



# SLOVENSKI STANDARD

## SIST EN 12001:2012

01-november-2012

Nadomešča:

SIST EN 12001:2004+A1:2010

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### Stroji za transport, brizganje in polaganje betona in malte - Varnostne zahteve

Conveying, spraying and placing machines for concrete and mortar - Safety requirements

Förder-, Spritz- und Verteilmaschinen für Beton und Mörtel - Sicherheitsanforderungen

Machines pour le transport, la projection et la distribution de béton et mortier - Prescriptions de sécurité

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**Ta slovenski standard je istoveten z EN 12001:2012**

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#### **ICS:**

91.220

Gradbena oprema

Construction equipment

**SIST EN 12001:2012**

**en,fr,de**

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EUROPEAN STANDARD

**EN 12001**

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2012

ICS 91.220

Supersedes EN 12001:2003+A1:2009

English Version

## Conveying, spraying and placing machines for concrete and mortar - Safety requirements

Machines pour le transport, la projection et la distribution  
de béton et mortier - Prescriptions de sécurité

Förder-, Spritz- und Verteilmaschinen für Beton und Mörtel  
- Sicherheitsanforderungen

This European Standard was approved by CEN on 6 July 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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## Contents

	Page
Foreword.....	4
Introduction .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 List of significant hazards .....	9
5 Safety requirements and/or protective measures .....	11
5.1 General.....	11
5.2 Requirements common to all machines.....	11
5.2.1 Hazards resulting from the failure of hydraulic or pneumatic systems.....	11
5.2.2 Risk of slipping .....	11
5.2.3 Electrical hazards .....	11
5.2.4 Stop system.....	11
5.2.5 Thermal protection and exhaust fumes .....	12
5.2.6 Ergonomics .....	12
5.2.7 Multiple control stations .....	12
5.2.8 Fixed guards.....	12
5.2.9 Requirements for transport and travel .....	12
5.2.10 Control-system requirements (electrical and hydraulic).....	12
5.2.11 Stability .....	14
5.2.12 Noise .....	14
5.2.13 Electromagnetic compatibility (EMC).....	15
5.3 Requirements for specific machines .....	15
5.3.1 Mobile and stationary concrete pumps and shotcreting machines (see Annex A).....	15
5.3.2 Mortar-conveying and spraying machines (see Annex A) .....	19
5.3.3 Mobile and stationary concrete-placing booms (see Annex A).....	21
5.3.4 Delivery-line systems (see Annex A).....	24
6 Verification of safety requirements and/or protective measures .....	24
7 Information for Use.....	26
7.1 General.....	26
7.2 Accompanying documents .....	27
7.2.1 Instruction Handbook.....	27
7.2.2 Log Book .....	30
7.3 Marking .....	30
7.3.1 General.....	30
7.3.2 Concrete pumps, shotcreting machines, mortar-conveying and spraying machines .....	31
7.3.3 Mobile and stationary concrete-placing booms .....	31
7.3.4 Delivery-line system .....	31
7.3.5 Pipes, hoses and connecting elements .....	31
Annex A (informative) Diagrams of different machines .....	33
Annex B (normative) Log Book for concrete pump and concrete-placing boom .....	40
B.1 General.....	40
B.2 Preliminary remarks and assemblies .....	41
B.3 Master record sheet.....	41
B.4 Master record sheet for verification of stationary machines .....	42
B.5 Master record sheet for verification of the other machines .....	42
B.6 Supplements to the master record sheet .....	42
B.7 Inspection records.....	42

B.7.1	General.....	42
B.7.2	Classification of mobile support structure .....	47
B.7.3	Example of support structure .....	48
B.7.4	Inspection report for concrete-placing boom.....	49
B.7.5	Inspection report for concrete pump.....	54
<b>Annex C</b>	<b>(normative) Noise test code for machines and equipment for conveying, spraying and placing concrete and mortar .....</b>	<b>57</b>
C.1	Scope .....	57
C.2	Determination of the A-weighted sound power level.....	57
C.2.1	General.....	57
C.2.2	Measurement surface and microphone positions .....	57
C.3	Determination of the A-weighted emission sound pressure level at workstations.....	58
C.3.1	General.....	58
C.3.2	Workstations .....	58
C.4	Operating conditions.....	58
C.4.1	Operating conditions during test.....	58
C.4.2	Test under load .....	59
C.4.3	Period of observation.....	59
C.5	Information to be recorded during the test.....	59
C.6	Information to be reported.....	59
C.7	Declaration and verification of noise emission values.....	59
<b>Annex D</b>	<b>(normative) Remote control – Function allocation .....</b>	<b>61</b>
<b>Annex ZA</b>	<b>(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC .....</b>	<b>62</b>
<b>Bibliography</b> .....		<b>63</b>

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**EN 12001:2012 (E)****Foreword**

This document (EN 12001:2012) 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 February 2013, and conflicting national standards shall be withdrawn at the latest by February 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12001:2003+A1:2009.

The following standard has been substantially restructured and revised compared to its preceding version EN 12001:2003+A1:2009 including a thorough revision of the incorporation of the requirements of EN ISO 13849-1:2008.

Attention is drawn to the fact that the following list of technical changes is non-exhaustive and shall not replace a thorough reading of the complete text.

- iTeh STANDARD PREVIEW**  
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- The scope and the definitions have been refined.
  - Clause 5 - Safety Requirements and/or protective measures - has been totally revised and restructured by updating and amending all requirements where necessary.
  - The texts on verification in Clause 6 have been edited and put into a table for better reading. The requirements for the Information for Use (Clause 7) have been rearranged and completed where appropriate.
  - Annex B has been edited and completed where necessary. Annex C (Noise test code) underwent a complete revision to incorporate requirements of additional normative references. The function allocation for the remote control has been moved from informative Annex A to a new normative Annex D.

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, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

This document is a type-C standard as stated in EN ISO 12100:2010.

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

When provisions of this type-C standard are different from those that 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.

NOTE Some machines covered by this standard present risks that are very similar to mobile cranes.

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## EN 12001:2012 (E)

## 1 Scope

### 1.1 This European Standard specifies the safety requirements for

- conveying machines,
- spraying machines,
- placing machines, and
- delivery line systems

for concrete and mortar as defined in the definitions in 3.3 to 3.6.

The machinery can be stationary or mobile.

This European Standard does not cover:

- machines that are mobile during conveying, spraying and placing;
- cabins for any machines covered by this standard;
- additional functions beyond conveying, spraying and placing concrete and mortar, e.g. separate mixing function or crane function;
- requirements for operation in tunnels;
- support structures (i.e. tower systems) not exclusively designed for the use with concrete distribution booms.

This European Standard does not establish the additional requirements for operations subject to special rules (e.g. potentially explosive atmospheres, supply by electrical networks where voltage, frequency and tolerance differ from those of the public supply, earthquake, lightning, using on public roads).

**1.2 This European Standard deals with all significant hazards, hazardous situations and events relevant to conveying, spraying and placing machines when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4). This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards during transportation, assembly, dismantling, disabling, scrapping, operation and maintenance.**

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

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 614-1:2006+A1:2009, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 894-1:1997+A1:2008, *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+A1:2008, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3:2000+A1:2008, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 13309:2010, *Construction machinery — Electromagnetic compatibility of machines with internal power supply*

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

EN ISO 2867:2011, *Earth-moving machinery — Access systems (ISO 2867:2011)*

EN ISO 3744:2010, *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 3744:2010)*

EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 11201:2010, *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 11201:2010)*

EN ISO 11204:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections (ISO 11204:2010)*

EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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

EN ISO 13732-1:2008, *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 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

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

EN ISO 13855:2010, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)*

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

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

**EN 12001:2012 (E)****3.1****concrete and mortar**

homogeneous mix comprised of cement, graded aggregate and water plus additives

**3.2****additive**

material added to concrete or mortar to change the properties of the mix

**3.3****conveying, spraying and placing machine for concrete****3.3.1****concrete pump**

machine with a hopper to accept concrete for pumping (see example Figure A.1)

Note 1 to entry: A concrete pump is either a piston pump or a peristaltic pump. The concrete hopper can be fitted with an agitator. The concrete pump can be mounted on a truck, trailer or special-purpose vehicle and should only be operated in stationary position. The pumping is achieved via the mechanical transport of the material through delivery lines. The concrete pump can be used in combination with a concrete-placing boom or as a component of a shotcreting machine (see example: Figure A.1).

**3.3.2****shotcreting machine**

machine with a hopper to accept concrete for spraying

Note 1 to entry: The hopper can be fitted with an agitator. The spraying is achieved via the mechanical or pneumatic transport through delivery lines. Pneumatic concrete spraying machines can be used with or without air chambers. The shotcreting machine can be self-propelled or mounted on a trailer and should only be operated in stationary position (see example: Figure A.1).

**3.4****mortar-conveying and spraying machine**

machine for the conveying and/or spraying of mortar

Note 1 to entry: The conveying is realised by mechanical (see example: Figures A.2 a), A.3 and A.4) or pneumatical (see example: Figure A.2 b)) transport through delivery lines. Regarding pneumatic delivery, the hopper is actually a pressurised air chamber (see example: Figure A.2 b)). For mechanical drive, the pumping is realised by a screw pump. A mixer can be integrated (see example: Figure A.2 a)). The conveying and spraying machine can be mounted on a trailer, but should only be operated in stationary position (see example: Figures A.2, A.3 and A.4).

**3.5****concrete-placing boom**

power-driven, slewable device consisting of one or more extending or fold-out parts for guiding the delivery line

Note 1 to entry: This concrete-placing boom may be mounted on a truck, trailer or special-purpose vehicle (e.g. for terrain, tunnel or rail application). The concrete-placing boom can be self-propelled or towed, but should only be operated in stationary position (see Figures A.1 b) and A.5).

**3.6****delivery-line system**

entirety of pipes, hoses, couplings, valves and end hoses through which the concrete, mortar or their constituents are to be transported, including drive and control panel

**3.7****control station/panel****3.7.1****control station for normal operation**

place where the control device governing the machines for normal operation is located

Note 1 to entry: A distinction is made between:

- control station on/at the machine;
- remote-control panel.

A machine can be fitted with more than one control device.

### 3.7.2

#### **emergency-control station**

control station not foreseen for normal operation, but to bring the machine into a safe status in case of a control failure

Note 1 to entry: See 3.9, emergency operation.

### 3.8

#### **normal operation**

operation of the machine with all systems functioning

Note 1 to entry: Exceptions: repair and maintenance, emergency operation.

### 3.9

#### **emergency operation**

operation of the machine under circumvention of the emergency-stop system

Note 1 to entry: Emergency operation can be: operation of a machine with system malfunction driven by a hydraulic power pack and operated via manual valve control because of engine failure.

### 3.10

#### **maximum delivery pressure**

maximum pressure in the delivery line system including the case of blockage in the delivery line system

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## 4 List of significant hazards

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

Table 1 — List of significant hazards

	Hazards	Locations/circumstances/consequences	see Subclause/Annex:
4.1	Mechanical hazards		
4.1.1	Crushing	Accessibility to zones between fixed and moving parts	5.3.1.1, 5.3.1.2, 5.3.1.3, 5.3.1.4, 5.3.1.5, 5.3.1.7, 5.3.2.1, 5.3.2.2, 5.3.2.3, 5.3.2.6, 5.3.3.2, 5.3.3.3
4.1.2	Shearing	Access to areas between fixed and moving parts outside and inside conveying and spraying machines Access to fixed and moving parts inside the hopper, either from the inlet or from another point	5.3.1.2, 5.3.1.3
4.1.3	Entanglement	Access to unprotected shafts	5.3.1.5, 5.3.2.3
4.1.4	Entrapment	Access to moving parts inside the hopper Access to the moving parts of the mixer Access to feed points of V-belt or chain-sprocket drives	5.3.1.5, 5.3.2.3
4.1.5	Impact	Access to moving parts of outriggers and concrete-placing boom	5.3.3.4, Figure A.5
4.1.6	High-pressure fluid ejection	Access to the hydraulic system Access to the delivery-line system	5.3.4
4.1.7	Ejection of parts or material	Access to outlet and wear of piping	5.3.1.1, 5.3.1.6, 5.3.2.4, 5.3.4
4.1.8	Strength	Loss of strength	5.3.1.6, 5.3.3.1
4.1.9	Stability	Loss of stability	5.3.1.6, 5.3.2.4, 5.3.3.1, 5.2.10.6.3, 5.2.10.7, 5.2.11
4.1.10	Slipping, tripping, falling	Access to areas where slipping, tripping or falling is possible	5.2.2, 5.3.1.6, 5.3.2.5, 5.3.3.1
4.2	Electrical hazards	Electrocution, electric shocks or burns	5.2.3, 5.2.7, 5.2.10
4.3	Thermal hazards	Access to hot machine parts	5.2.5
4.4	Noise hazards	Hearing loss and other physiological damage, impaired oral communication and perception of warning signals	5.2.12, 7.2.1.1 m), Annex C
4.5	Hazards from materials and consumables used	Contact with or inhalation of harmful fluids, gases, dust or aerosols	5.2.1, 5.2.5, 5.3.4, 7
4.6	Ergonomics	Injury due to poor design of control stations/panels Inadequate lighting Unsuitable operator's position for fuelling Inadequate access means	5.2.6 7.2.1.1 k) 5.2.6 5.2.2, 5.3.1.6, 5.3.2.5, 5.3.3.1
4.7	Hazards resulting from system failures	Failure of power supply Failure of control systems	5.2.1, 5.2.4, 5.2.7, 5.2.10, 5.3.2.4, 5.3.3.2
4.8	Electromagnetic compatibility (EMC)	Unforeseeable functions of the machine and/or disturbance of external devices	5.2.13

## 5 Safety requirements and/or protective measures

### 5.1 General

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

In addition, the machine shall be designed according to the principles of EN 12100:2010 for hazards that are relevant, but not significant, and which are not dealt with by this document (e.g. sharp edges).

NOTE DIN 15018-1:1984, DIN 15019-2:1979, DIN 24117:2007 and DIN 24118:2007 are suitable for the conceptual verification by calculation.

The general section (see 5.2) deals with hazards common to all conveying, spraying and placing machines. The specific section (see 5.3) covers the hazards related to the individual type of machines.

### 5.2 Requirements common to all machines

#### 5.2.1 Hazards resulting from the failure of hydraulic or pneumatic systems

The hydraulic system shall be designed in accordance with EN ISO 4413:2010. The following shall be especially taken into account:

- line breaks during operation (e.g. line-break protective devices);
- maintenance and servicing work to be carried out (provision of check/vent valves, mechanical locking devices, etc.).

#### 5.2.2 Risk of slipping

Workstations, access walkways and gangways shall be of an anti-slip type, e.g. checker plates or gratings, according to EN ISO 2867:2011.

#### 5.2.3 Electrical hazards

Electrical installations shall comply with EN 60204-1:2006.

#### 5.2.4 Stop system

##### 5.2.4.1 Emergency-stop device

The emergency-stop device shall comply with EN ISO 13850:2008.

The machine shall be equipped with an emergency-stop device according to EN 60204-1:2006, 9.2.5.4.2, stop category 0. Machines shall have an emergency-stop device at each control station. Cable remote control stations are considered as being control stations on the machine.

Controls not intended for normal operation, not included in the control system of the emergency-stop device (see 3.9, emergency operation) shall be safeguarded against unintended use and be described in the Information for Use.

##### 5.2.4.2 Stop system for cable-less remote control

The cable-less remote control shall be equipped with a stop function according to EN 60204-1:2006, 9.2.7.3.

**EN 12001:2012 (E)****5.2.5 Thermal protection and exhaust fumes**

The maximum temperature of touchable surfaces shall comply with EN ISO 13732-1:2008 taking a contact time of 1 s into account.

Where necessary, guards or thermal insulation material shall be used.

Exhaust fumes shall be conducted away from operator workstations.

**5.2.6 Ergonomics**

The general requirements of EN 614-1:2006+A1:2009, EN 894-1:1997+A1:2008, EN 894-2:1997+A1:2008 and EN 894-3:2000+A1:2008 shall be used for the ergonomic aspects.

**5.2.7 Multiple control stations**

If there is more than one control station at the machine, the respective function (e.g. start-up, shutdown, open) shall only be possible from one control station. Priority switching from one control station to another shall be possible. The control system shall be in accordance with EN ISO 13849-1:2008, Performance Level c.

**5.2.8 Fixed guards**

The fixing systems of fixed guards shall remain attached to the guards or to the machinery when the guards are removed. Fixed guards shall follow the design principle as defined in EN 953:1997+A1:2009.

**5.2.9 Requirements for transport and travel**

Means shall be provided for the driver before transport to check that items are in transport position (e.g. direct vision, mirrors, warning lights, buzzers).

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**5.2.10 Control-system requirements (electrical and hydraulic)****5.2.10.1 General**

The parts of the control system implementing the safety functions shall fulfil the performance levels as defined in EN ISO 13849-1:2008 in accordance with the following clauses.

**5.2.10.2 Guards/covers**

Guards intended to be opened once a day or more (e.g. hopper grill-type guards) shall be interlocked so that the dangerous movement (e.g. movement of material distribution valve in the hopper or of the agitator) automatically stops within 0,5 s after they are opened. The overall part of the control system performing the stop function shall fulfil Performance Level c.

However, if this is used less than once a day, the guard may be a fixed guard.

**5.2.10.3 Movable machine parts**

Machine parts that safeguard dangerous movements and are intended to be moved for access once a day or more (e.g. see 5.3.2.3) shall be considered as moveable interlocking guards. The dangerous movements shall automatically stop within 0,5 s after the guards are opened. The overall part of the control system performing the stop function shall fulfil Performance Level c.

#### 5.2.10.4 Support system

##### 5.2.10.4.1 Control system of the support system for full operating range

The control system of the support system (e.g. outriggers) for the full operating range of the boom shall fulfil Performance Level c.

The control system of the support system shall be interlocked with the boom-control system that when activating the boom function, the correct horizontal position of the outriggers shall be verified.

It is not required to verify the vertical outrigger movement.

Adjusting of the outriggers with the boom not in the stored position may be allowed.

##### 5.2.10.4.2 Control system of the support system for reduced operating range

The control system of the support system (e.g. outriggers) and boom for reduced support area and reduced operating range of the boom shall fulfil Performance Level d.

The control system of the support system shall be interlocked with the boom-control system that only when the boom is in stored position, the support system can be operated.

When activating the boom function, the correct position of the outriggers and vertically the ground contact of the outriggers shall be verified.

Adjusting of the outriggers with the boom not in the stored position shall be allowed only when the boom position is verified that it does not put a load on the outrigger to be moved.

Hydraulic cylinders shall be equipped with hydraulic line break protective devices (e.g. load-holding valves).

##### 5.2.10.5 Emergency-stop device

The overall part of the control system performing the emergency-stop function shall fulfil Performance Level c.

#### 5.2.10.6 Concrete-placing boom including slewing mechanism

##### 5.2.10.6.1 Control system of the concrete-placing boom for full operating range

The control system of the concrete-placing boom for full operating range of the boom shall fulfil Performance Level c. The control system of the boom shall be interlocked with the support system that only when the support system is fully deployed, the boom can be operated.

##### 5.2.10.6.2 Control system of the concrete-placing boom for reduced operating range

The control system of the boom shall be interlocked with the support system that only when the support system is deployed in a manner allowed by the manufacturer, the boom can be operated. The system shall verify that the boom can only be moved in the allowed operation area. The control system of the concrete-placing boom for reduced support area and reduced operating range of the boom shall fulfil Performance Level d.

Hydraulic cylinders shall be equipped with hydraulic line break protective devices (e.g. load-holding valves).

##### 5.2.10.6.3 Control system of the concrete-placing boom for cleaning procedure

Necessary movements of the boom for cleaning procedures of the concrete pump can be allowed without a fully deployed support system. Only those movements shall be possible that do not cause loss of stability without support system.