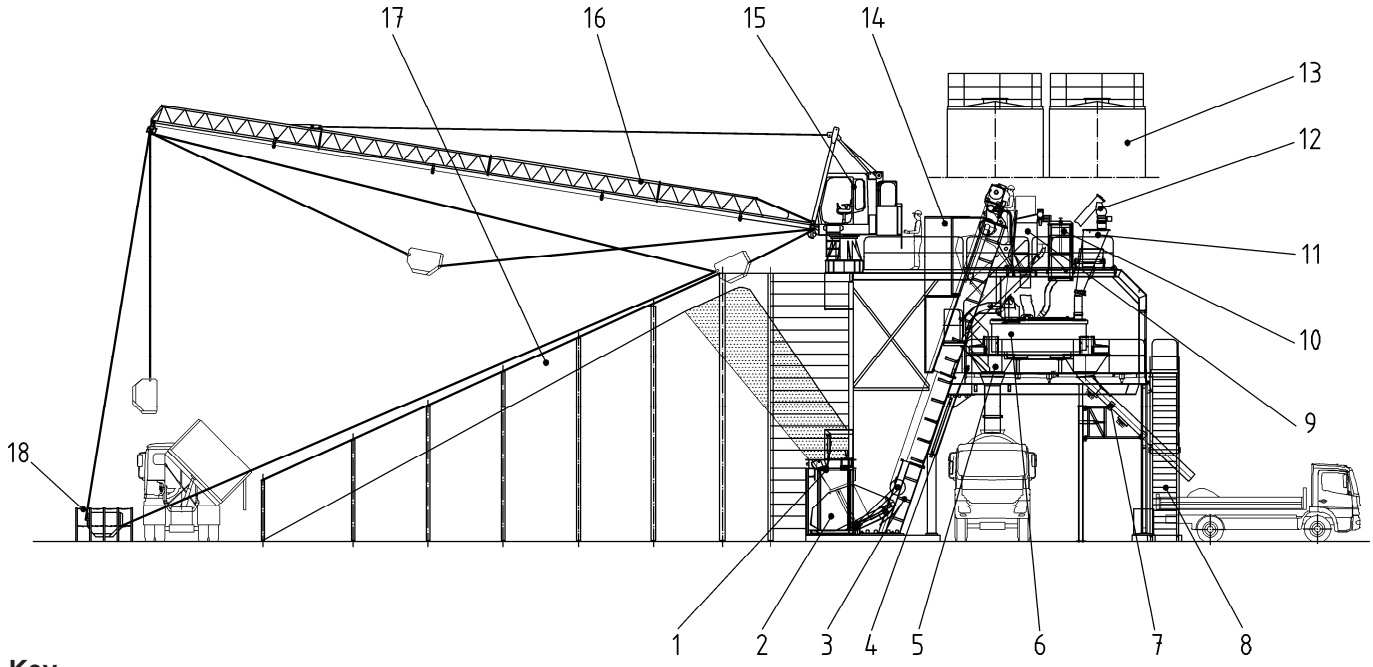
Illustration of mixer and plants



Key

1 flywheel
2 brake linkage
3 towing device
4 foot pedal/lever
5 chassis
6 wheels
7 motor base plate
8 access door of the enclosure/housing
9 covering
10 pulley
11 mixing vessel
12 crown gear
13 crown protection
14 supporting frame
15 driving axle
16 pinion drive
17 mixing blade
18 gear system for tilting mechanism
19 tilting mechanism

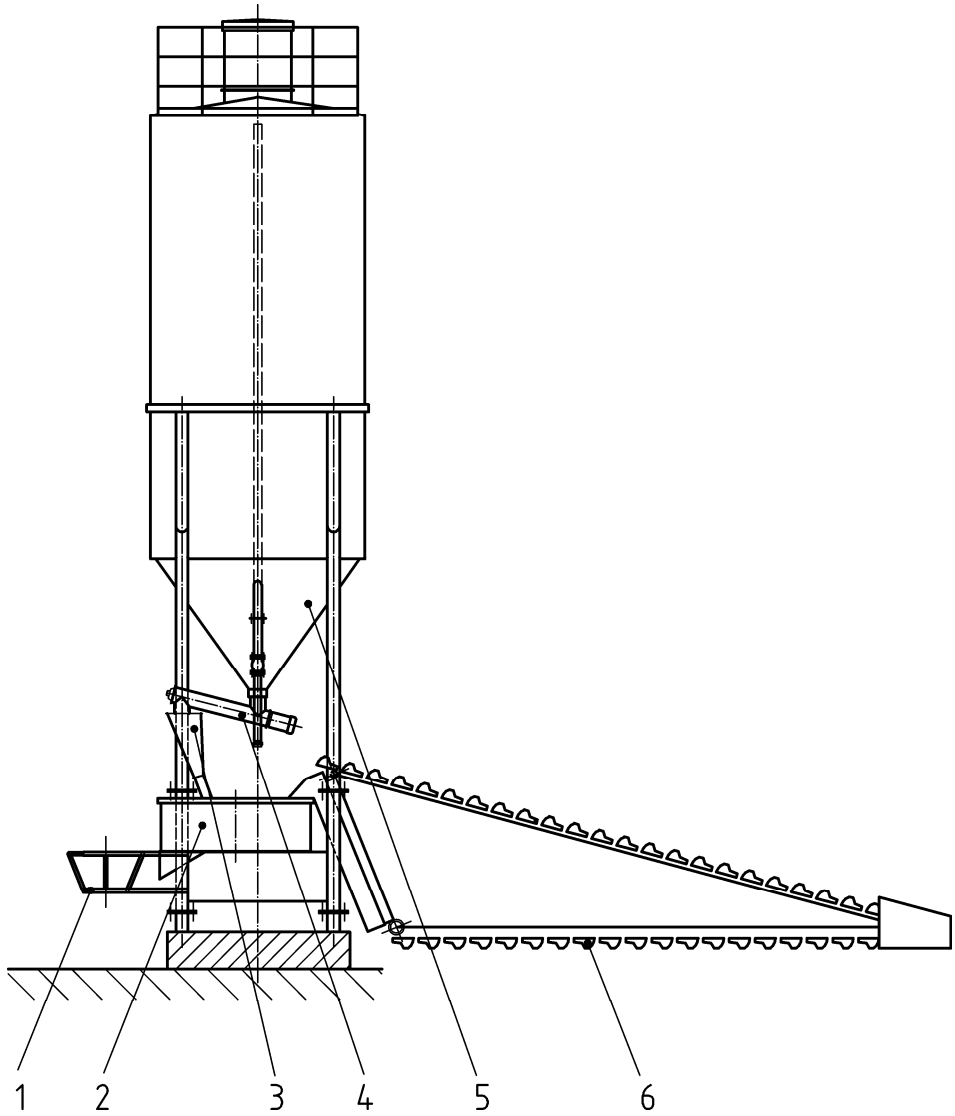
Figure B.1 — Small mobile tipping drum mixer



Key

1 batching table
2 charging bucket
3 elevator track
4 machine platform
5 discharge hopper
6 pan mixer
7 discharging to truck
8 ascent by means of working platforms
9 mixer dedusting
10 water weigher
11 cement weigher
12 conveyor screw
13 cement bin
14 protective devices batching plant
15 scraper fundamental device with cabine
16 iib with scraper bucket
17 compartment wall of aggregate compartments
18 locking device for working area of the scraper

Figure B.2 — Example of a dragline scraper and a star plant

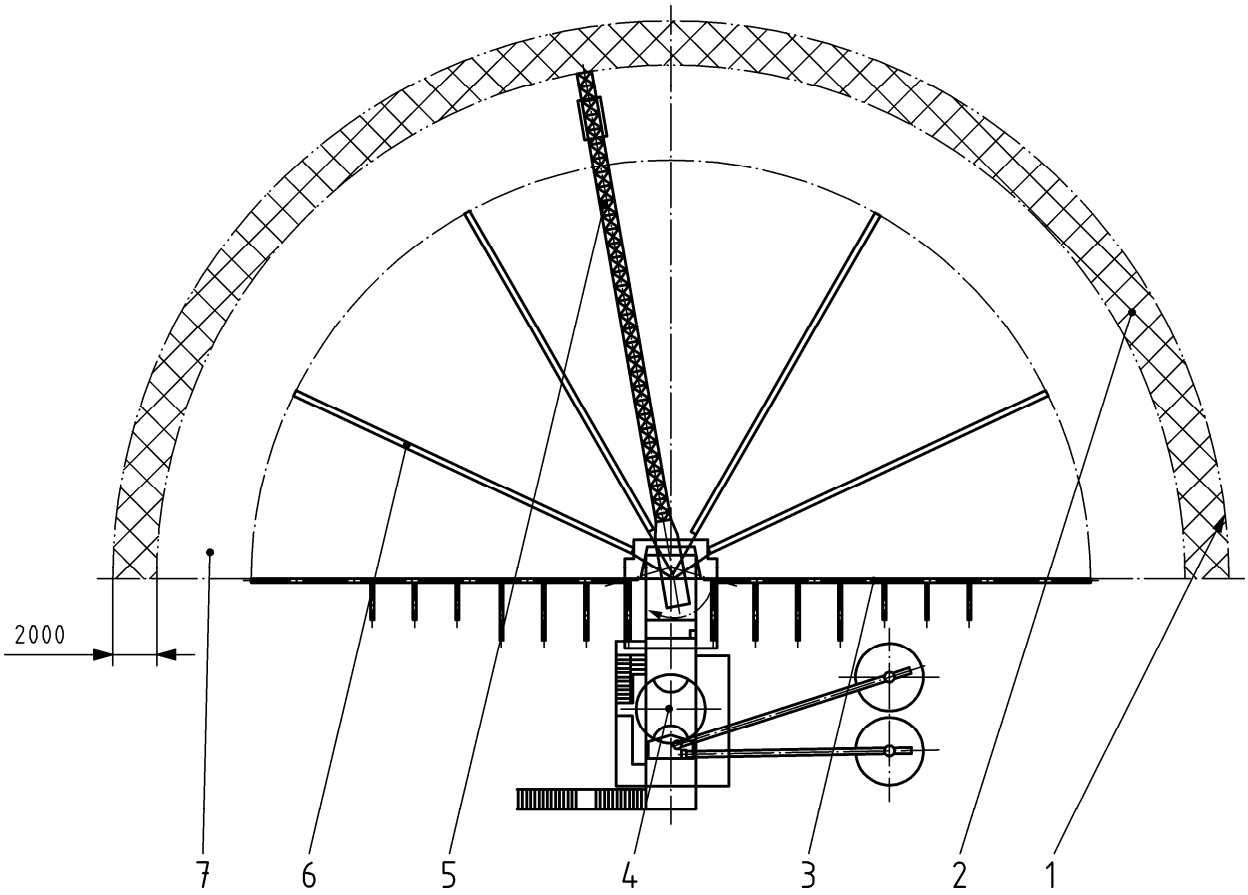


Key

1 protecting cage
2 pan mixer
3 cement weigh hopper
4 conveyor screw - cement
5 cement bin
6 rotating scraper conveyor

Figure B.3 — Example of a scraper radius plant (front view)

Dimensions in millimetres

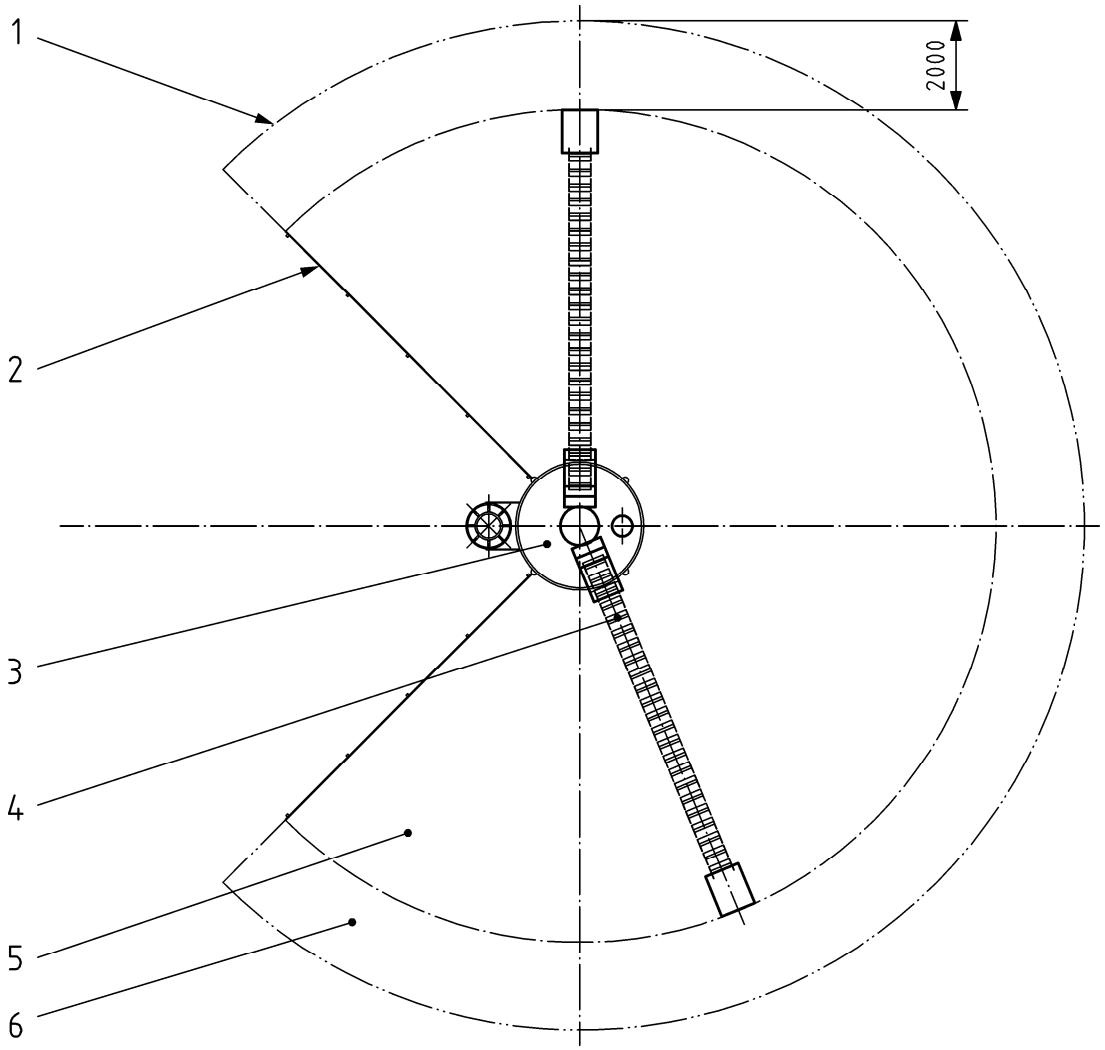


Key

1 locking device for working area of the scraper
2 prohibited zone
3 supporting wall
4 concrete mixing plant
5 scraper
6 compartment wall of aggregate compartments
7 working area of the scraper

Figure B.4 — Protection walls and safety barrier for plant with one radius lift arm

Dimensions in millimetres

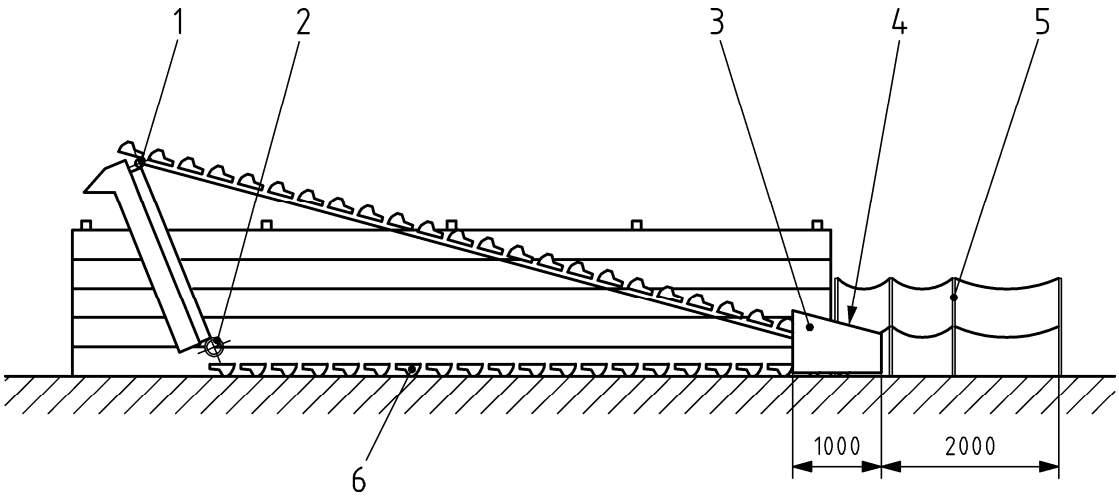


Key

1 locking device for working area
2 supporting wall
3 concrete mixing plant
4 rotating scraper conveyor
5 aggregates
6 prohibited zone

Figure B.5 — Protection walls and safety barrier for plant with one or more radius lift arm(s)

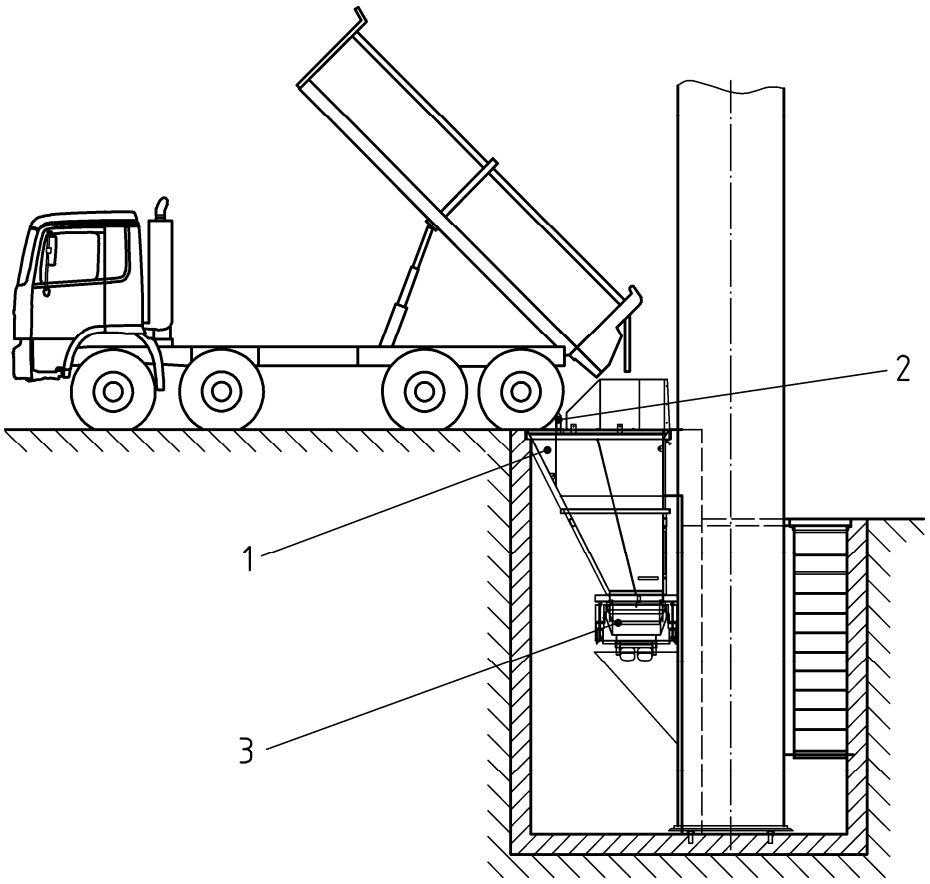
Dimensions in millimetres



Key

1 head pulley
2 intermediate pulley
3 tail pulley
4 guard
5 mobile posts and guard
6 scraper (bucket-type)

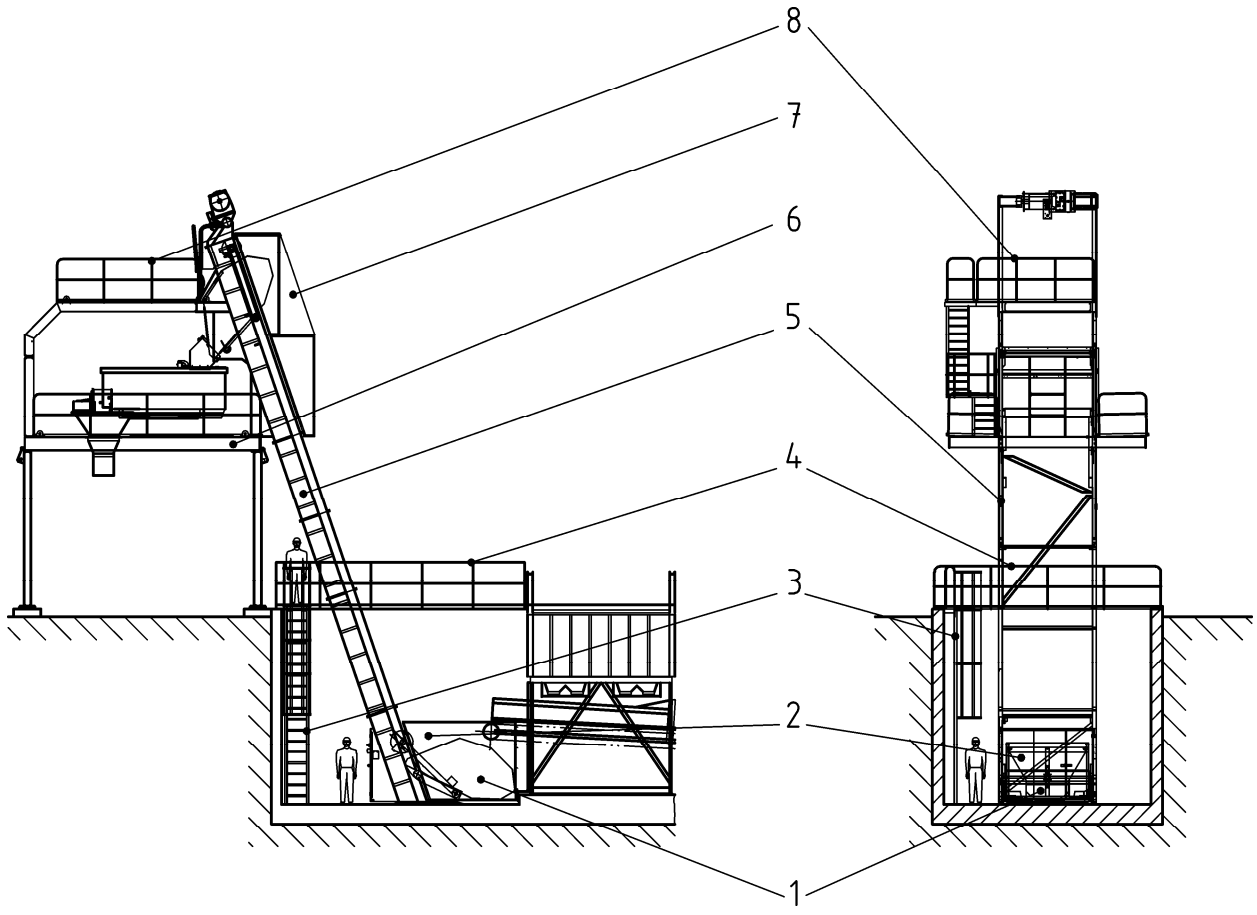
Figure B.6 — Radius lift arm with buckets



Key

1 charging hopper
2 barrier protection
3 bunker discharge groove

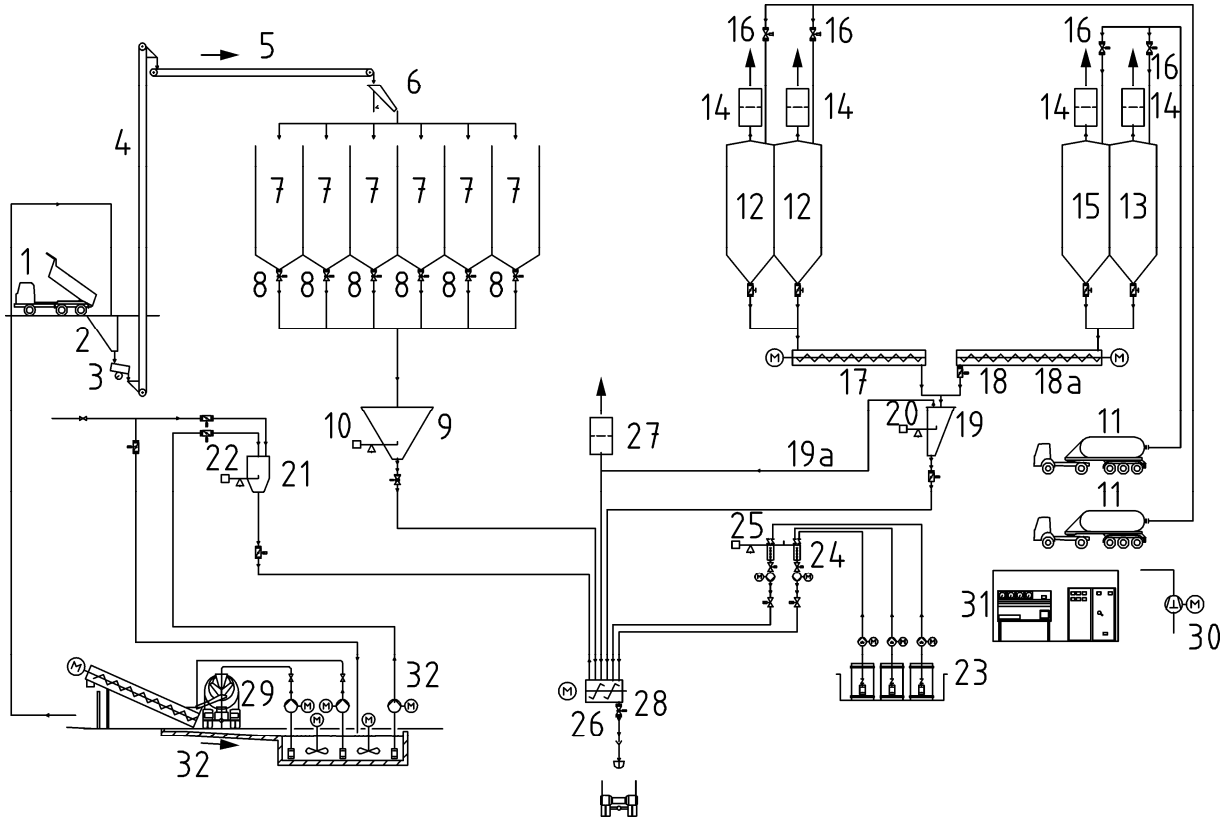
Figure B.7 — Example of a ground tipping hopper



Key

1 charging bucket
2 protecting grid elevator track
3 ascent
4 railing
5 elevating path
6 machine stage
7 protecting grid machine platform
8 railing machine platform

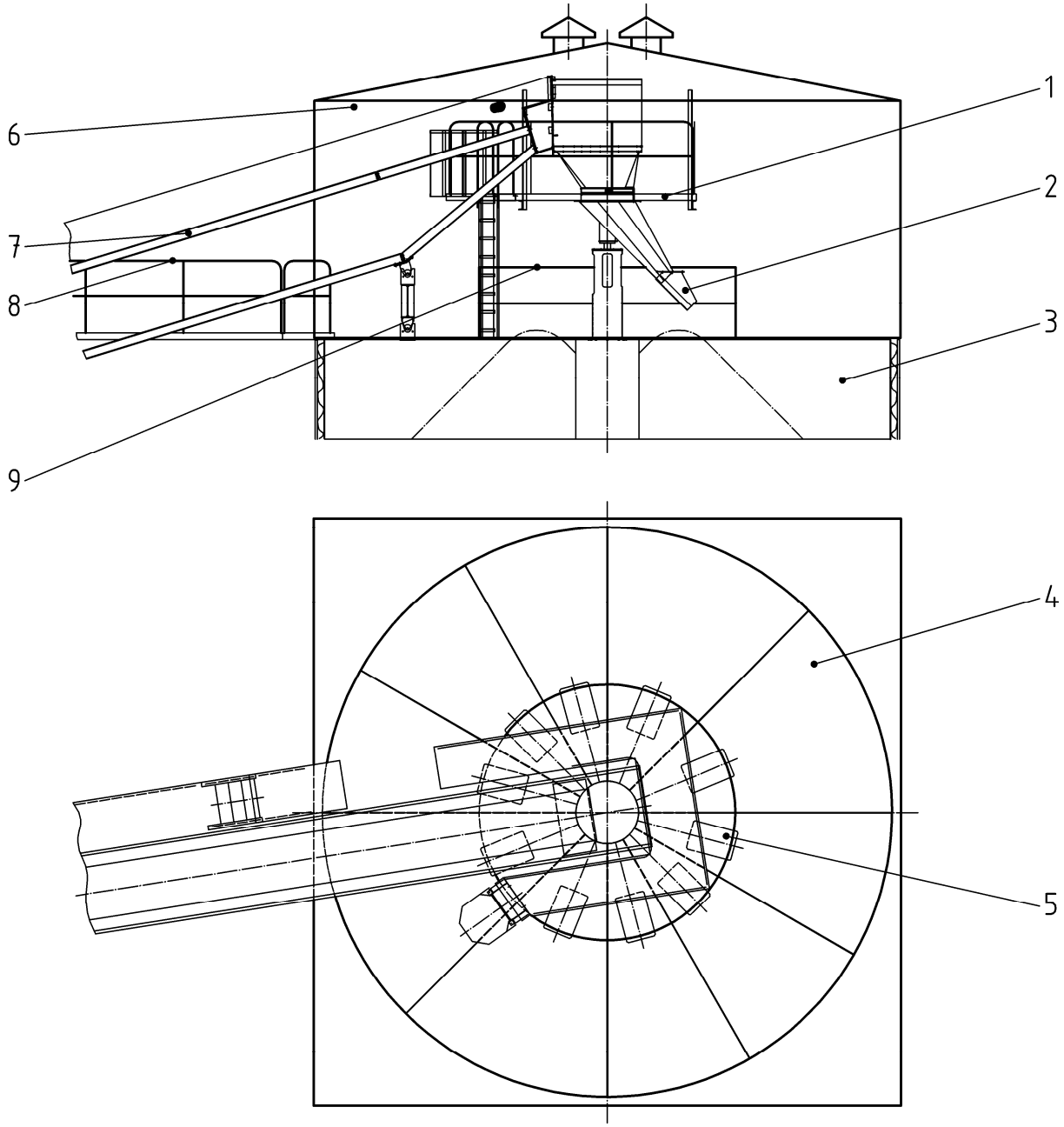
Figure B.8 — Example of a skip hoist system



Key

1 truck
2 charging hopper
3 bunker discharge groove
4 bucket elevator
5 service conveyor belt
6 rotary pipe distributor
7 aggregate silo
8 batching gate
9 aggregate weigher hopper
10 aggregate scales
11 silo truck
12 cement bin
13 filler bin
14 exhaust air filter
15 microsilica bin
16 silo filling indicator
17 conveyor screw – cement
18 conveyor screw – filler
18a conveyor screw – microsilica
19 cement weigh hopper
19a aeration – cement weigher
20 cement weigher
21 water weighing receptacle
22 water weigher
23 admixture tank
24 admixture cylinder
25 admixture weigher
26 pan mixer
27 mixer dedusting
28 mixer gate
29 concrete-mixing truck
30 pneumatic plant
31 microprocessor control system
32 recycling plant

Figure B.9 — Dosing equipment of a batching plant

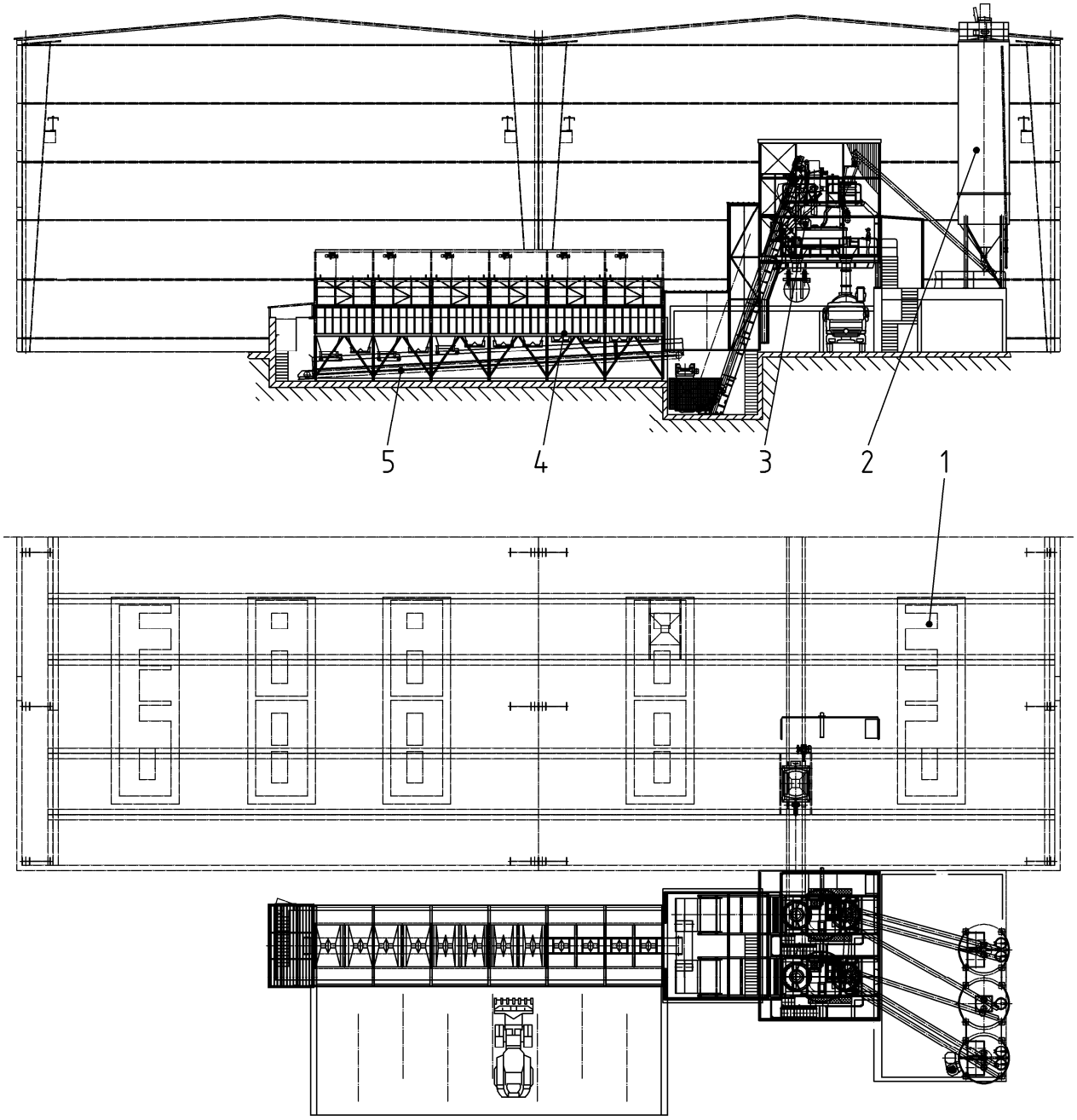


Key

1 maintenance platform
2 rotary pipe distributor
3 silo body
4 silo chamber
5 batching gate
6 protective house
7 belt conveyor
8 catwalk
9 railing

Figure B.10 — Aggregate distribution system (e.g. distribution shoot)

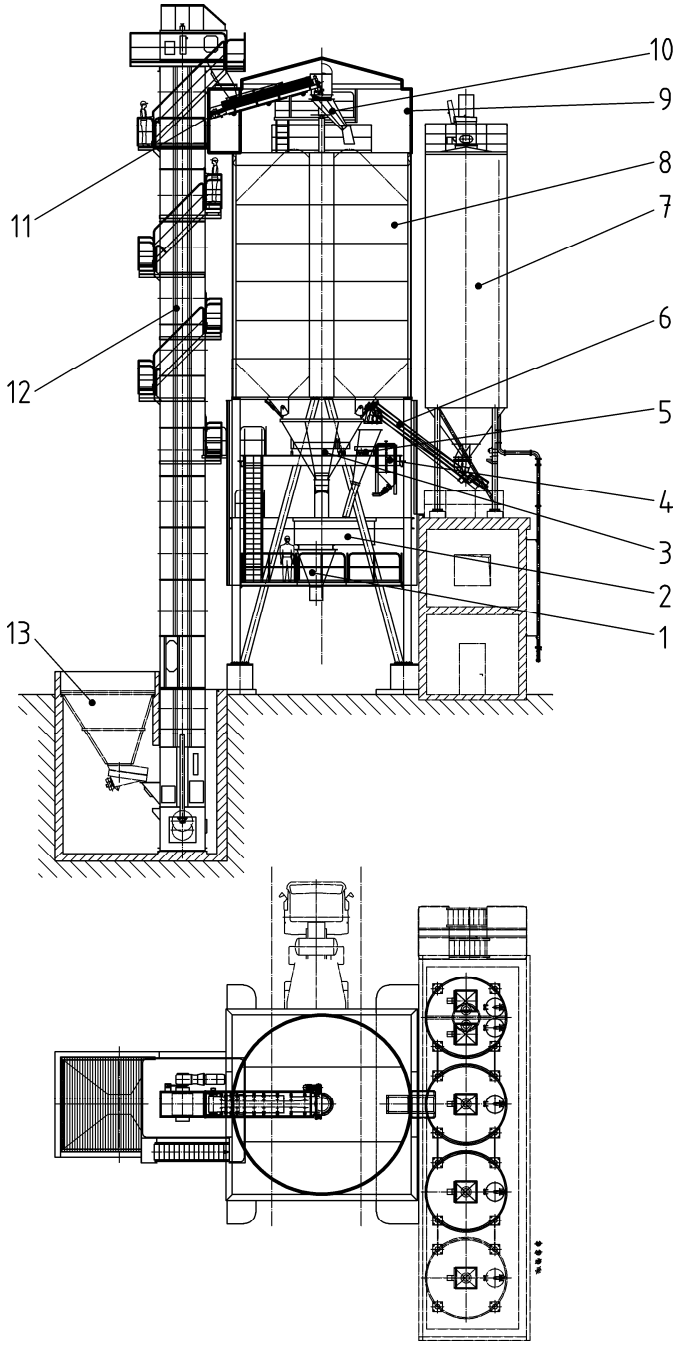
NOTE Conveyor systems may also be used.



Key

1 finished part
2 cement bin
3 concrete mixing plant
4 aggregate silo
5 weighing strap

Figure B.11 — Example of concrete production plant with the plant featuring in-line hopper aggregate storage equipment



Key

1 discharge funnel
2 pan mixer
3 aggregate weigher hopper
4 water weigher
5 cement weigher
6 conveyor screw
7 cement bin
8 silo body
9 protective house
10 rotary pipe distributor
11 service conveyor belt
12 bucket elevator
13 charging hopper

Figure B.12 — Example of a vertical mixing plant fed by conveyor belt or bucket elevator

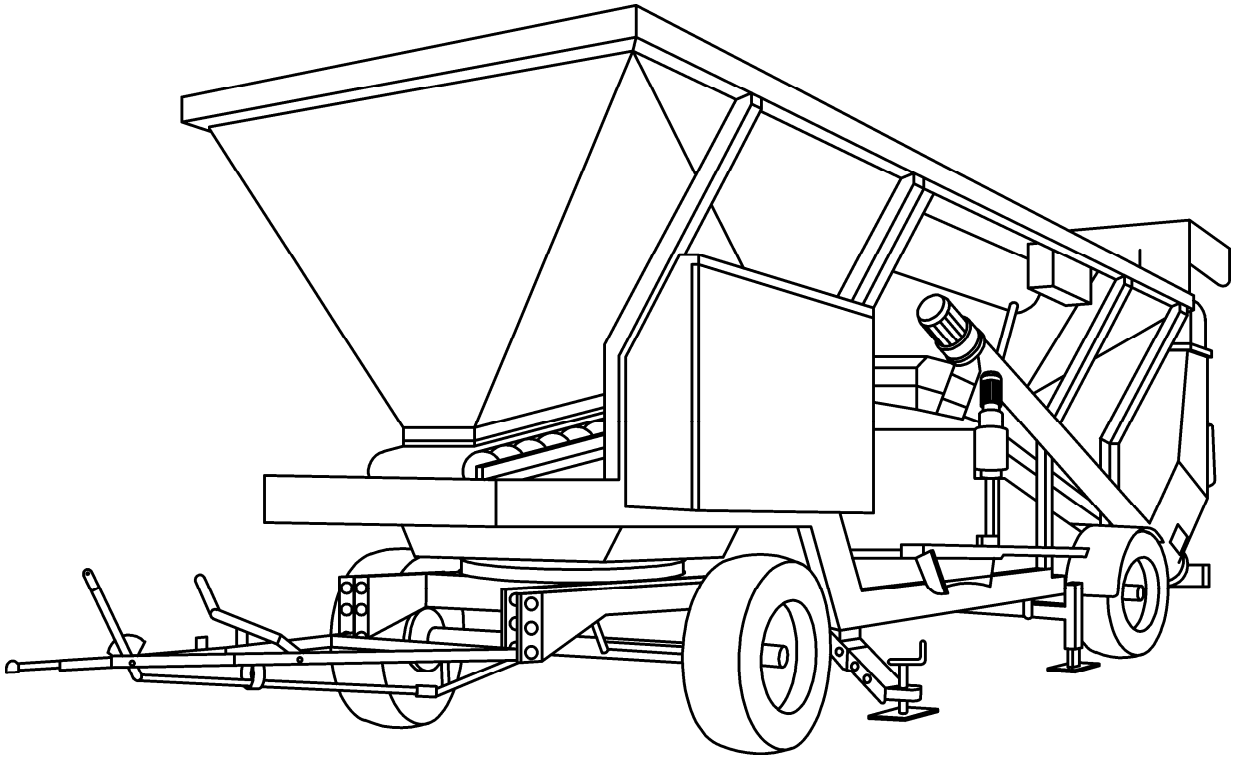
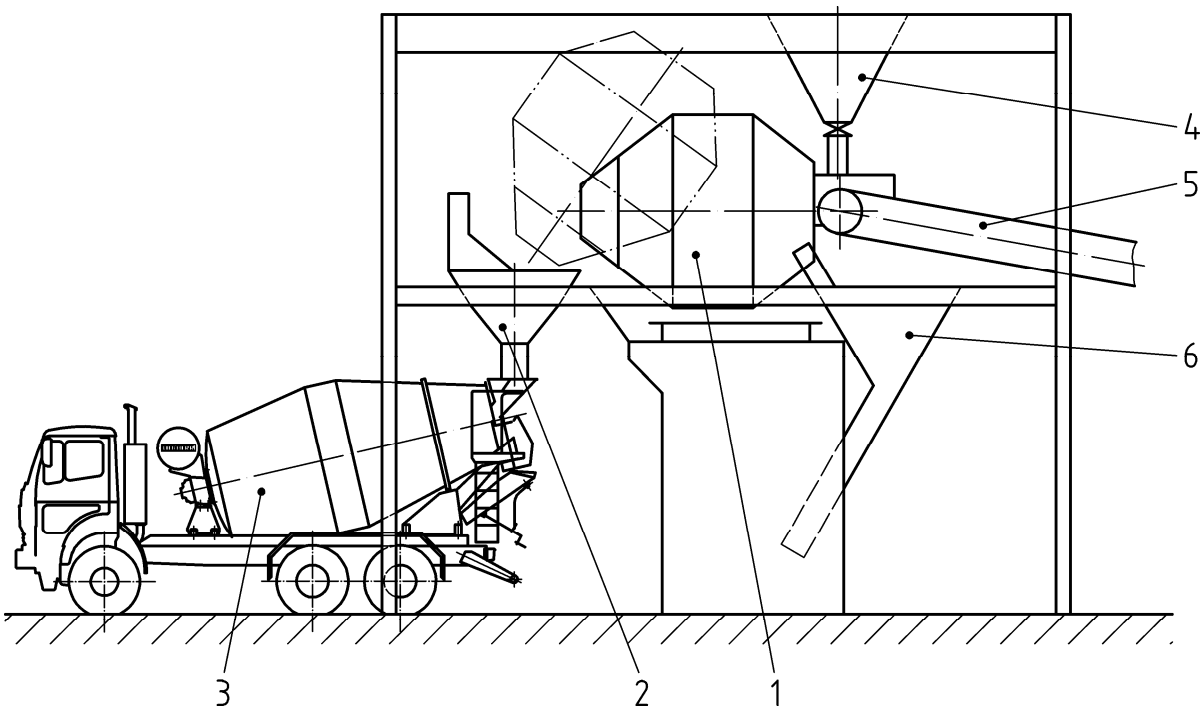


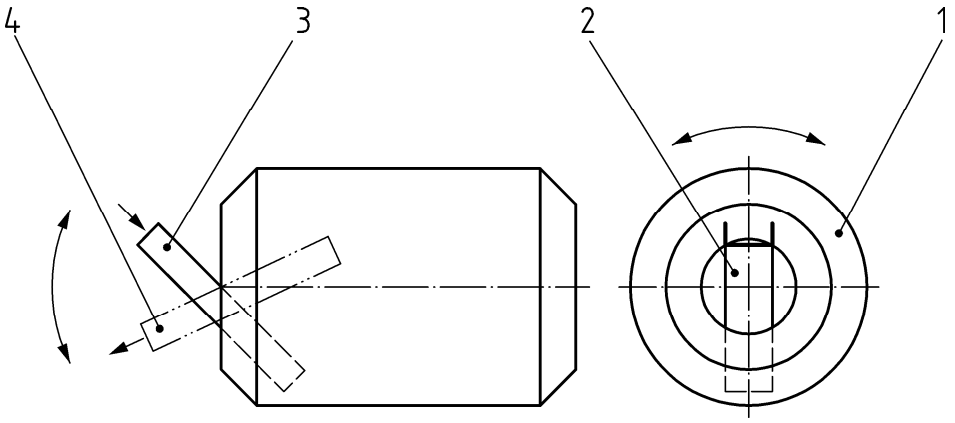
Figure B.13 — Example of a mobile mixing



Key

1 tipping drum mixer
2 mixer discharge chute
3 truck mixer
4 cement weigh hopper
5 loading conveyor
6 spillage chute

Figure B.14 — Tipping drum mixer



Key

1 drum
2 chute
3 chute in charging position
4 chute in discharging position

Figure B.15 — Chute discharge mixer

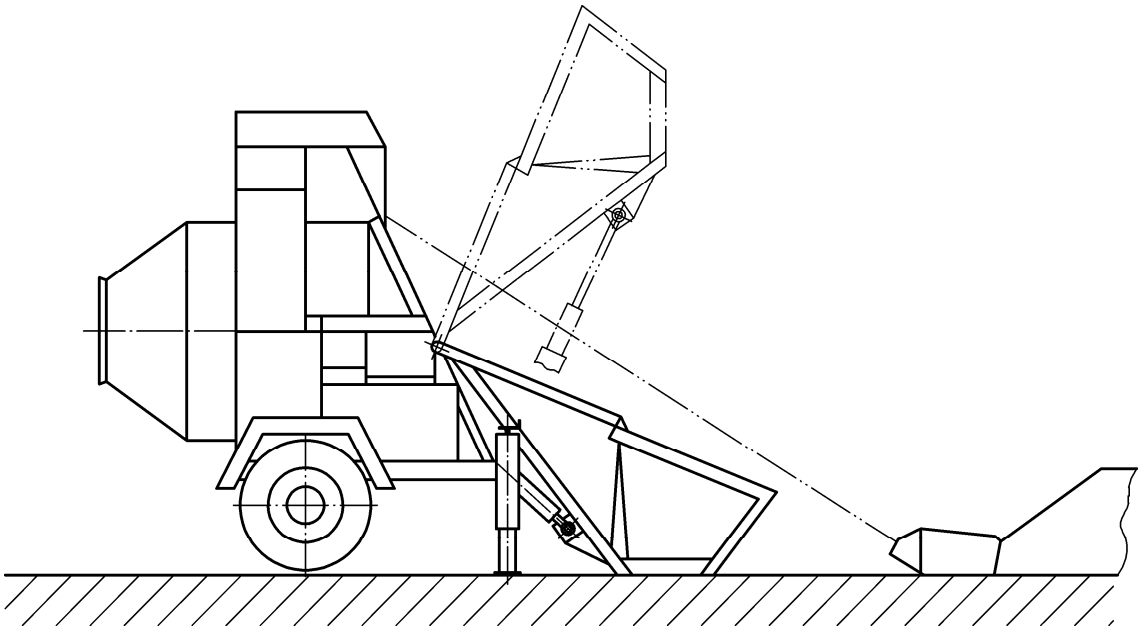


Figure B.16 — Reversing drum mixer

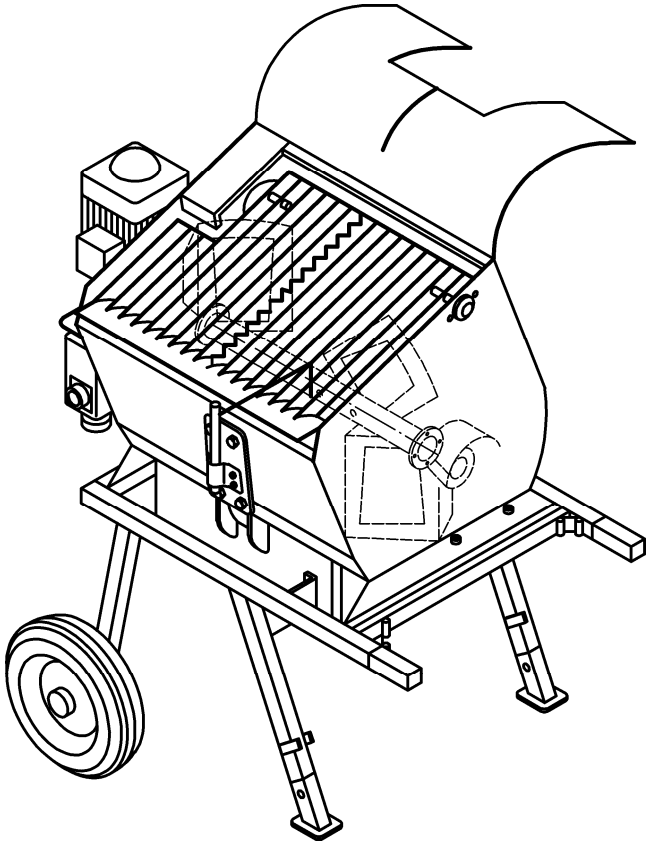
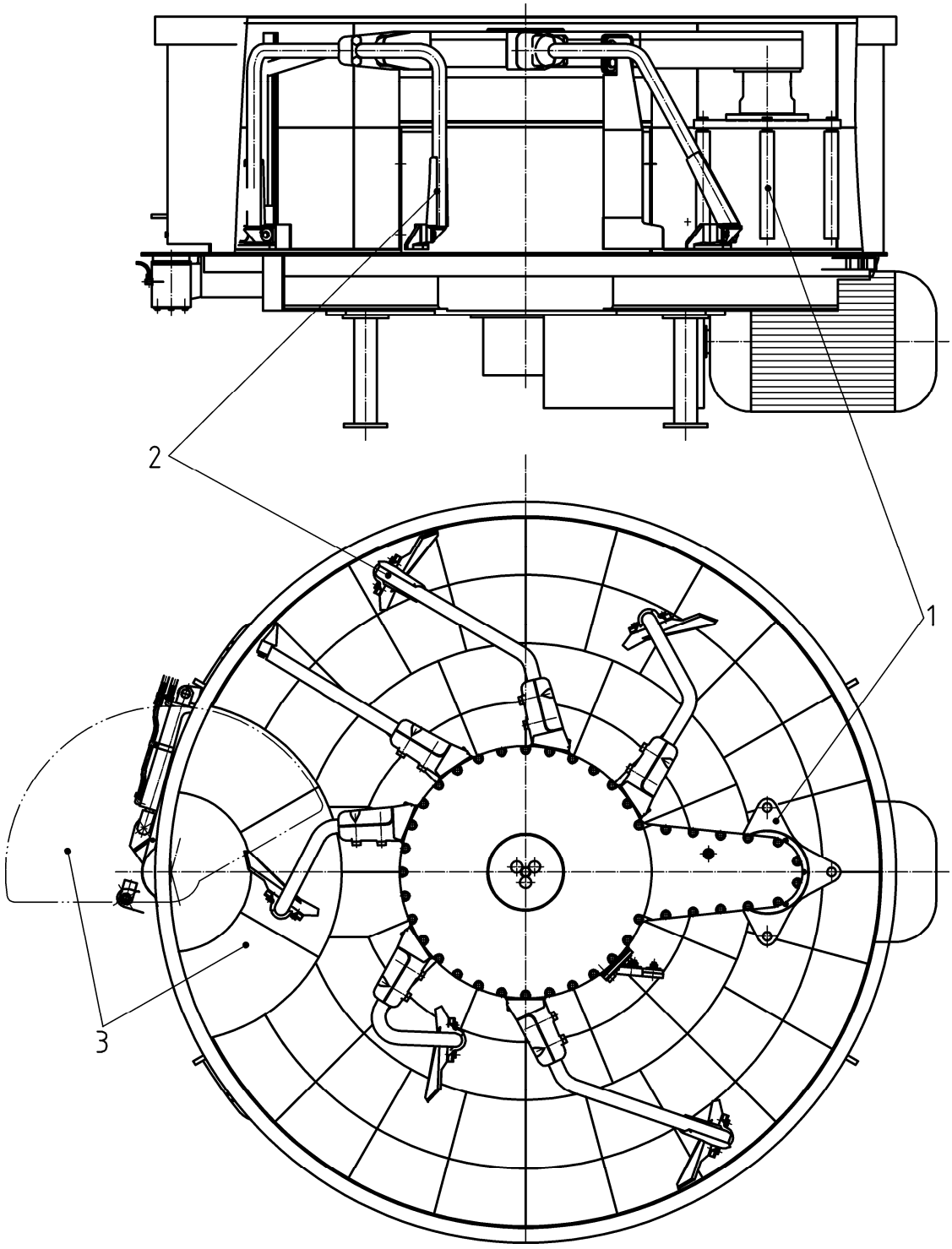


Figure B.17 —Trough mixer

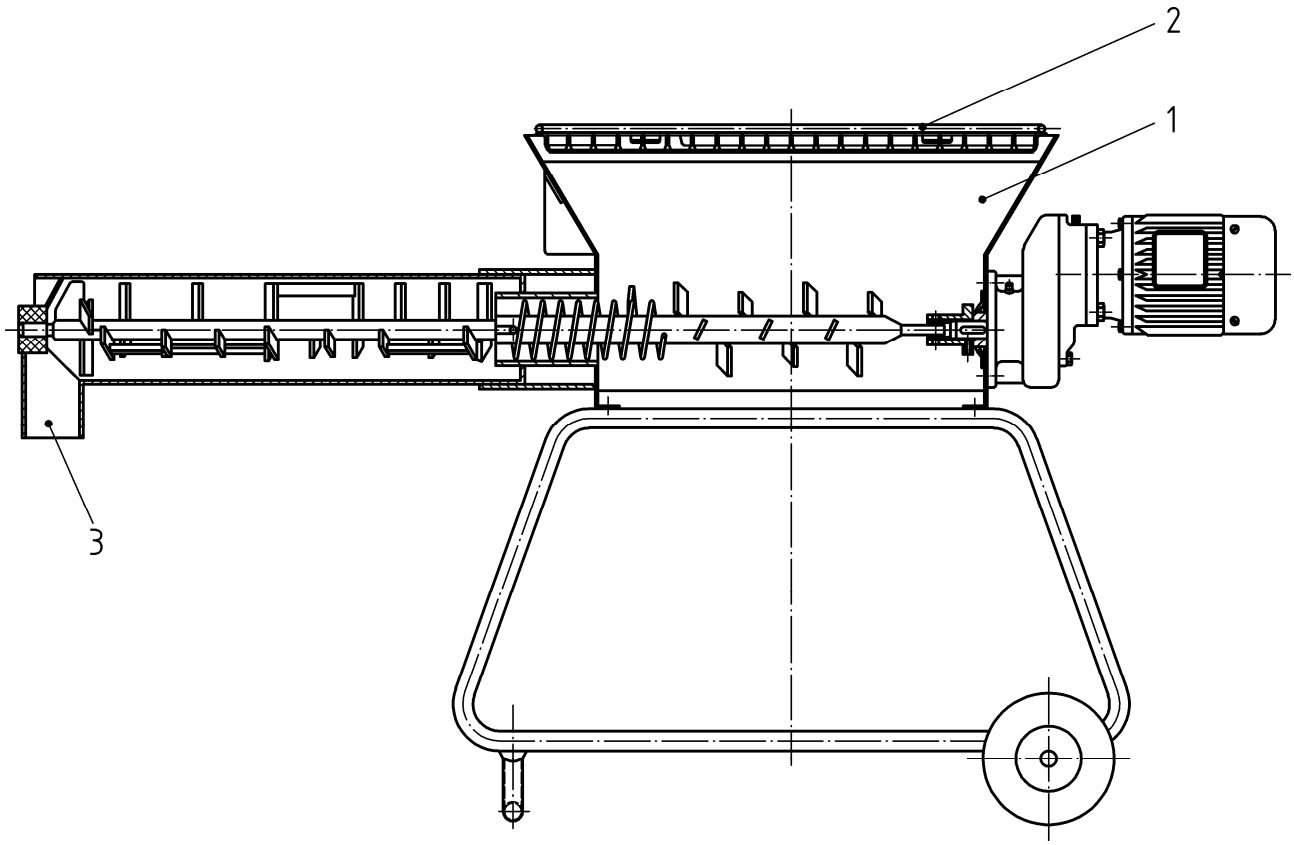
Fixed horizontal trough – batch loading – horizontal paddle or screw shaft



Key

1 whirler
2 agitating arm
3 mixer gate

Figure B.18 — Stationary pan with concentrically placed rotating paddles



Key

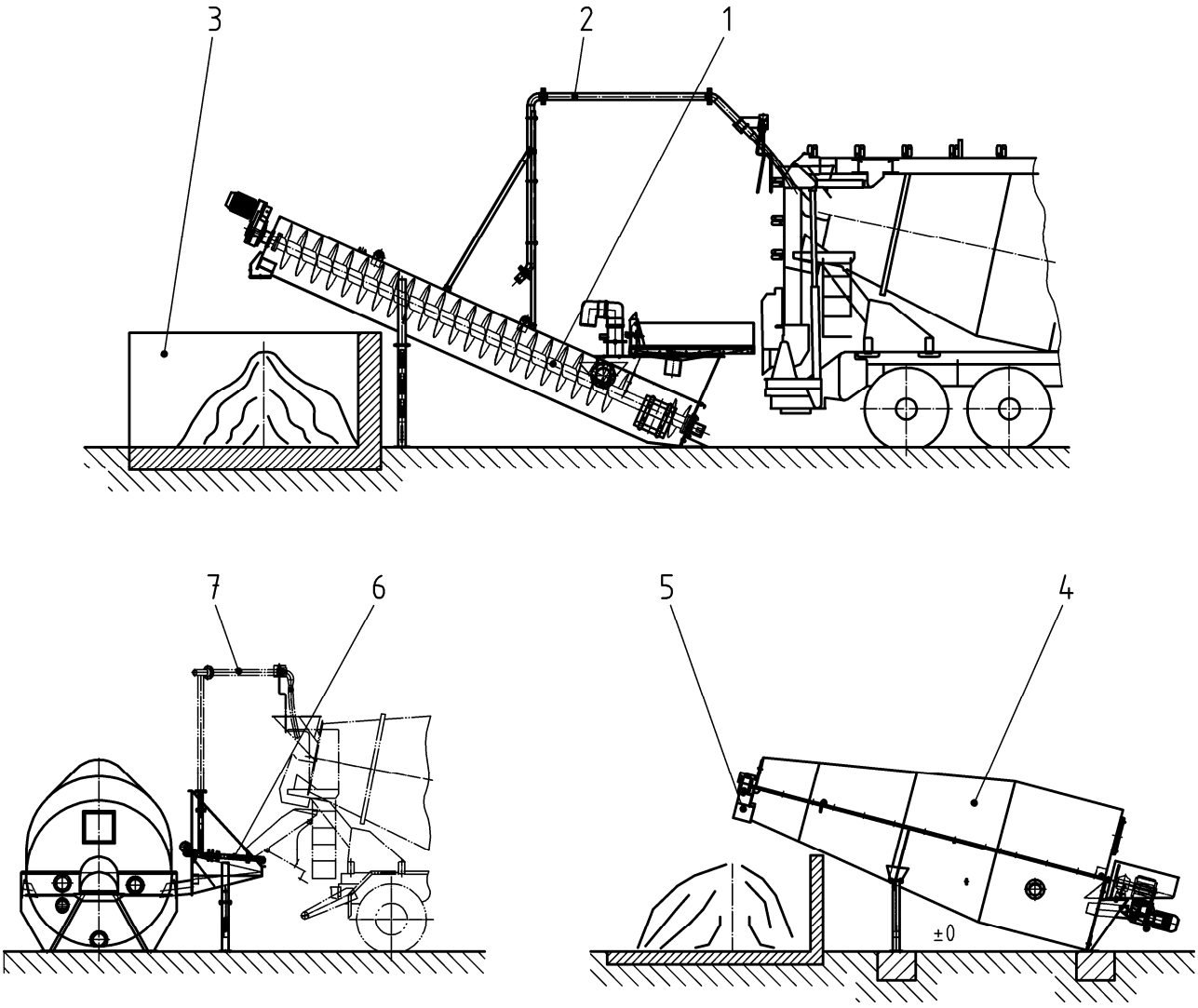
1 hopper
2 covering
3 outlet

Figure B.19 — Example of a through-flow mixer

Installation options:

Waste concrete reprocessing plant

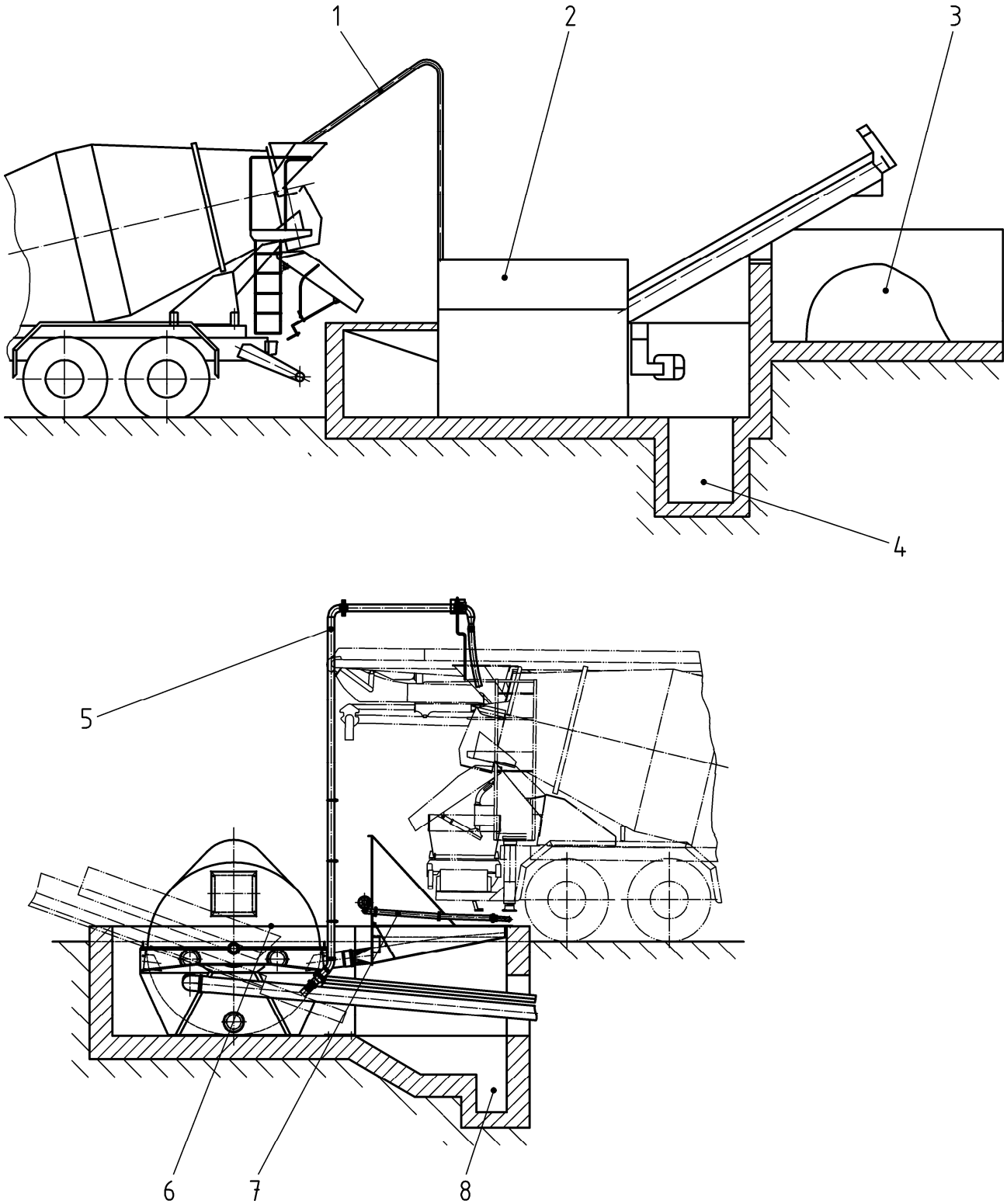
(above ground)



Key

1 washing-out screw
2 rinsing shear legs
3 mixed gravel box
4 washout trough
5 discharge
6 charging hopper
7 rinsing shear legs

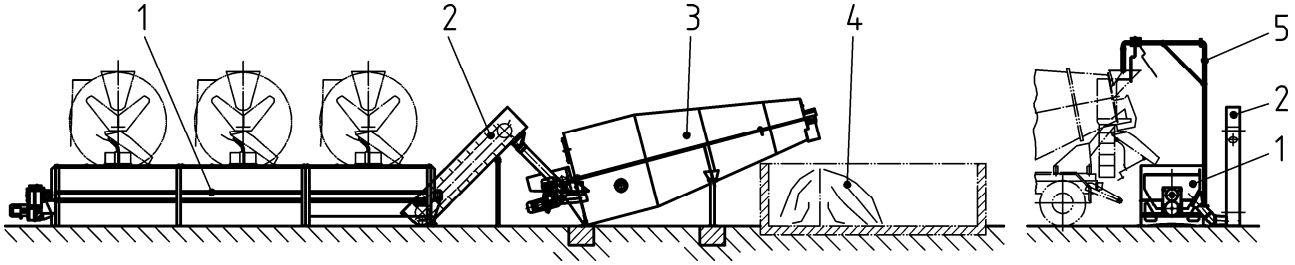
Figure B.20 — Waste concrete reprocessing plant (above ground)



Key

1 rinsing shear legs
2 recycling plant
3 mixed gravel box
4 pump sump
5 rinsing shear legs
6 recycling plant
7 charging hopper
8 pump sump

Figure B.21 — Waste concrete reprocessing plant (plant partly underground)



Key

1 dosing storage basin
2 hauling gear
3 washout trough
4 mixed gravel box
5 rinsing shear legs

Figure B.22 — Waste concrete reprocessing plant

Dimensions in millimetres

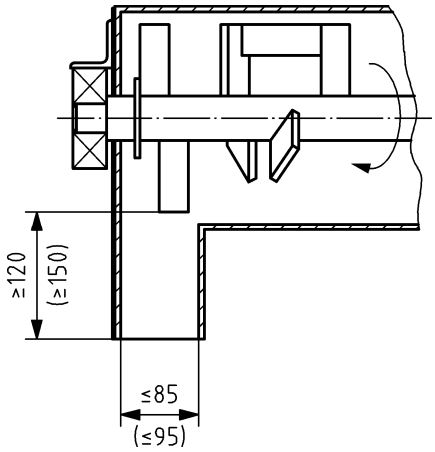


Figure B.23 — Dimensions of outlet hopper of through-flow mixers

Annex C
(normative)

Noise test code

C.1 Scope

This noise test code specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of the noise emission characteristics of mixers and plants for the preparation of concrete and mortar.

Noise emission characteristics include emission sound pressure levels at workstations and the sound power level. The determination of these quantities is necessary for:

— manufacturers to declare the noise emitted;

— comparing the noise emitted by machines in the family concerned;

— purposes of noise control at the source at the design stage.

The use of this noise test code ensures reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise measurement method used.

This noise test code does not provide a method for measuring or determining the noise emitted when cleaning the mixer or the plant, e.g. using hammers or machines for surface cleaning.

C.2 Sound power level determination

C.2.1 Mixers

The A-weighted sound power level shall be measured according to EN ISO 3744:1995 for mixers not mounted in a plant with the following deviations:

The microphone array shall be as given in Table C.1 and Figure C.1.

NOTE Table and drawing from directive 2000/14/EG, Annex III, part A.

Table C.1 — Coordinates of the 12 microphone positions

Number of microphone	x/r	y/r	z
1	1	0	1,5 m
2	0,7	0,7	1,5 m
3	0	1	1,5 m
4	- 0,7	0,7	1,5 m
5	-1	0	1,5 m
6	- 0,7	- 0,7	1,5 m
7	0	-1	1,5 m
8	+ 0,7	- 0,7	1,5 m
9	0,65	0,27	0,71 r
10	- 0,27	0,65	0,71 r
11	- 0,65	- 0,27	0,71 r
12	0,27	- 0,65	0,71 r

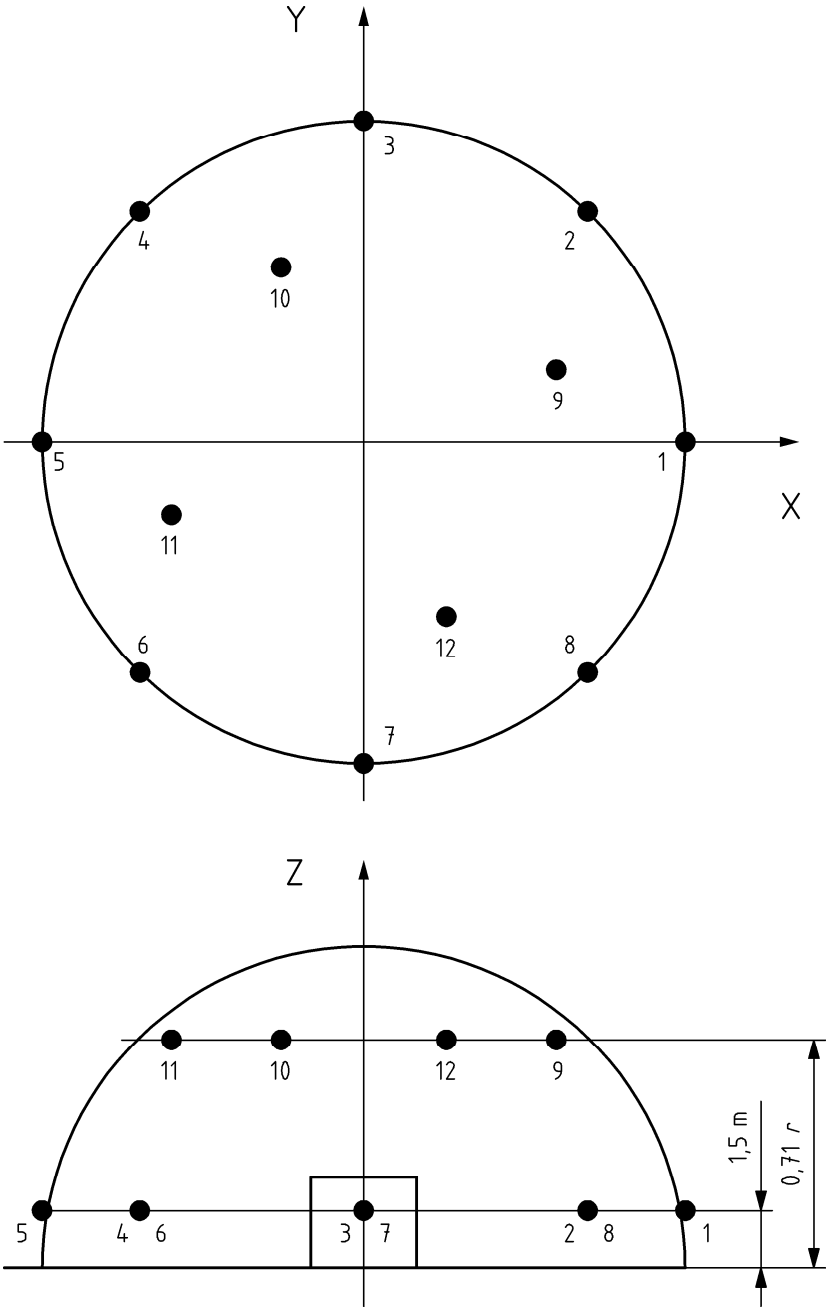


Figure C.1 — Microphone array on the hemisphere (12 microphone positions)

The number (12) of microphones may be reduced to six, but the microphone positions 2, 4, 6, 8, 10 and 12 shall be used in any case.

C.2.2 Plants

Plants are very large machines. Therefore the determination of the sound power level shall be replaced by the determination of A-weighted sound pressure levels around the plant as follows.

The manufacturer shall determine on which point, on the line 1,00 m away from the contour of the plant and 1,60 m above the ground, the highest A-weighted emission sound pressure level is measured. This level and this position shall be recorded, reported and declared.

C.3 Emission sound pressure level determination

C.3.1 Mixers

The A-weighted emission sound pressure level shall be measured according to EN ISO 11201:1995 at the loading, mixing and emptying workstations.

At each of these workstations the measurement point shall be at a height of 1,55 m ± 0,075 m above the ground plane in a distance of 1,00 m from the surface of the mixer. The measurement shall be carried out without the presence of the operator. The three values with the corresponding positions shall be recorded and be reported. The highest value and the position where it has been measured shall be declared.

C.3.2 Plants

The A-weighted emission sound pressure level shall be measured according to EN ISO 11201:1995 at the workstations:

— in the cabin, if one exists,

— where an operator stands for maintenance purposes.

In the cabin, the measurement point(s) shall be at a height of 1,55 m ± 0,075 m for a standing operator. If there is a seat at the control station the measurement point shall be at a height of 0,8 m ± 0,05 m above the seat and the operator shall be present during the measurement.

If there is no air conditioning system in the cabin, the measurement shall be carried out with windows open. If there is an air conditioning system, it shall be in operation at maximum speed during the measurement with windows closed.

For maintenance personnel, the A-weighted emission sound pressure level shall be measured according to EN ISO 11201:1995 at a distance of 1,00 m from mixing, conveying, batching, dosing and discharging equipment at a height of 1,55 m ± 0,075 m without the operator present. The values and positions where they are measured shall be recorded and reported. The highest value and the position where it has been measured shall be declared.

C.4 Installation conditions

Mixers shall be installed on a horizontal plane and in the manner the operator prepares the machine before using it.

For plants, measurement shall be carried out when the plant is installed and ready for use.

C.5 Operating conditions

For both mixers and plants:

— mixing device shall be filled to its rated capacity with sand of granulation 0 mm to 3 mm. The humidity shall be 4 % to 10 %;

— mixing device shall be at least at the rated speed;

— rated capacity and the mixing device speed shall be recorded, reported and declared in the instruction handbook;

— period of observation shall be at least 15 s. It shall cover at least one loading, mixing and emptying work cycle.

For plants, all equipment shall be at least once in operation during the measurement.

C.6 Information to be recorded

The information to be recorded shall be in accordance with EN ISO 3744:1995 and EN ISO 11201:1995 and C.2, C.3 and C.5 of this annex.

C.7 Information to be reported

The information to be reported shall be in accordance with EN ISO 3744:1995 and EN ISO 11201:1995 and C.2, C.3 and C.5 of this annex.

C.8 Declaration of noise emission values

The noise declaration shall contain the following data.

For mixers:

— highest of the A-weighted emission sound pressure levels measured at the three workstations and the position where it has been measured (see C.3.1);

— A-weighted sound power level (see C.2.1);

— detailed description of the operating conditions during measurement;

— position where the declared highest A-weighted emission sound pressure level has been obtained.

For plants:

— A-weighted emission sound pressure level at the operator position(s) in the cabin, if one exists, and the highest value of the measurements carried out at mixing, conveying, batching, dosing and discharging equipment (see C.3.1);

— highest A-weighted emission sound pressure level measured on the contour (see C.2.2) if any of the A-weighted emission sound pressure levels at workstations exceed 80 dB;

— detailed description of the operating conditions during measurement;

— positions where the declared values have been obtained.

The noise declaration shall indicate that the values have been obtained according to this noise test code. Deviations to this noise test code, if any, shall be declared.

For both the A-weighted sound power level and the A-weighted emission sound pressure level at workstations, the format of the noise declaration shall be a single-number format as defined in EN ISO 4871:1996 i.e. the measured value and the associated uncertainty are added up to form one single value.

NOTE No technical data on noise emission are presently available to estimate the standard deviation of reproducibility for mixers and plants. Therefore, the values of the standard deviation of reproducibility for A-weighted levels stated in EN ISO 3744:1995 namely 1,5 dB and EN ISO 11201:1995 namely 2,5 dB may be regarded as interim upper boundaries and used for the determination of the uncertainty K when preparing the noise declaration. Investigations requiring a joint effort of manufacturers are necessary to determine a possibly lower value of the standard deviation of reproducibility, which will result in a lower value of the uncertainty K. Results of such investigations will be reflected in a future version of this standard.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive Machinery 98/37/EC, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive Machinery 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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[1] EN ISO 11688-2:2000, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)*

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