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Building construction machinery and equipment — Truck mixers —

Part 2: Safety requirements

FDIS stage

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Contents

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Foreword

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This document was prepared by Technical Committee ISO/~~TC195~~TC 195, *Building construction machinery and equipment*, Subcommittee SC 1, *Machinery and equipment for concrete work*.

A list of all parts in the ISO 19711 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— ——machine manufacturers (small, medium and large enterprises);

— ——health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— ——machine users/employers (small, medium and large enterprises);

— ——machine users/employees (e.g. trade unions, organizations for people with special needs);

— ——service providers, e.g. for maintenance (small, medium and large enterprises);

— ——consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

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

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

Building construction machinery and equipment — Truck mixers — —

Part 2: Safety requirements

1 Scope

This document specifies the safety requirements for truck mixers defined in ISO19711-1.

This document does not deal with carrier vehicles, e.g. trucks, tractors, construction machinery and mobile industrial handling equipment or other self-propelled vehicles.

This document does not include requirements which are covered in directives related to the construction of vehicles or national road regulations.

NOTE The use in public road traffic is governed by the national regulations.

This document deals with all significant hazards, hazardous situations and events relevant to truck mixers when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex D Annex D).). This document specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards during transportation, assembly, dismantling, disabling, scrapping, operation and maintenance of the truck mixer.

Figures to show examples in this document are listed in Annex A Annex A.

This document is not applicable to truck mixers manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 19711-1, *Building construction machinery and equipment — Truck mixers — Part 1: Terminology and commercial specifications*

IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments*

ISO 2867, *Earth-moving machinery — Access systems*

ISO 3457, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

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

ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13766--1, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 1: General EMC requirements under typical electromagnetic environmental conditions*

ISO 13766--2, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 2: Additional EMC requirements for functional safety*

ISO 13849--1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19711-1, ISO 12100 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ——ISO Online browsing platform: available at https://www.iso.org/obp

— ——IEC Electropedia: available at https://www.electropedia.org/

3.1
drum opening
opening for charging and discharging the drum

3.2
control station
unit with control devices for operating the functions of the truck mixer

Note 1 to entry: The control station can be a remote-control station with cable or cable-less.

2

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Note 2 to entry: See Figure A.1~~Figure A.1.~~

Note 3 to entry: Functions of the truck mixer include, e.g. rotation direction of drum, rotating speed, stop function of the drum, working light switch, power chute switch.

3.3
work station
place where the main control station of the drum drive is arranged, that is usually located near the discharge chute

Note 1 to entry: The work station is for operating the charging, mixing and discharging. The *operator* (3.8~~(3.8)~~) is either standing on ground level (see Figure A.1~~Figure A.1)~~) or in case of rear discharge type truck mixer, it can be on the tread at the rear underrun protective device. Additional control stations can be provided, e.g. in the cabin of the truck.

3.4
drum closure system
device to cover the *drum opening* (3.1~~(3.1)~~) partly or completely to prevent spilling of mixture

Note 1 to entry: The drum closure system is optional.

3.5
supporting arm
superstructure for carrying the charge device and discharge device and the working platform

3.6
rear splash guard
device below the drum preventing the drum from getting dirty

Note 1 to entry: The rear splash guard is provided on the rear discharge type truck mixer.

Note 2 to entry: See Figure A.15~~Figure A.15.~~

3.7
interface
connections that allow the transfer of physical forces, energies, commands and/or information (e.g. mechanical, hydraulic, pneumatic, electrical, electronical) between the mixer device and the truck or trailer on which it is mounted

3.8
operator
person authorised and trained to operate a truck mixer

Note 1 to entry: In general, the mixer operator is also the driver of the truck mixer.

3.9
normal operation
operation of the machine with all systems in function

3.10
emergency operation
operation of the machine with a system failure

EXAMPLE In case of energy source(s) or control system failure, a separate hydraulic power pack is connected; and the mixer device is operated by manual valve actuation under circumvention of the emergency-stop system.

3.11
visual aid
system that provides visual information without warning

Note 1 to entry: The system generally includes a monitor and camera.

3.12
visibility test rectangle (VTR)
VTR
rectangle located on the plane ground as reference, aligned symmetrically to the longitudinal axis of the truck mixer in order to test the *visual aid* (3.11(see Figure A.16))

Note 1 to entry: See Figure A.16.

3.13
truck mixer drum cleaning system
separate machine to remove residual mixture from the inside of the drum

4 Safety requirements and/or protective measures

4.1 General requirements

4.1.1 General

Machinery shall conform to the safety requirements and/or protective measures of this clause.

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

4.1.2 Mechanical hazards

4.1.2.1 Risk of slipping

The surface of means of access, e.g. steps, working platform, shall be slip-resistant. See ISO 2867:2011, Annex A, for examples of slip-resistant surfaces.

4.1.2.2 Risk of entanglement, crushing, shearing

To protect the operator from the risk of entanglement, crushing and shearing, fixed guards shall be provided in accordance with ISO 14120. Due to functional restrictions, the following exceptions to ISO 13857:2019, Table 3 and Table 4, shall apply.

For the empty truck mixer standing on level ground, Table 1Table 1 defines the minimum clearances between the drum and non-moving parts, with the hazard zone situated at a distance *W* from an imaginary vertical plane parallel to the longitudinal axis of the vehicle intersecting the most outer point of the vehicle (reference plane).

Table 1 — Minimum clearance *a* depending on the distance *W* to the reference plane

W	**Minimum clearance, *a***
≥ 800 mm	≥ 20 mm
< 800 mm	≥ 50 mm
NOTE See Figure A.3~~Figure A.3.~~	

Besides the general minimum clearances of Table 1~~Table 1.~~, further exceptions are defined in Table 2~~Table 2.~~.

Table 2 — Clearances for specific entanglement points

	Entanglement points	**Clearance**
1	drum roller cover - drum track ring	max. 10 mm (Figure A.6~~Figure A.6~~)
2	drum - supporting arm	min. 20 mm (Figure A.7~~Figure A.7~~)
3	drum - charge device bracket	min. 20 mm (Figure A.8~~Figure A.8~~)
4	drum - discharge hopper	min. 20 mm (Figure A.9~~Figure A.9~~)
5	drum - guard rail at working platform	min. 50 mm (Figure A.10~~Figure A.10~~)
6	drum closure system - discharge hopper	min. 20 mm (Figure A.11~~Figure A.11~~)
7	drum - extension chute	min. 20 mm (Figure A.12~~Figure A.12~~)
8	drum - extension chute with bracket	min. 20 mm (Figure A.13~~Figure A.13~~)
9	drum - concrete delivery pipe	min. 20 mm (Figure A.14~~Figure A.14~~)
10	drum - rear splash guard	min. 20 mm (Figure A.15~~Figure A.15~~)

The hazard zones shall be indicated by decals; and the residual risk shall be described (see 6.3.2~~6.3.2.~~).

4.1.2.3 Risk of impact, risk of injection

The hydraulic system shall be designed in accordance with ISO 4413.

The pneumatic system shall be designed in accordance with ISO 4414.

NOTE The hydraulic system and the pneumatic system of the truck or trailer are not covered.

The interface specified by the truck or trailer manufacturer shall be used.

4.1.3 Electrical hazards

Electrical installations shall conform to IEC 60204-1.

The interface specified by the truck or trailer manufacturer shall be used.

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4.1.4 Thermal hazards

Parts or surfaces that reach temperatures >75 °C under normal operating conditions shall be designed, constructed, positioned, or provided with a thermal guard to minimize the risk of contact from the workstation in accordance with ISO 3457.

For ergonomic data that can be used to establish temperature limit values for hot surfaces, see ISO 13732-1.

4.1.5 Noise

4.1.5.1 Noise reduction at the design stage

Machinery shall be designed and constructed in such a way that risks resulting from the emission of airborne noise are reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source.

When designing machinery, the available information and the technical measures to reduce noise at the source given in ISO/TR 11688-1 should be taken in to account.

NOTE ISO/TR 11688-2 gives useful information on noise-generation mechanisms in machinery.

Noise sources mainly include the power source(s), drum drive and the drum with its content. The power source on the truck is the main source of noise.

In case the truck is purchased by the truck mixer manufacturer, the truck mixer manufacturer is recommended to ask for a low-noise truck.

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

NOTE See also Annex B~~Annex B~~.

4.1.5.2 Information on noise emission

Information on noise emission shall be given in the information for use (see 6.3.2~~6.3.2)~~.).

4.1.6 Electromagnetic compatibility (EMC)

Truck mixers with combustion engine shall conform to the requirements of electromagnetic compatibility as specified in ISO 13766-1 and ISO 13766-2.

Electric grid-connected truck mixers shall conform to IEC 61000-6-2.

Any other drive design or combination of drive designs shall conform to the applicable standards.

4.2 Control system

4.2.1 Stop system

4.2.1.1 Emergency stop

The machine shall have an emergency stop at each control station (see also 4.2.3~~4.2.3)~~.). The emergency stop shall conform to ISO 13850 and shall stop all power-driven machine functions.

NOTE According to the state of the art, the energy source(s), for example, the engine of the truck, auxiliary motor, can stay in operation.

Stop category 0 according to IEC 60204-1:2016, 9.2.2, shall be fulfilled.

The emergency-stop system shall fulfil performance level c according to ISO 13849-1.

4.2.1.2 Normal stop

A normal stop device shall be provided to bring the machine to a complete stop. In case of a combustion engine, the ignition lock (key- and keyless-systems) shall be considered as a normal stop device. In case of an electric drive, an additional supply disconnecting device according to IEC 60204-1:2016, 5.3 and 9.2.5.3, shall be provided. Stop category 0 according to IEC 60204-1:2016, 9.2.2, shall be fulfilled.

4.2.1.3 Starting of the machinery

An intended control device for starting the operation of the machinery shall be provided.

4.2.1.4 Restarting of the machinery

When restarting the machinery after a stoppage, an unexpected start-up of hazardous functions of the machine shall be prevented. To prevent the unexpected start-up of the truck mixer, the safety-related part of the control system shall fulfil performance level c according to ISO 13849-1.

4.2.1.5 Devices for switching off for prevention of unexpected start-up

Means to isolate machinery from energy sources shall be provided and shall be capable to be locked. For a truck mixer, the ignition key of the truck or the ignition key of the auxiliary engine are considered to fulfil the requirement.

4.2.2 Multiple control stations

If there is more than one control station at the machine, the respective function shall only be possible from one control station at the same time according to IEC 60204-1: 2016, 9.2.7.4.

The safety-related part of the control system shall fulfil performance level c in accordance with ISO 13849-1.

NOTE A mechanical control system where multiple levers are connected to activate the same function at the same time does not fulfil the requirements of 4.2.2~~4.2.2~~.

4.2.3 Cable-less remote control

A cable-less remote control is considered a control station. All requirements for control systems equally apply for cable-less remote controls, except for the emergency stop.

A cable-less remote control shall be equipped with a stop function according to IEC 60204-1:2016, 9.2.7.3. The safety-related part of the stop system shall fulfil performance level c according to ISO 13849-1. In case of the presence of a cable-less remote control, the machine shall be equipped with at least one emergency stop at the rear (see 4.2.1.2~~4.2.1.2~~).

4.3 Manual control devices for emergency operation

Manual control devices for emergency operation, for example, to discharge the drum, shall be protected against unintended use, for example, by a fixed guard, a distance guard or the structure of the machinery acting as a guard. The use of these manual control devices shall be described~~{~~ [see 6.2.3.1~~6.2.3.1~~ b~~}~~].

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4.4 Positioning of control devices

4.4.1 Control devices at the work station

The control devices at the work station close to drum opening shall be positioned in a distance from the ground between 800 mm and 1 800 mm.

4.4.2 Other control devices

Handling positions of other control devices and equipment used on the construction site shall be positioned in a maximum height from the ground or from the tread on the rear underrun protective device according to Table 3~~Table 3~~.

Table 3 — Maximum height of other control devices

Frame height	Maximum height of other control devices
Up to 1 000 mm	1 800 mm
Higher than 1 000 mm up to 1 100 mm	1 900 mm
Higher than 1 100 mm	2 000 mm

4.5 Working lights

For the illumination of the work station, at least one working light shall be provided with a minimum light power of 800 lm.

4.6 Additional removable equipment

Additional, removable equipment (e.g. extension chutes) and tools to be handled manually by the operator shall have a maximum mass of 25 kg each. Means shall be provided for the operator to fix such equipment and to secure it against unintended movement.

4.7 Interface mixer device and truck or trailer

The interface between the mixer device and the truck or trailer shall be designed and constructed in accordance with the specifications defined by the truck or trailer manufacturer.

4.8 Drum

4.8.1 Drum access hole

At least one drum access hole shall be provided. The size of a drum access hole shall have a minimum clear diameter of 500 mm except in the following cases. The mass of a drum access hole cover shall not exceed 25 kg (see ISO 2867:2011, 5.11).

For a drum of a smaller size with a rated drum capacity up to 6 m^3, it shall have a minimum diameter of 420 mm. For a drum of a larger size with a rated drum capacity 6 m^3 and over, a minimum diameter of 500 mm shall apply.

If the rectangular or oval shape is used for the opening, the larger opening dimension shall be at a minimum 500 mm; and the smaller opening dimension shall be at a minimum 400 mm.