BS EN 12001:2012

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

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National foreword

This British Standard is the UK implementation of EN 12001:2012. It supersedes BS EN 12001:2003+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/513/-/8, Concrete plant.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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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

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Contents

Page

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of an identical text or by endorsement, at the latest by February 2013, and conflicting national standards shall be withdrawn at the latest by February 2013.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.

— 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.

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.

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

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.

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).

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.

The control system shall be designed in the same way as the control system of the placing boom (see 5.2.10.6.1 or 5.2.10.6.2).

5.2.10.7 Moveable counterweight and active suspension system

Moveable counterweight or moveable components acting as counterweight shall be locked in position before the operation of the concrete-placing boom.

If the movement is power-driven, the power supplies shall be interlocked to ensure correct operation sequence between concrete-placing boom and counterweight.

If a malfunction of the moveable counterweight can lead to the overturning of the machine, the control system shall fulfil Performance Level d.

5.2.10.8 Warning device for travelling position

If a control system is employed to fulfil 5.2.9, it shall fulfil Performance Level b.

5.2.11 Stability

5.2.11.1 Safety against tip-over

Machinery and its components and fittings shall be stable enough to avoid overturning, falling or uncontrolled movements during transportation, assembly, dismantling and any other action involving the machinery.

NOTE DIN 24117:2007 is suitable for the stability calculation or load test (measurement) of a concrete pump with placing boom.

5.2.11.2 Stability of mortar-conveying and spraying machines according to Figure A.2, A.3 and A.4

The stability shall be guaranteed up to an inclination of 10 degrees in each direction during operation.

5.2.12 Noise

5.2.12.1 Noise reduction at the design stage

Main noise sources are the power source, compressors and hydraulic pumps.

When designing machinery, the available information and the technical measures to reduce noise at the source given in EN ISO 11688-1:2009 shall be taken into account.

NOTE EN ISO 11688-2 gives useful information on noise-generation mechanisms in machinery. If it is not possible to reduce noise emission at the source by design efficiently, it is recommended to equip the machines with protective measures/devices (e.g. encapsulation) to reduce the noise emitted.

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.

5.2.12.2 Information on noise emission

Information on noise emission shall be given in the Information for Use (see 7.2.1.1 m)). If sales literature provides performance data, the same information on noise emission as that given in the Information for Use shall be included.

5.2.13 Electromagnetic compatibility (EMC)

Conveying, spraying and placing machines for concrete and mortar shall comply with the requirements of electromagnetic compatibility as specified in EN 13309:2010. For electrically driven machines, the EMC requirements for the industrial sector shall be applied.

5.3 Requirements for specific machines

5.3.1 Mobile and stationary concrete pumps and shotcreting machines (see Annex A)

Table 2 — Mobile and stationary concrete pumps and shotcreting machines

<table>
<tr><th>Component</th><th>Hazard group</th><th>Hazard</th><th>Safety measures</th></tr>
<tr><td>5.3.1.1
Hopper</td><td>Mechanical</td><td>Crushing between agitator, valve, hopper wall and grill-type type guard</td><td>Grill-type guards in hopper openings of concrete pumps and shotcreting machines on filling or cleaning openings shall be movable guards interlocked with the drives of the agitators/valves in such a way that the drives are stopped within 0,5 s when opened. The closing of the grill-type guard shall not restart operation. The restarting in operating conditions may be effected by voluntary actuation of a device other than the normal starting device, positioned in a way that the operator is able to see the hopper. The interlocking control system of the grill-type guard shall fulfil Performance Level c.

Grill-type guards shall be secured by design or lockable in their open position.

With concrete pumps and shotcreting machines, the filling opening of the hopper shall be secured by a grill-type guard in the following dimensions:
<table>
<tr><th colspan="2">Grill-type guard, unidirectional type</th><th colspan="2">Grill-type guard, mesh type</th></tr>
<tr><th>a (Figure 4)</th><th>h (Figure 1 and 2)</th><th>b (Figure 3)</th><th>h (Figure 1 and 2)</th></tr>
<tr><td>70 mm</td><td>200 mm</td><td>80 mm</td><td>180 mm</td></tr>
<tr><td>35 mm</td><td>100 mm</td><td>70 mm</td><td>150 mm</td></tr>
<tr><td></td><td></td><td>40 mm</td><td>90 mm</td></tr>
</table>
a = maximum permissible clearance between rods in mm

b = maximum permissible mesh width in mm

h = minimum permissible clearance of grill-type guards from crushing point between agitator and hopper wall in mm

NOTE These clearances between the rods or mesh widths are the best compromise between safety and performance to allow the bulk material “concrete” to be filled (other clearances hamper the bulk material).

Stepping on the grill-type guard shall be prohibited (see 7.2.1.1 h)).

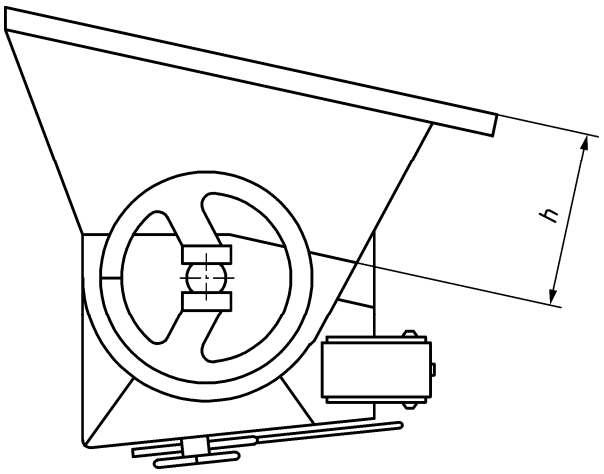
Moving mechanical components (e.g. switch mechanism for concrete valve) shall be covered with a fixed guard according to EN 953:1997+A1:2009.</td></tr>
</table>

Table 2 *(continued)*

Component	Hazard group	Hazard	Safety measures
	Mechanical	Ejection of parts or material due to low concrete level in hopper or during back pumping	The proper concrete filling height in the hopper during the pumping process shall be defined. For concrete pumps, a cover shall be provided to prevent ejection of concrete (see 7.2.1.1 h)). Cleaning procedure shall be defined in the Information for Use (see 7.2.1.1 i)).

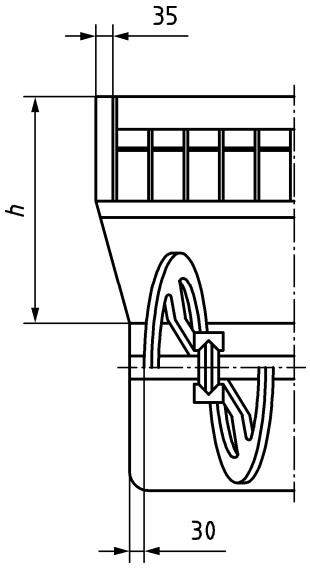
Mobile and stationary concrete pumps and shotcreting machines:

Dimensions in millimetres



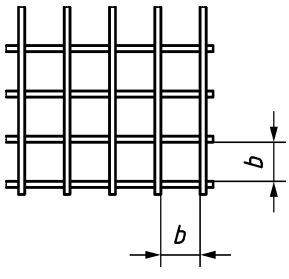
Key
h minimum permissible clearance of grill-type guards from crushing point between agitator and hopper wall in mm

Figure 1 — Guard (grill) – crushing-point clearance



Key
h minimum permissible clearance of grill-type guards from crushing point between agitator and hopper wall in mm

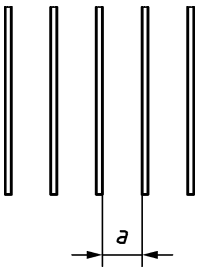
Figure 2 — Hopper wall – guard clearance



Key

b maximum permissible mesh width in mm

Figure 3 — Guard (grill), mesh type



Key
a maximum permissible clearance between rods in mm

Figure 4 — Guard (grill), unidirectional type

Table 2 *(continued)*

Component	Hazard group	Hazard	Safety measures
5.3.1.2 Discharge opening of the hopper	Mechanical	Crushing or shearing between fixed and movable parts	The control device(s) for power-operated discharge-opening covers shall be of hold-to-run type. The distance from the control device(s) to the crushing points shall be large enough to ensure that, when the control device(s) is (are) released, the hazard points are accessible only when the hazardous movement has ended. The distances shall be in accordance with EN ISO 13855:2010. The size of the discharge opening shall allow material to leave the hopper during cleaning procedure without having to reach into the hazard zone under normal operating conditions. Description of the danger shall be given in the Information for Use including appropriate signage to the dangerous point on the machine (see 7.2.1.1 i) and 7.2.1.1 j)).
5.3.1.3 Delivery-line connection		Crushing or shearing between fixed and movable parts	Description of the danger shall be given in the Information for Use including appropriate signage to the dangerous point on the machine (see 7.2.1.1 h), 7.2.1.1 i) and 7.2.1.1 j)).
5.3.1.4 Pump	Mechanical	Crushing between fixed and movable parts	Crushing points shall be protected by fixed guards. Moving mechanical components (e.g. between waterbox and delivery piston) shall be covered with a fixed guard in accordance with EN 953:1997+A1:2009.
5.3.1.5 Drive area	Mechanical	Crushing between hinged guards and machine parts	Hinged guards shall be located or equipped in such a way that they cannot close inadvertently when in open position.
		Entanglement by free-running shafts	Fixed guards with distances according to EN ISO 13857:2008.
		Entrapment between V-belt and driving pulleys	Fixed guards with distances according to EN ISO 13857:2008.
5.3.1.6 Entire machine	Mechanical	Strength	The design of the machine shall be carried out using state-of-the art techniques (see 5.1). The intended use of the machine shall be considered.
		Stability due to faulty support on the subsoil	The maximum support forces occurring shall be marked on the outriggers.
		Loss of stability by the machine or parts thereof while being moved by lifting gear on the construction site	Machines or their individual components that can be moved or lifted with lifting gear for assembly purposes on construction sites shall be equipped with suitable lifting points.
		Ejection of parts or material	The machines shall be constructed in such a way that blockages in the delivery lines can be removed with minimised risk. This can be achieved with a reverse-pumping device.

Table 2 *(continued)*

Component	Hazard group	Hazard	Safety measures
	System failure	Inadvertent, uncontrolled movements of machine parts due to several control stations at the machine	The operation shall only be possible from one preselected control station. The actuating elements shall be securable against unauthorised operation and shall be positioned, designed and marked in such a way as to prevent mistaken identity.
		Stability due to malfunction of moveable counterweight, i.e. lifting axles and active suspension system	Verification of moveable counterweight, i.e. lifting axles, and active suspension system interlocked with operation of concrete-placing boom (see also 5.2.10.7).
		Loss of stability due to non-designated use of support system	Verification of support system interlocked with operation of concrete-placing boom (see also 5.2.10.4).
		Loss of stability due to non designated use of concrete-placing boom, i.e. not fully deployed system, use as a crane	Designated use and reasonable foreseeable misuse shall be defined by the manufacturer in the Information for Use (see also Clause 7).
	Mechanical	Slip, trip and fall	Access systems to walkways as well as walkways shall be in accordance with EN ISO 2867:2011 except for mobile concrete-placing booms and shotcrete booms. Information about access systems shall be given for mobile concrete-placing booms and shotcrete booms (see 7.2.1.1 h)). Information shall be given that the access to the machine during normal operation is prohibited (see 7.2.1.1 a) and 7.2.1.1 h)).
5.3.1.7 Concrete-placing boom	Mechanical	Crushing between movable concrete-placing boom parts and fixed machine parts, between moving machine parts and devices not belonging to the machine	See 5.3.3.3

5.3.2 Mortar-conveying and spraying machines (see Annex A)

NOTE For combined machines with mixers, see also EN 12151:2007.

Table 3 — Mortar-conveying and spraying machines

Component	Hazard group	Hazard	Safety measures
5.3.2.1 Hopper	Mechanical	Crushing between agitator, hopper wall and grill-type guard	Hoppers containing agitators or worm conveyors shall be protected with a grill-type guard as a fixed guard (see 7.2.1.1 h) and 7.2.1.1 j)). The mesh width may be at a maximum of 60 mm and the distance between guard and crushing point shall be at least 120 mm. In contrast, grill-type guards of mortar-conveyance machinery using compressors whose air chamber shall be pressure-sealed with a cover prior to conveyance after each filling and mixing operation may have a maximum mesh width of 70 mm. The grill-type guard shall have a minimum clearance of 120 mm from the crushing point between agitator or worm conveyor and hopper wall. Grill-type guards which are intended to be opened once a day or more shall be interlocked with the drives of reachable moving parts in such a way that the drives are stopped within 0,5 s when they are opened. If wet mortar is given into a hopper, cleaning of the hopper and moving parts inside once a day is essential. If cleaning is possible without opening the guard, the guard shall be permanently fixed and not removable. The cut-out mechanism shall not be circumvented by simple means. Hinged grill-type guards shall be located or equipped in such a way that they cannot close inadvertently when in opened position. Outlet openings shall be secured by a hopper or a guard, at the base of which a grill-type guard complying with the following specifications is mounted: Maximum permissible mesh width of grill 70 mm and minimum clearance between grill-type guards and crushing points 150 mm or maximum permissible mesh width of grill 40 mm and minimum clearance between grill-type guards and crushing points 120 mm. Interpolations are possible. Stepping on the grill-type guard shall be prohibited (see 7.2.1 h)).

Table 3 *(continued)*

Component	Hazard group	Hazard	Safety measures
5.3.2.2 Hopper	Mechanical	Crushing between hinged hopper and fixed machine parts	Movable hoppers shall be lockable in their limit position to prevent any inadvertent movement. To control the closing movement of power-operated hoppers, a hold-to-run control device shall be provided. The control device(s) shall have sufficient clearance from the crushing points. The clearance shall be large enough to prevent contact with moving parts. The view on the hazard zone shall be possible. An unexpected actuation shall not be possible.
5.3.2.3 Driving area	Mechanical	Crushing between moving and fixed parts after opening guards or machine parts	Crushing points shall be protected by fixed guards. Movable guards or machine parts which are intended to be opened once a day or more shall be interlocked with the drives of reachable moving parts in such a way that the drives are stopped within 0,5 s when the guards are opened. Hinged guards or covers shall be located or equipped in such a way that they cannot close inadvertently when in opened position.
		Entanglement by free-running drive shafts	Fixed guards with distances according to EN ISO 13857:2008, Table 4.
		Entrapment between V-belts and drive units	Fixed guards with distances according to EN ISO 13857:2008, Table 4.
5.3.2.4 Entire machine	Mechanical	Loss of stability by the machine or parts thereof while being moved by lifting gear on the construction site	Conveying and spraying machines or their individual components which are moved or lifted with lifting gear for assembly purposes on construction sites shall be equipped with attachment points.
		Uncontrolled movements of machine parts due to reciprocal controlling facilities at more than one control console	Operation possible from one pre-selected control console only (positive switchover essential).
		Initiation of hazardous movements	Actuating elements initiating hazardous movements shall be equipped with a hold-to-run control device. The control device(s) shall have sufficient clearance from the crushing points. The clearance shall be large enough to prevent contact with moving parts. The view on the hazard zone shall be possible. An unexpected actuation shall not be possible. Actuating elements shall be securable against unauthorised operation and shall be positioned, designed and marked in such a way as to prevent mistaken identity.

Table 3 *(continued)*

Component	Hazard group	Hazard	Safety measures
	Mechanical	Ejection of parts or material when the lock of the conveying vessel lid is being opened	The vessel lid shall be interlocked in such a way that it can only be opened when the system is depressurised.
		Whilst removing blockages	The machines shall be designed in such a way that persons are not endangered by ejection of returning material. Blockages in the delivery lines shall be removed with minimised risk. This can be achieved, for example, through appropriate designing of the return nozzle or by ejection-proof attachment of the return hose to the return nozzle and the mortar hopper or with a reverse-pumping mechanism.
5.3.2.5 Entire machine	Mechanical	Slipping on the way to workplaces for maintenance work	Access systems to walkways as well as walkways shall be in accordance with EN ISO 2867:2011. Exception: Where walkways in accordance with EN ISO 2867:2011 exceed the dimensions permitted by Road Traffic Licensing Regulations, information about access systems shall be given (see 7.2.1.1 h)). Information shall be given that the access to the machine during normal operation is prohibited (see 7.2.1.1 h)).

5.3.3 Mobile and stationary concrete-placing booms (see Annex A)

Table 4 — Mobile and stationary concrete-placing booms

Component	Hazard group	Hazard	Safety measures
5.3.3.1 Entire machine	Mechanical	Strength	The design of the machine shall be carried out using state-of-the-art techniques (see 5.1). The intended use of the machine shall be considered.
		Loss of stability by the machine or parts thereof while being moved by lifting gear on the construction site	Machines or their individual components that are moved or lifted with lifting gear for assembly purposes on construction sites shall be equipped with attachment points.
		Slipping on the way to workplaces for maintenance work	Access systems to walkways as well as walkways shall be in accordance with EN ISO 2867:2011 except for mobile concrete-placing booms and shotcrete booms. Information about access systems shall be given for mobile concrete-placing booms and shotcrete booms (see 7.2.1.1 h)). Information shall be given that the access to the machine during normal operation is prohibited (see 7.2.1.1 h)).

Table 4 *(continued)*

Component	Hazard group	Hazard	Safety measures
5.3.3.2 Outrigger	System failure	Inadvertent, uncontrolled movements of machine parts due to several control stations at the machine	The operation shall only be possible from one preselected control station. The movement of the boom and the outriggers shall not be possible at the same time (e.g. mode selector).
		Inadvertent initiation of hazardous movements	Outrigger controls shall be secured against inadvertent actuation: — They shall be hold-to-run control devices which can be disabled to secure against unauthorised/unintended movement (e.g. mode selector); — they shall be positioned, designed and marked in such a way as to prevent mistaken identity actuating elements which initiate hazardous movements; — Movements of extending or slewing mechanism of outriggers shall be less than or equal to 0,75 m/s; — Vertical movement of outriggers shall be less than or equal to 0,40 m/s if the actuating element is out of the working range; — Vertical movement of outriggers shall be less than or equal to 0,2 m/s if the actuating element is in the working range.
	Mechanical	Crushing between movable supports and fixed machine parts or devices not belonging to the machine	Actuating elements for slewing, telescoping and vertically adjustable devices shall be equipped with a hold-to-run control device together with an enabling control device and shall be located in a minimum distance of 0,5 m from the crushing point. The control circuits of the outriggers shall be independent of one another. Outriggers shall be able to be secured when in transport position.

Table 4 *(continued)*

Component	Hazard group	Hazard	Safety measures
5.3.3.3 Concrete-placing boom	Mechanical	Crushing between moving concrete-placing boom parts and fixed machine parts, between moving machine parts and devices not belonging to the machine	Concrete-placing boom controls shall be hold-to-run control devices which can be disabled to secure against unauthorised/unintended movement (e.g. mode selector). They shall be positioned, designed and marked in such a way as to prevent mistaken identity actuating elements which initiate hazardous movements. The actuating elements of portable control devices (remote control) are assigned in accordance with Annex D. Lifting and lowering movements at the end of the concrete-placing boom shall not exceed a maximum speed of 0,75 m/s when one concrete-placing boom arm is being actuated. The maximum speed when all movements at the end of the concrete-placing boom are activated simultaneously shall be less than or equal to 3 m/s. The end of the concrete-placing boom shall not be slewed at more than 1,5 m/s when maximum horizontal reach.
5.3.3.4 End hose	Mechanical	Impact due to uncontrolled movement (e.g. induced by pump defects) and detachment of the end hose	Additional safety means against detachment of the end hose or other extension lines. End hoses shall have no extension coupling, outlet sockets or other hazardous outlets, and their length shall not exceed 4 m if the end hose is guided by an operating person. If a delivery line other than the end hose is connected, it shall not be guided manually. The delivery line shall comply with the Information for Use issued by the manufacturer, with account being taken of stability.

5.3.4 Delivery-line systems (see Annex A)

Table 5 — Delivery-line systems

Component	Hazard group	Hazard	Safety measures
	Mechanical	High-pressure fluid ejection, pumped material emerging under high pressure	Pipes, hoses and their connections shall be designed in such a way as to withstand the maximum delivery pressure. The following safety factors shall be observed in regard to the maximum delivery pressure in new-state delivery systems: — end hoses: 1,75 — pipes, hoses and their connections as well as accessories (e.g. transfer valves): 2,00 — hoses and their connections for mortar-conveying and spraying machines: 2,50 Pipeline couplings shall be designed in such a way as to be securable against inadvertent opening. For pneumatic cleaning, the end hose shall be removable. A catching device for the cleaning means shall be provided (see 7.2.1.1 h)). Delivery-line systems shall be designed or equipped in such a way that blockages in delivery lines can be removed without danger, e.g. by providing a reverse pumping function. The machines shall be designed in such a way that there is no risk to persons from material ejected by reverse pumping.

6 Verification of safety requirements and/or protective measures

The design of the machines shall be checked by verification. This clause contains the methods for verification of conformity of machines with the requirements of Clause 5.

The verification shall be done in accordance with the following table.

Table 6 — Verification

Reference no. of Clause 5	Safety requirement and/or protective measure	Method of verification		
		Visual check (design)	Functional test	Measurement/ calculation
5.2.1	Requirements for failure of hydraulic or pneumatic systems	X	X	see 5.2.10.1
5.2.2	Requirements to avoid slipping	X		
5.2.3	Electrical installation	X	X	X for electrically driven machines only
5.2.4.1	Emergency-stop device	X	X	see 5.2.10.1
5.2.4.2	Stop system for cable-less remote control	X	X	see 5.2.10.1
5.2.5	Thermal protection and exhaust fumes	X		X for thermal protection only
5.2.6	Ergonomics	X	X	
5.2.7	Power supply, control systems	X	X	X for electrically driven machines only
5.2.8	Fixed guards	X		
5.2.9	Requirements for transport and travel	X	X	
5.2.10.1	General	X	X	X
5.2.10.2	Guards/covers	X	X	X
5.2.10.3	Movable machine parts	X	X	X
5.2.10.4.1	Control system of the support system for full operating range	X	X	X
5.2.10.4.2	Control system of the support system for reduced operating range	X	X	X
5.2.10.5	Emergency-stop device	X	X	X
5.2.10.6.1	Control system of the concrete-placing boom for full operating range	X	X	X
5.2.10.6.2	Control system of the concrete-placing boom for reduced operating range	X	X	X
5.2.10.6.3	Control system of the concrete-placing boom for cleaning procedure	X	X	X
5.2.10.7	Moveable counterweight and active suspension system	X	X	X
5.2.10.8	Warning device for travelling position	X	X	
5.2.11.1	Safety against tip-over [a]			X

[a] DIN 24117:2007 is suitable for the stability calculation or load test (measurement) of a concrete pump with placing boom.

Table 6 *(continued)*

Reference no. of Clause 5	Safety requirement and/or protective measure	Method of verification		
		Visual check (design)	Functional test	Measurement/ calculation
5.2.11.2	Stability of mortar-conveying and spraying machines according to Figure A.2, A.3 and A.4			X
5.2.12	Noise	X		X
5.2.13	Electromagnetic compatibility			X
5.3.1.1	Hopper	X	X	X
5.3.1.2	Discharge opening of the hopper	X	X	
5.3.1.3	Delivery-line connection	X		
5.3.1.4	Pump	X		
5.3.1.5	Drive area	X	X	
5.3.1.6	Entire machine	X	X	X
5.3.1.7	Concrete-placing boom	X	X	X
5.3.2.1	Hopper	X	X	X
5.3.2.2	Hopper	X		
5.3.2.3	Driving area	X	X	
5.3.2.4	Entire machine	X	X	X
5.3.2.5	Entire machine	X	X	X
5.3.3.1	Entire machine	X	X	X
5.3.3.2	Outriggers	X	X	X
5.3.3.3	Concrete-placing boom	X	X	X
5.3.3.4	Safety requirements for end hose	X		X
5.3.4	Delivery-line systems	X		X

7 Information for Use

7.1 General

The Information for Use shall cover all phases of the machine's lifetime.

The Information for Use shall be drawn up in accordance with EN ISO 12100:2010, 6.4.1.

7.2 Accompanying documents

7.2.1 Instruction Handbook

7.2.1.1 General

The Instruction Handbook shall be drawn up in accordance with EN ISO 12100:2010, 6.4.5. It shall contain specifications on personal protective equipment.

The Instruction Handbook shall define the intended use and indicate the reasonable foreseeable misuse of the machine and the identified remaining risks.

The Instruction Handbook shall inform about the following:

a) Operator:

   1) Competence and training of personnel in charge of operation and servicing of conveying and spraying machines and concrete-placing booms;

   2) Necessary knowledge and understanding of the Information for Use.

b) The need to keep the Instruction Handbook in a readily accessible place on the machine and, in addition, the Log Book for concrete-placing booms and concrete pumps;

c) Loading and transporting of the machine or preparing the truck for driving;

d) Mobility of the machine on unlevel terrain;

e) Installation of the machine;

f) Permitted delivery lines and instructions related to lengthening of conveying, spraying and placing equipment;

g) Instructions on connecting to the electrical supply and specifically the need to avoid connection to a household socket;

h) The need for the user/operator to check and to ensure that:

   1) the hazard zone of the machine is free of persons;

   2) nobody steps on the machine during normal operation, except to reach and stay on defined working places;

   3) stepping on grill-type guards subject to wear is prohibited;

   4) the subsoil (support area) can withstand the maximum load induced by the outriggers;

   5) protective devices are not altered or removed during operation;

   6) protective devices are refitted after servicing and maintenance work;

   7) operation is interrupted in the event of faults with an adverse effect on safety (e.g. leaking delivery line, damaged hydraulic lines on cylinders);

   8) the machine is secured against unauthorised use;

   9) before the restart, no one is in the hazard zone of the hopper and the end of the delivery-line system;

   10) an adequate distance is kept from excavated areas;

11) an adequate distance is kept to other present machinery. Special attention shall be paid to overlapping operating zones;

12) an adequate distance is kept from high voltage lines;

13) all moving parts are secured against uncontrolled movement when in travelling position;

14) the machine is never moved with the concrete-placing boom in an unintended position;

15) maintenance work, assembly and dismantling work, and inspections which cannot be carried out from ground level or fixed working places need to be carried out from independent working platforms;

16) the operator shall have a clear view of the hazard areas from the control position;

17) the probability of blockage is minimised by adjusting the operating conditions;

18) the electrical supply is disconnected before opening an electrical enclosure and the machine is not operated unless the electrical enclosure is fully closed;

19) personal protective equipment is used as specified;

20) the machine is not placed in zones where instability of subsoil is possible;

21) the machine is not placed in zones where materials can fall down onto the workplace;

22) the system is depressurised, e.g. by reverse pumping, before the delivery line is opened (also for blockage removal);

23) for pneumatic cleaning, the end hose shall be removed. A catching device shall be attached at the end of the delivery line. If a delivery hose is present in the delivery line system, it shall be secured against uncontrolled movements;

24) concrete-placing booms and end hoses shall not be extended beyond the length specified in the manufacturer's specifications;

25) the proper concrete filling height in the hopper is kept during the pumping process;

26) the hopper is covered during start up of the pumping process and back-pumping process to prevent ejection of material out of the hopper.

i) Cleaning procedure and disposal of the waste water;

j) Residual risks: existing residual risks shall be described exactly and instructions given to avoid hazardous situations (i.e. at cleaning, maintenance or emergency operation);

k) Workplace lighting;

l) The need for stationary concrete-placing boom to be verified after on-site assembly: the on-site assembly instruction for stationary machines and the need for them to be verified completely after on-site assembly.

m) Noise emission:

1) The noise declaration in accordance with Annex C.7;

2) if, after taking technical measures for noise control at source, noise emission levels are so high that further protection of the operator is necessary, the Instruction Handbook shall recommend possible measures to reduce noise emission further and, if necessary, the wearing of personal hearing protectors.

n) The specifications of the spare parts to be used when these affect the operator's health and safety;

o) The user shall be informed about his responsibility to arrange for reinspections to be carried out (see 7.2.1.3);

p) Maintenance (see 7.2.1.2).

7.2.1.2 Maintenance

The Instruction Handbook shall give data on maintenance of the hydraulic system, e.g. inspection intervals, location of liquid-level indicator, filling and drainage points, inspection and monitoring points, instructions on handling the hydraulic fluid used, pressure-relief mechanisms, data on servicing, operation and inspection of the hydraulic accumulator(s) and on the service period of the hydraulic hoses and their annual inspection for operational safety.

The Maintenance Manual shall contain the necessary information for maintenance as well as the respective safety precautions.

The spare-parts list shall contain and provide clear-cut identification of all safety-relevant spare parts and shall provide information on the location at which the parts are to be installed.

7.2.1.3 Reinspection

Concrete pumps and concrete-placing booms including their delivery lines shall be reinspected for operational reliability by a competent person nominated by the user at least once a year. The reinspection shall be carried out even if one year has not passed since the last inspection as soon as 1000 operating hours are achieved. The operating hours meter on the machine shall be used to determine when a reinspection is due. This operating-hours meter records the hours of pumping operations. The operating-hours meter shall always be kept in a functioning condition. It shall not be interfered with or altered in any way. Machines which are more than 5 years old shall be reinspected as soon as 500 operating hours are achieved, but at least once a year. Machines which are more than ten years old shall be reinspected as soon as 250 operating hours are achieved, but at least once a year.

All other machines shall be reinspected for operational reliability by a competent person nominated by the user at least once a year.

The regular reinspection is essentially a visual and functional inspection for safety-assessment purposes and shall be documented in the Log Book.

This reinspection shall comprise:

— reinspection of the condition of the components and devices with respect to cracking, damage, wear, corrosion and other changes;

— reinspection of the completeness and function of the safety devices;

— reinspection in order to establish whether defects discovered during the above mentioned inspections, which might impair safety, have been properly rectified.

In addition, the information for the user issued by the manufacturer shall be observed with respect to special instructions on maintenance and inspection.

7.2.1.4 Mobile and stationary concrete-placing boom

The Instruction Handbook shall inform about the following:

— The concrete-placing boom is designed for concrete with a maximum specific weight of 2400 kg/m³.

— The concrete-placing boom shall not be used as a crane if not otherwise defined by the manufacturer.

— The concrete-placing boom shall not be operated at higher wind speeds. If such a case occurs, the machine shall be put immediately into a safe position. The safe position shall be defined by the manufacturer.

NOTE DIN 24117:2007 is suitable for specifying the maximum wind speeds during which the concrete-placing boom should not be operated.

All persons shall be well clear of the hazard zone of the end hose when pumping is started and when pumping is continued after a break.

The operator shall have a clear view of the placing site if the machine is equipped with a remote control. If this is not possible, assistance shall be given by another worker.

Instructions on the maximum reaction forces occurring at the corners shall be observed during installation so that the support pressures can be transferred with certainty to the subsoil.

7.2.1.5 Delivery-line systems

Delivery-line systems shall be safely attached.

The minimum wall thickness of the delivery line for the maximum operating pressure shall be specified in the Instruction Handbook.

The Instruction Handbook shall contain information on the checking of the wear of pipe walls, especially in curved pipes.

7.2.2 Log Book

A Log Book shall be in accordance with Annex B and shall be supplied with the machine except for mortar machines. The user shall be informed about the need to fill in the Log Book with the result of any inspection and test.

NOTE The contents of the Log Book are independent from any Road Traffic Licensing Regulations.

7.3 Marking

7.3.1 General

All marking shall be visible, legible and durable with the following particulars, except for pipes, hoses and connecting elements:

— business name and full address of the manufacturer and, where applicable, his authorised representative;

— designation of machinery;

— year of construction, that is the year in which the manufacturing process is completed;

— serial or identification number, if any;

— designation of series or type, if any;

— mandatory marking[1)].

For the marking of pipes, hoses and connecting elements, see 7.3.5.

1) For machines and their related products intended to be put on the market in EEA, this is the CE marking as defined in the European applicable directive(s), e.g. Machinery, Low Voltage, Explosive Atmosphere, Gas Appliances.

7.3.2 Concrete pumps, shotcreting machines, mortar-conveying and spraying machines

Concrete pumps and mortar-conveying and spraying machines shall be marked visibly, legibly and durably with the following additional particulars:

— maximum operating pressure of the hydraulic system in bar;

— maximum delivery pressure in bar;

— power ratings of electrical equipment (voltage, frequency, output, etc.).

7.3.3 Mobile and stationary concrete-placing booms

Mobile and stationary concrete-placing booms shall be marked visibly, legibly and durably with the following additional particulars:

— maximum operating pressure of the hydraulic system in bar;

— maximum permissible outer diameter and wall thickness in millimetres;

— maximum length of end hose in metres;

— the maximum support forces occurring shall be marked on the outriggers;

— power ratings for electrical equipment (voltage, frequency, output, etc.);

— warnings on appropriate plates shall prohibit the use of the concrete-placing boom as a crane if not otherwise defined by the manufacturer and shall have data on safe clearances from high voltages lines.

7.3.4 Delivery-line system

Delivery-line systems shall be marked visibly, legibly and durably with the following additional particular:

— maximum working pressure in bar.

7.3.5 Pipes, hoses and connecting elements

7.3.5.1 Pipes, hoses and connecting elements for conveying of concrete and mortar

For the components pipes, hoses and connecting elements for the conveying of concrete and mortar, the following minimum marking is necessary and shall be marked visibly, legibly and durably:

— for steel pipes: maximum permissible outer diameter and wall thickness in millimetres;

— for rubber hoses: nominal diameter in millimetres;

— company logo or identification code;

— identification number of the component, i.e. part number;

— maximum working pressure in bar.

7.3.5.2 Pipes, hoses and connecting elements for mobile and stationary concrete-placing booms

For pipes, hoses and connecting elements for mobile and stationary concrete-placing booms, the following minimum marking is necessary and shall be marked visibly, legibly and durably:

a) for steel pipes: maximum permissible outer diameter and wall thickness in millimetres;

b) for rubber hoses: nominal diameter in millimetres;

c) company logo or identification code;

d) identification number of the component, i.e. part number;

e) maximum working pressure in bar;

f) component weight in kilograms;

   1) for concrete-holding components, i.e. hoses, elbows or pipes, the component weight including concrete at a specific weight of 2400 kg/m^3;

   2) for others (e.g. couplings, shut-off-valve), the component weight.

Annex A
(informative)

Diagrams of different machines

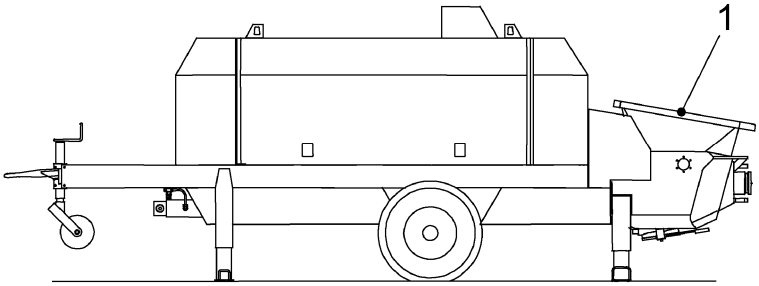


Figure A.1 a) — Example of a stationary concrete pump

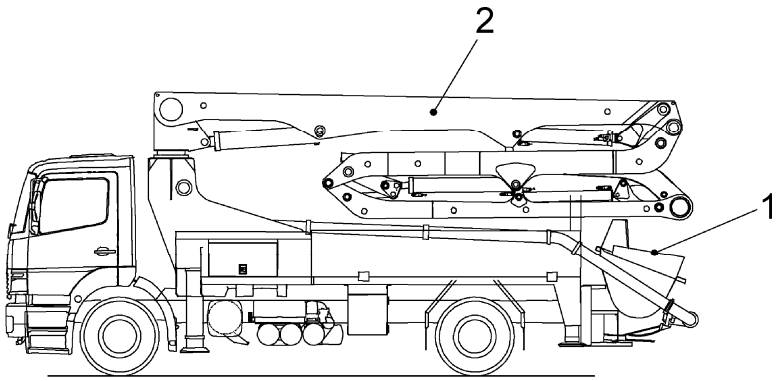


Figure A.1 b) — Example of a mobile concrete pump with placing boom

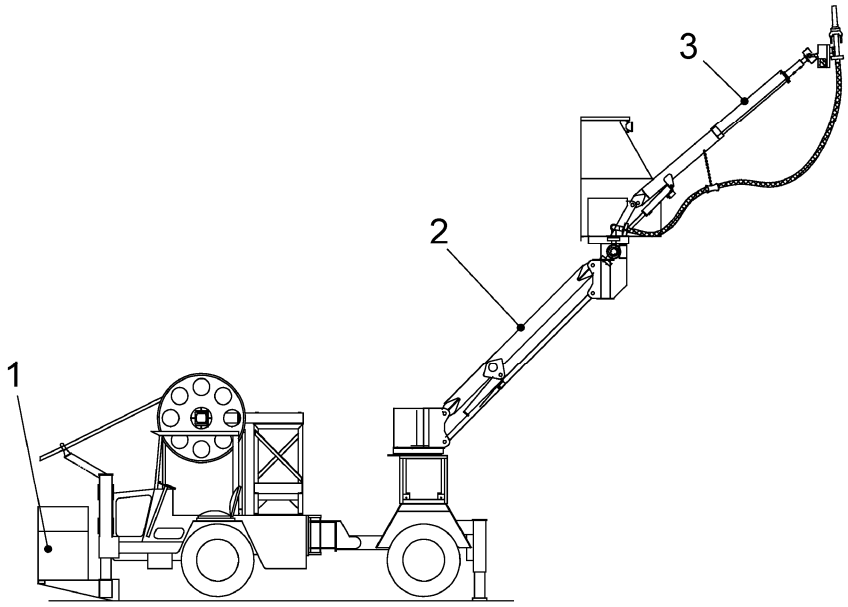


Figure A.1 c) — Example of a shotcreting machine with a pump

Key
1 hopper
2 concrete-placing boom
3 concrete-placing boom section for guiding spraying nozzle

Figure A.1 — Mobile and stationary concrete pumps and shotcreting machines

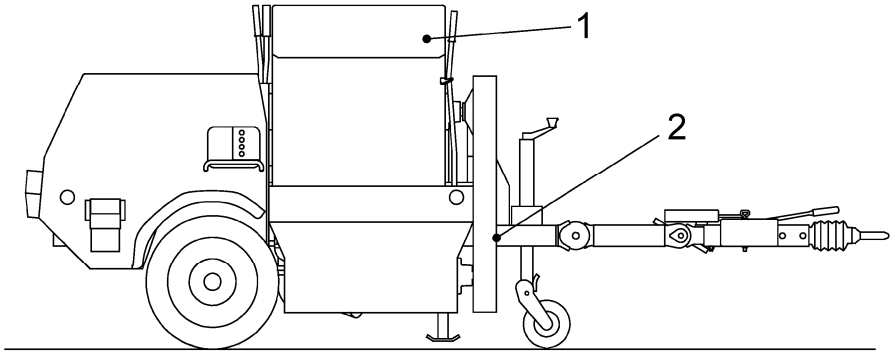


Figure A.2 a) — Mortar-conveying and spraying machine

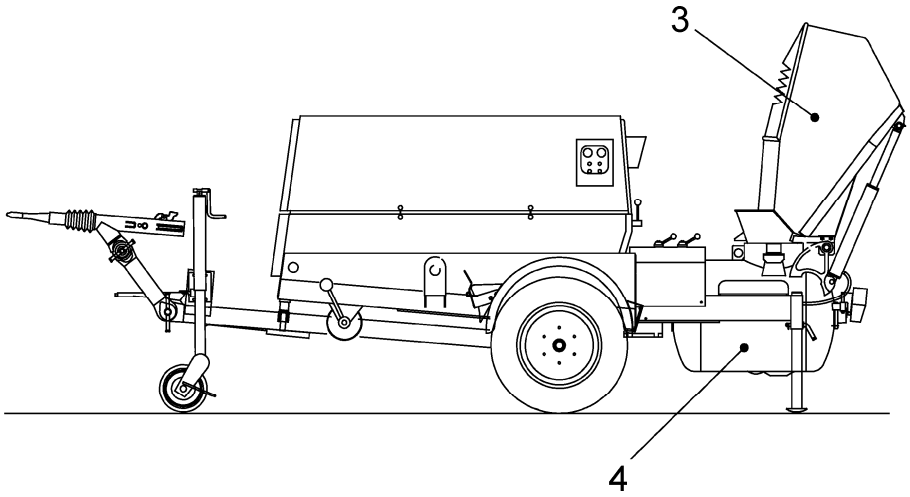
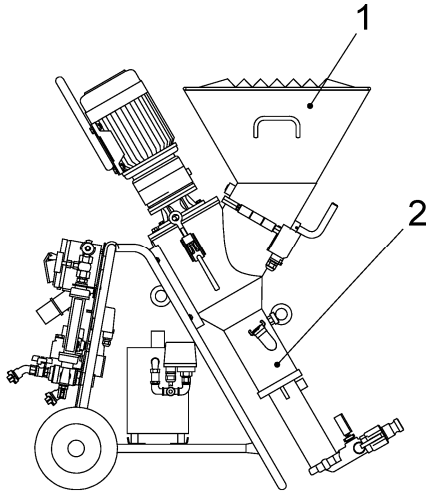


Figure A.2 b) — Mortar-conveying machine

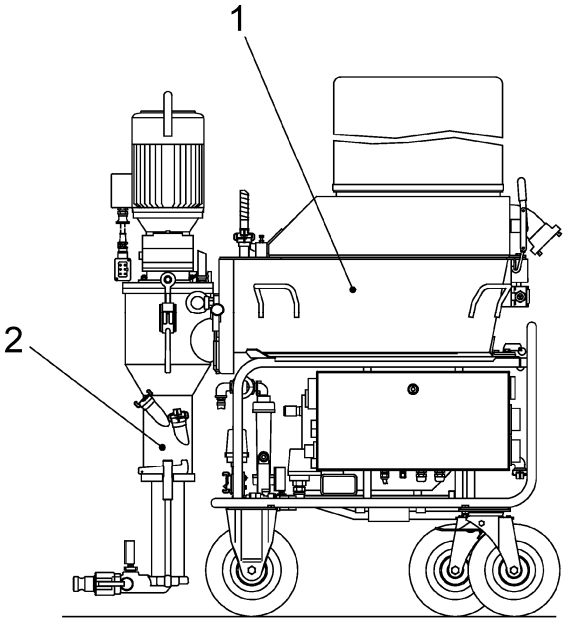
Key
1 mixer
2 pump
3 hopper
4 air chamber

Figure A.2 — Mortar-conveying and spraying machine



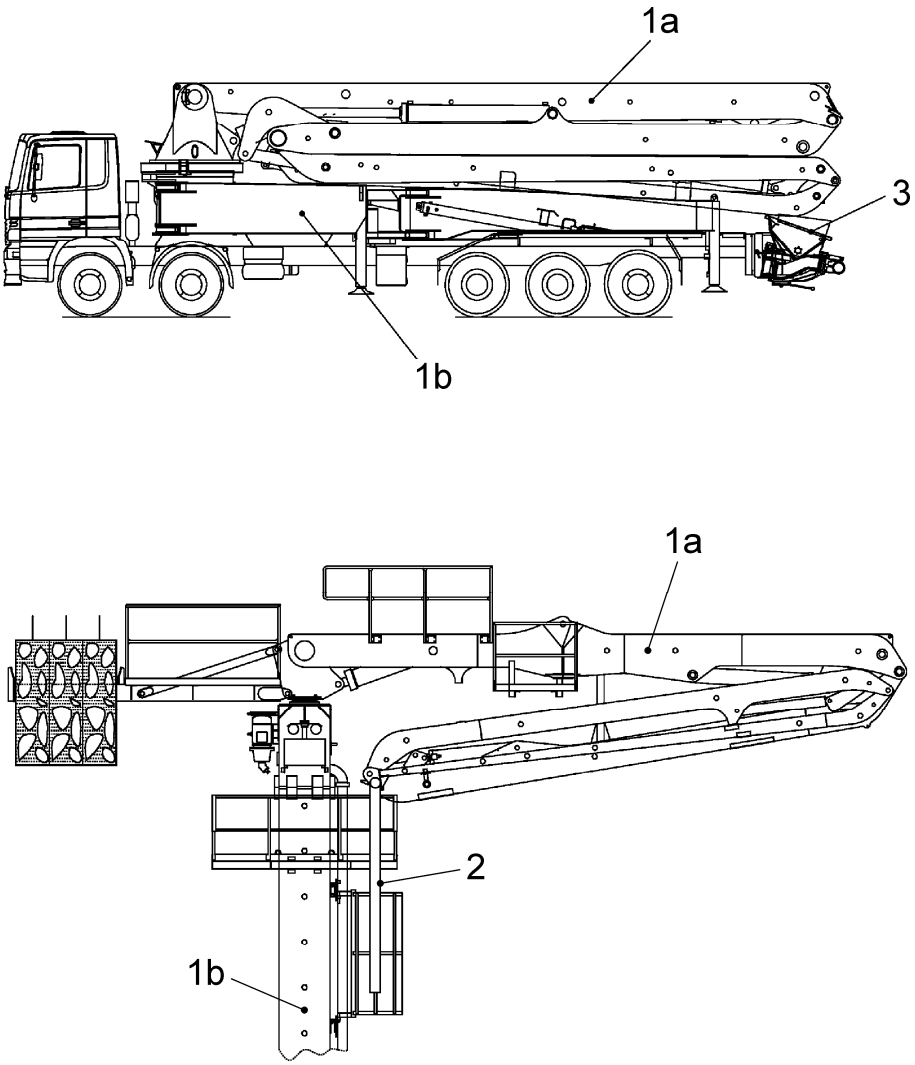
Key
1 hopper
2 mixing and pumping area

Figure A.3 — Mortar-conveying and spraying machine



Key
1 mixer
2 mixing and pumping area

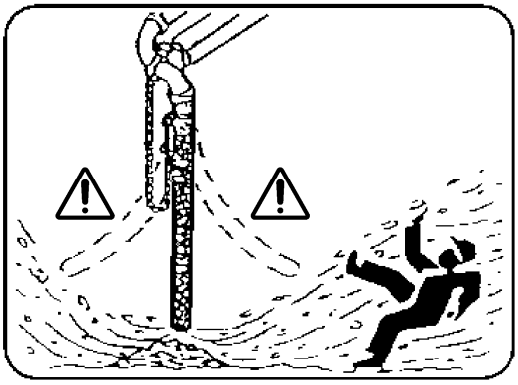
Figure A.4 — Mortar-conveying and spraying machines

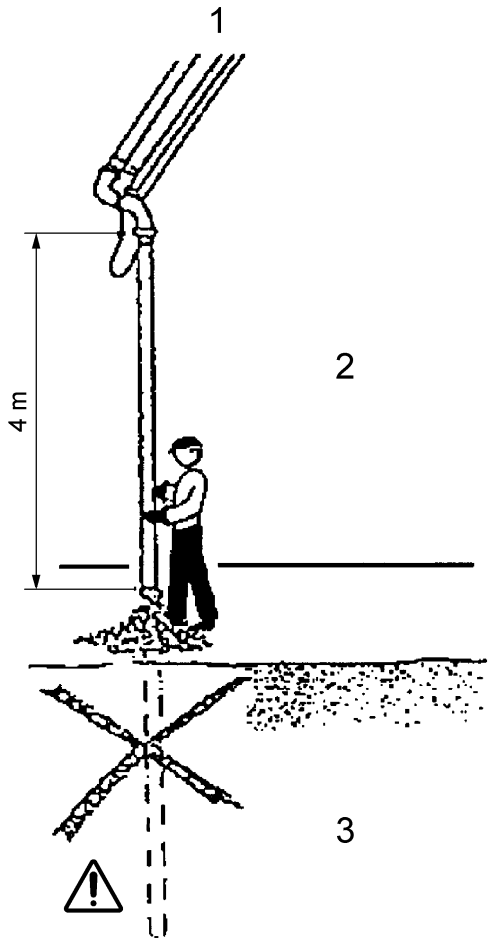


Key
1a concrete-placing boom
1b support structure
2 end hose
3 hopper

Figure A.5 — Mobile and stationary concrete-placing booms

Dimensions in meters





Key
1 end arm
2 end hose, maximum length 4 m when guided by an operating person
3 end hose exceeding 4 m is prohibited to be guided by an operating person

Figure A.6 — End hose

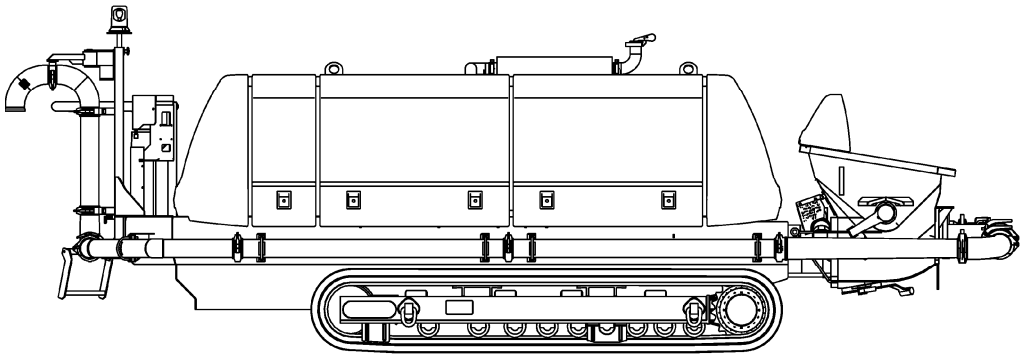


Figure A.7 — Concrete pump on crawler tracks

Annex B
(normative)

Log Book for concrete pump and concrete-placing boom

B.1 General

Concrete pump*:			
Manufacturer:			
Type:		Serial no.:	

Concrete-placing boom*:			
Manufacturer:			
Type:		Serial no.:	

Support structure*:			
Manufacturer:			
Type:		Serial no.:	

Customer (owner):	

* Delete where not applicable

This Log Book for concrete pumps and concrete-placing booms consists of the following elements as outlined below.

B.2 Preliminary remarks and assemblies

a) **Preliminary remarks**

Before being delivered to the customer, concrete-placing booms and concrete pumps shall undergo an inspection, which shall be documented in the Log Book.

Concrete-placing booms shall not be put into operation until the inspection has confirmed their compliance with the national accident prevention regulations, guidelines and rules of the art. Any defects found by the competent expert during the final inspection shall be rectified prior to the concrete-placing boom being put into operation.

The Log Book does not cover inspections in accordance with the National Law.

After on-site assembly and prior to initial commissioning, stationary concrete-placing booms shall be inspected by a specialist or competent expert for proper conditions and correct assembly.

In addition to concrete pumps, concrete-placing booms including their delivery lines shall be inspected, depending on the extents of use and operating conditions according to 7.2.1.3 if not specified otherwise in the Instruction Handbook by the manufacturer.

Specialists are defined as persons whose technical training and experience have provided them with adequate know-how in the field of concrete pumps and concrete-placing booms and who are sufficiently familiar with the pertinent national regulations, accident prevention regulations, directives and generally accepted rules of the art to assess the safe operating condition of concrete pumps and concrete-placing booms.

Besides specialists, the following persons, for example, may be appointed to carry out regular inspections:

1) production engineers;

2) master mechanics;

3) service mechanics employed by the manufacturer.

It is at the discretion of the user whom he appoints as a specialist to carry out the inspections, provided the appointed person meets the above-stated requirements.

A Log Book shall be kept for concrete pumps and concrete-placing booms. The results of inspections shall be recorded in it and certified by the inspector.

An Instruction Handbook including the information required for installation of the concrete pump and for assembly and dismantling of the concrete-placing boom shall be available for concrete pumps and concrete-placing booms.

b) **Classification of support structures**

1) Mobile;

2) stationary.

B.3 Master record sheet

— Concrete pump and concrete-placing boom, mobile;

— concrete-placing boom, stationary;

— verification of inspections and inspection procedure.

B.4 Master record sheet for verification of stationary machines

B.5 Master record sheet for verification of the other machines

B.6 Supplements to the master record sheet

— Repairs of the concrete-placing boom;

— repairs of the concrete pump.

B.7 Inspection records

B.7.1 General

— Concrete-placing boom;

— concrete pump.

This Log Book shall be checked for completeness by each competent expert and specialist and supplemented accordingly. No sheets shall be removed.

B.7.1.1 Master record sheet: concrete pump and concrete-placing boom, mobile

Concrete pump manufacturer:					
Type:		Serial no.:		Year of construction:	
Permissible maximum operating gauge pressure in hydraulic system:				bar	
Maximum delivery pressure:		bar, side outlet if existing:			bar

Concrete-placing boom manufacturer:					
Type:		Concrete-placing boom no.:		Year of construction:	
Maximum horizontal reach (from centre of slewing head):				m	
Maximum permissible outer diameter and wall thickness:				mm	
End hose: DN		mm, length:			m
Permissible maximum operating gauge pressure in hydraulic system:				bar	
Maximum delivery pressure:		bar			
Stabilising width, front:		m, rear:			m
Maximum reaction forces at corners:		kN			

Chassis manufacturer:			
Type:		Chassis no.:	

Superstructure manufacturer:			
Serial no.:		Year of construction:	

Remarks (special features):

Manufacturer:

(Place) (Date) (Stamp/signature)

B.7.1.2 Master record sheet: Concrete-placing boom, stationary

Concrete-placing boom manufacturer:					
Type:		Serial no.:		Year of construction:	
Maximum horizontal reach (from centre of slewing head):					m
Maximum permissible outer diameter and wall thickness:					mm
End hose: DN			mm; length:		m
Permissible maximum operating gauge pressure in hydraulic system:					bar
Maximum delivery pressure:			bar		

Base:					
Support:		Type no.:		Serial no.:	
* Tubular column/s:	m	Type no.:		Serial no.:	
* Tubular boom base:		Type no.:		Serial no.:	
* X-type foot:		Type no.:		Serial no.:	
* Floor supporting frame:		Type no.:		Serial no.:	
* Shaft supporting frame:		Type no.:		Serial no.:	
* Hydr. climbing device:		Type no.:		Serial no.:	
* Quick-disc. connector, male end:		Type no.:		Serial no.:	
* Quick-disc. connector, fem. end:		Type no.:		Serial no.:	
* Lattice tower adapter:		Type no.:		Serial no.:	

* For further parts, e.g. for satellite deployment, see „Log Book for separate base, stationary, concrete-placing boom“ if present.

Support structure manufacturer:		Type:	

Remarks (special features, etc.):

Manufacturer:

(Place) (Date) (Stamp/signature)

B.7.1.3 Supplement to the master record sheet by contractor

Type: _____

Concrete-placing boom no.: _____

Repairs of the concrete-placing boom

1. The following repairs have been done on the concrete-placing boom as compared with the master record sheet:

_____

_____

_____

2. The following load-bearing components of the concrete-placing boom have been replaced or repaired:

_____

_____

_____

The concrete-placing boom has undergone a reinspection.
No/The following* defects were found:

_____

There are/are no reasons why the machine should not be put back into operation*
A reinspection is/is not required*

_____

Competent expert:

_____

(Place, date)

_____

(Signature) (Name)

Repairs of the concrete-placing boom

1. The following repairs have been done on the concrete-placing boom as compared with the master record sheet:

_____

2. The following load-bearing components of the concrete-placing boom have been replaced or repaired:

_____

The concrete-placing boom has undergone a reinspection.
No/The following* defects were found:

_____

There are/are no reasons why the machine should not be put back into operation*
A reinspection is/is not required*

_____

Competent expert:

_____

(Place, date)

_____

(Signature) (Name)

* Delete where not applicable

B.7.1.4 Supplement to the master record sheet

Type: _____

Serial no.: _____

Repairs of the concrete pump

1. The following repairs have been done on the concrete pump as compared with the master record sheet:

_____

_____

_____

_____

_____

Competent expert:

_____

(Place, date)

_____

(Signature) (Name)

Repairs of the concrete pump

1. The following repairs have been done on the concrete pump as compared with the master record sheet:

_____

_____

_____

_____

_____

Competent expert:

_____

(Place, date)

_____

(Signature) (Name)

B.7.2 Classification of mobile support structure

With designation of the support structure or parts to be inspected:

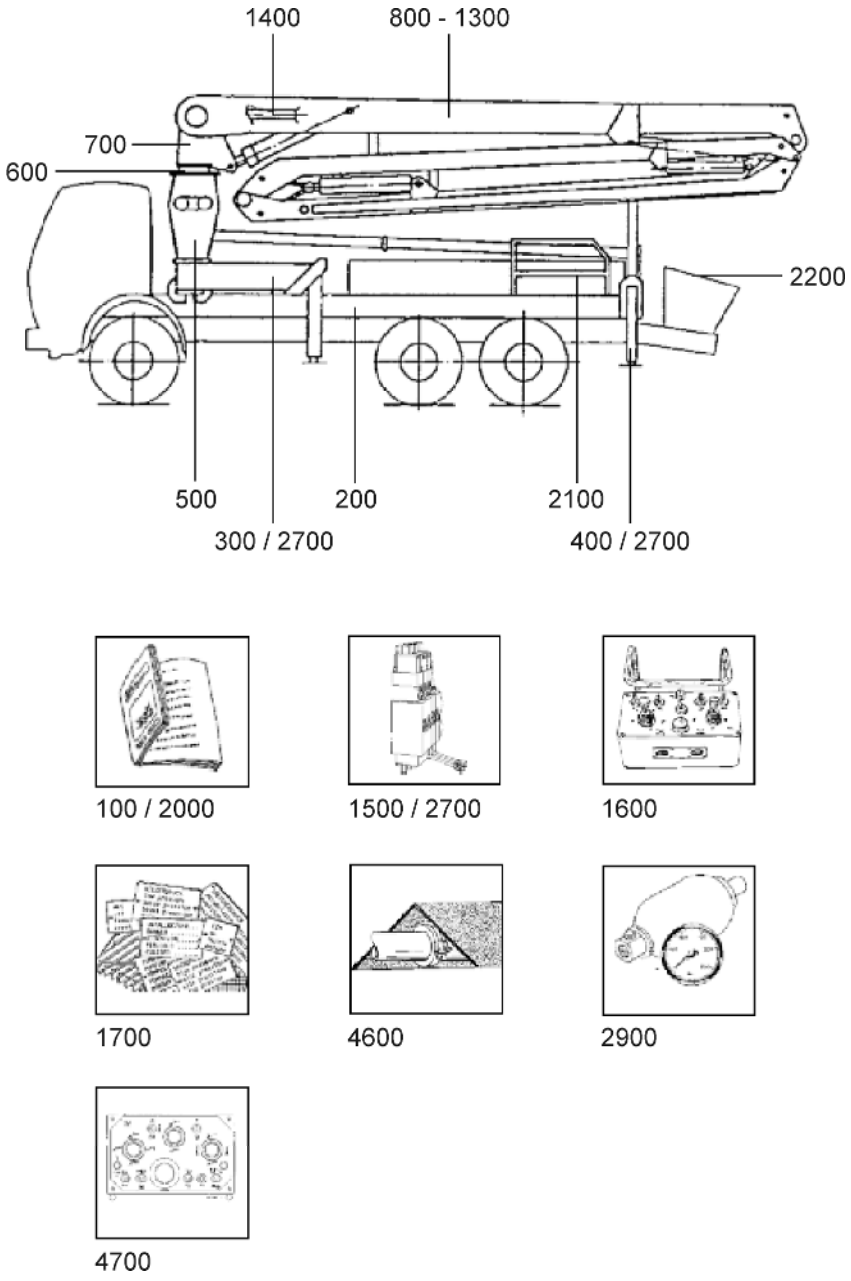


Figure B.1 — Classification of mobile support structure

B.7.3 Example of support structure

With designation of the support structure or parts to be inspected:

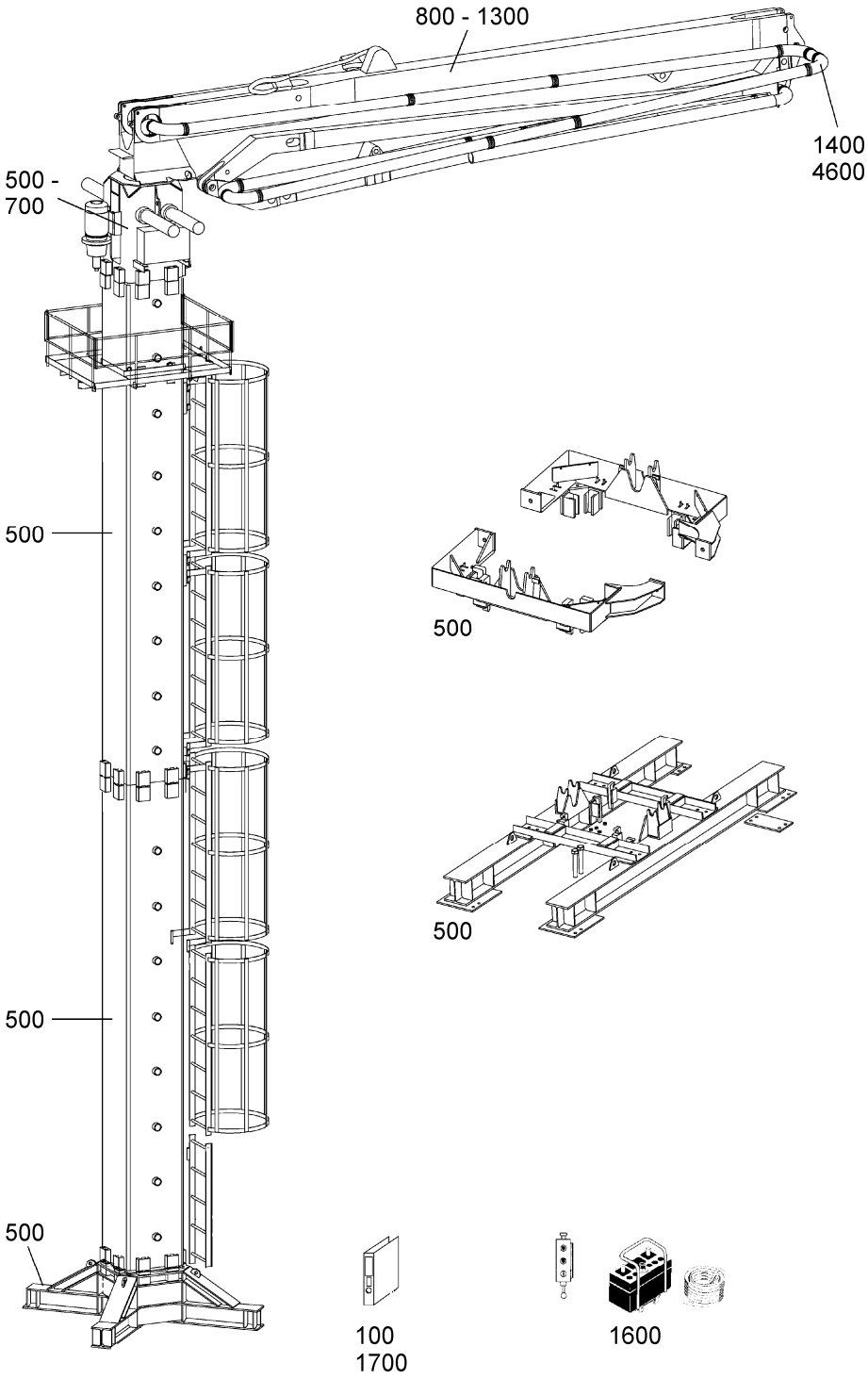


Figure B.2 — Example of support structure

B.7.4 Inspection report for concrete-placing boom

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – Result of the inspection

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
100	**Machine documents**			Pivot cylinder	
	Instruction Handbook			Extension hydraulics	
	Spare-parts list			Pressure setting	
200	**Support structure**		**400**	**Rear outriggers R+L**	
	Frame attachment			Shipping block	
300	**Front outriggers R+L**			Outriggers	
	Shipping block			Extension box	
	Outriggers			Superstructure frame in extension box area	
	Extraction box			Extraction safeguard	
	Extraction safeguard				
	Slewing bearing		Remarks:		
	Slewing safeguard				
	Outrigger safeguard				
	Outrigger blocks				
	Outrigger cylinder attachment				
	Outrigger cylinder				

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.4 Inspection report for concrete-placing boom

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
	Slewing bearing			Hydraulic climbing device	
	Slewing safeguard			Lattice tower adapter	
	Outrigger safeguard			Quick-disconnect connector, male end	
	Outrigger blocks			Quick-disconnect connector, female end	
	Outrigger cylinder attachment		**600**	**Slewing head with ball pivot connection**	
	Outrigger cylinder			Slewing head	
	Pivot cylinder			Ball-mounted slewing ring	
	Extension hydraulics			Ball-mounted slewing ring attachment	
500	**Concrete-placing boom pedestal**			Drive pinion	
	Concrete-placing boom pedestal attachment			Slewing drive attachment	
	Superstructure frame			Slewing limitation	
	Chassis frame			Slewing drive (gearing clearance)	
	Concrete-placing boom support (structural steel)			Slewing drive	
				Brake function	
	Concrete-placing boom support			Speed	
	Shipping block			Pressure setting	
	Hydraulic line			Hydraulic lines	
	Tubular column ___ m		**700**	**Slewing head with slewing column**	
	Tubular column ___ m			Slewing head	
	Tubular boom base			Slewing column bearing	
	X-type foot			Slewing drive (gearing clearance)	
	Floor supporting frame			Speed	
	Floor supporting frame			Pressure setting	
	Shaft supporting frame			Hydraulic lines	
	Shaft supporting frame			Pivot cylinder	
Remarks:					

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.4 Inspection report for concrete-placing boom

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections
01 cracks
02 broken
03 leaking
04 no function
05 short life
06 wear
07 chips
08 corrosion
09 damaged paint
10 worn through
11 scored
12 bent
13 noise
14 vibration
15 others
16 porous
17 burnt out
18 loose
19 jammed
20 judders
21 soiled
22 loose contact
23 temperature
24 deformation
25 bearing clearance
26 lubrication
27 legibility
28 parts missing
29 hydraulic
30 electrical
31 reinspection required

		Fault code			Fault code
800	**Concrete-placing boom**		**900**	**Joint „A“ – Arm 1**	
	Arm 1			Joint bolt	
	Guidance and locking of arm			Cylinder A	
	Delivery-line support			Speed	
	Hook catch			Pressure setting	
	Arm 2			Hydraulic lines	
	Guidance and locking of arm			Safety valve (piston side)	
	Delivery-line support			Safety valve (rod side)	
	Hook catch			Twin cylinder synchronisation	
	Arm 3		**1000**	**Joint „B“ – Arm 1–2**	
	Guidance and locking of arm			Joint bolt	
	Delivery-line support			Cylinder B	
	Arm 4			Speed	
	Guidance and locking of arm			Pressure setting	
	Delivery-line support			Hydraulic lines	
	Arm 5			Safety valve (piston side)	
	Guidance and locking of arm			Safety valve (rod side)	
	Delivery-line support			Twin cylinder synchronisation	
			Remarks:		

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.4 Inspection report for concrete-placing boom

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification - inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
1100	**Joint „C“ Arm 2 + 3**			Joint bolt	
	Reversing lever			Cylinder E	
	Pressure rod			Speed	
	Joint bolt			Pressure setting	
	Cylinder C			Hydraulic lines	
	Speed			Safety valve (piston side)	
	Pressure setting			Safety valve (rod side)	
	Hydraulic lines		**1400**	**Concrete-delivery line**	
	Safety valve (piston side)			Fitted delivery line DN _____ suitable for concrete pump operating pressure	
	Safety valve (rod side)				
1200	**Joint „D“ Arm 3 + 4**			End hose DN and length	
	Reversing lever			Resid. delivery line wall thickness adequate	
	Pressure rod			Delivery line pivot points	
	Joint bolt			Coupling safeguard	
	Cylinder D			End hose safeguard	
	Speed			Adapter	
	Pressure setting			Original equipment line yes/no	
	Hydraulic lines		Remarks:		
	Safety valve (piston side)				
	Safety valve (rod side)				
1300	**Joint „E“ Arm 4 + 5**				
	Reversing lever				
	Pressure rod				

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.4 Inspection report for concrete-placing boom

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
1500	**Hydraulics, control and hydraulic valves**			„Use as crane prohibited“ plate	
	Pressure relief valves			Plate: directives for concrete pump and concrete-placing boom	
	Pressure setting				
	Hydraulic lines			Rating plate	
	Manual operation (switching function)			High-voltage warning plate	
	Concrete-placing boom control block				
	Hydraulic pump				
1600	**Electrical system**		**Specialist:**		
	Remote control (switching function)				
	Emergency-stop function				
	Elec. selector switch for concrete-placing boom function		Date:		
	Elec. control switch for concrete-placing boom movements				
	Elec. cable harnesses		Name: (in block capitals)		
	Central lubrication system				
1700	**Plates and labels**				
	Warning plates				
	Information plates		Signature: (Stamp)		
	Operational information plates				
	Abbr. operating instructions plate				
			Customer:		
Remarks:			Signature: (Stamp)		
			This inspection report is to be filed in the Log Book.		

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.5 Inspection report for concrete pump

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
2000	**Machine documents**		**2700**	**Hydraulic control**	
	Instruction Handbook			Pressure relief valve	
	Spare-parts list			Pressure setting	
2001	**Drive unit**			Hydraulic lines	
	Coupling and flange			Manual operation	
2200	**Gear unit**		**2800**	**Oil cooler**	
2300	**Hydraulic pump**		**2900**	**Accumulator**	
2400	**Oil tank**			Proof of prescribed tests according to pressure vessel regulations	
2500	**Fuel system**				
2600	**Cardan shaft**			Pressure gauge	
			Remarks:		

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.5 Inspection report for concrete pump

Inspection report no.:		Serial no.:		Op. hours.: Output m^3:	

Company:		Post code:		Place:	
Type of concrete-placing boom:		Concrete-placing boom no.:		Department:	

Verification – inspection results

No defects:	❍	**Defects:**	❍
Reinspection required:	❍	**Stop operation:**	❍
Reinspection by (date):			

Fault code:

00 no objections	**08 corrosion**	**16 porous**	**24 deformation**
01 cracks	**09 damaged paint**	**17 burnt out**	**25 bearing clearance**
02 broken	**10 worn through**	**18 loose**	**26 lubrication**
03 leaking	**11 scored**	**19 jammed**	**27 legibility**
04 no function	**12 bent**	**20 judders**	**28 parts missing**
05 short life	**13 noise**	**21 soiled**	**29 hydraulic**
06 wear	**14 vibration**	**22 loose contact**	**30 electrical**
07 chips	**15 others**	**23 temperature**	**31 reinspection required**

		Fault code			Fault code
3000	**Central lubrication system**		**4600**	**Other protective devices**	
3100	**Hydraulic motor**			Steps	
3200	**Hydraulic line**			Non-slip surface of steps	
3300	**Compressor**			Safety rail	
3400	**Switch cabinet**			Hinged grill-type guard on hopper (mechan. protective device)	
3500					
3600	**C-transfer tube**			Fixed grill-type guard on hopper (attachment)	
3700	**S-transfer tube**				
3800	**Agitator, hopper**			Distance between grill-type guard bars	
	Agitator, complete			Distance between grill-type guard and crushing point	
3900	**Rotor pump**				
4000	**Vacuum pump unit**			Hinged grill-type guard	
4100	**Frame**			Agitator stopped on opening of movable grill-type guard	
4200	**Water tank**				
4300	**Chassis**			Transfer tube stopped on opening of movable grill-type guard	
4400	**Flushing water pump**				
4500	**Vibrator**			Safeguard to prevent movable grill-type guard from falling	
				Cleaning-access closure of hopper	
				Rotor housing guard	

Remarks:

Enter corresponding fault no., e.g. 01 (cracks) - do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

B.7.5 Inspection report for concrete pump

Inspection report no.:		Serial no.:	

Fault code:

00 no objections
01 cracks
02 broken
03 leaking
04 no function
05 short life
06 wear
07 chips
08 corrosion
09 damaged paint
10 worn through
11 scored
12 bent
13 noise
14 vibration
15 others
16 porous
17 burnt out
18 loose
19 jammed
20 judders
21 soiled
22 loose contact
23 temperature
24 deformation
25 bearing clearance
26 lubrication
27 legibility
28 parts missing
29 hydraulic
30 electrical
31 reinspection required

		Fault code			Fault code
	Rotating shaft safeguarded		**4800**	**Miscellaneous**	
	V-belt safeguarded			Attachments added by the owner	
	Chain safeguarded			Repairs made by the owner	
	Valve-switching cylinder covered				
	All parts with burning/scalding hazard, e.g. exhaust, covered				
4700	**Electrical equipment**		**Specialist:**		
	Functioning of control elements				
	Emergency-stop device				
	Earthed connection		Date:		
	Cable, cable harness				
	Temperature sensor		Name: (in block capitals)		
4800	**Supports (pump)**				
	Shipping block				
	Extraction safeguard				
	Outrigger blocks		Signature: (Stamp)		
	Outrigger cylinder attachment				
	Outrigger cylinder pressure setting				
Remarks:			**This inspection report is to be filed in the Log Book.**		

Enter corresponding fault no., e.g. 01 (cracks) – do not cross 31 Cross corresponding fault code no. (00, 31) 01

Original: Log Book, 1st copy: manufacturer, 2nd copy: importer/supplier, 3rd copy: specialist

Annex C
(normative)

Noise test code for machines and equipment for conveying, spraying and placing concrete and mortar

C.1 Scope

This noise test code defines all necessary information to carry out efficiently and under standardised conditions the determination, declaration and verification of the noise-emission characteristics of machines and equipment for conveying, spraying and placing concrete and mortar.

Noise-emission characteristics include the emission sound pressure level at the workstation and the sound-power level.

The determination of those quantities is necessary for:

— manufacturers to declare the noise emitted;

— 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. Noise-measurement methods allowed by this standard are engineering methods (grade 2).

This document specifies noise-measurement methods, installation/mounting and operation conditions that shall be used for the test.

C.2 Determination of the A-weighted sound power level

C.2.1 General

The determination of the A-weighted sound power level shall be made according to EN ISO 3744:2010.

The uncertainty due to reproducibility of the measurement method used as applied to the machines covered by this standard is 3 dB (grade 2 “engineering”). This is the expanded measurement uncertainty as defined in EN ISO 3744:2010, Clause 9. The total uncertainty may be larger if the sound emission of the machine is unstable (see EN ISO 3744:2010, Clause 9 and H.2).

C.2.2 Measurement surface and microphone positions

C.2.2.1 Concrete pumps

Measurement surface and microphone positions shall be in accordance with EN ISO 3744:2010.

Due to the same type of design of concrete pumps and the resulting same location of the main sound sources, either the hemispherical or the parallelepiped measurement surface method can be used.

NOTE Outriggers, delivery lines and concrete-placing booms are not significant sound radiators and therefore they do not need to be considered for the determination of the reference box as defined in EN ISO 3744:2010.

C.2.2.2 All other machines

Measurement surface and microphone positions shall be in accordance with EN ISO 3744:2010. The hemispherical measurement surface shall be used.

NOTE Outriggers, delivery lines and concrete-placing booms are not significant sound radiators and therefore they do not need to be considered for the determination of the reference box as defined in EN ISO 3744:2010.

C.3 Determination of the A-weighted emission sound pressure level at workstations

C.3.1 General

The A-weighted emission sound pressure levels shall be determined in accordance to EN ISO 11201:2010 with grade 2 accuracy. If machines cannot be measured in an essentially free field over a reflecting plane, the emission sound pressure level shall be determined according to EN ISO 11204:2010 with grade 2 accuracy. The measurement shall be taken in absence of the operator.

The uncertainty due to reproducibility of the measurement methods used as applied to the machines covered by this standard is 3 dB (grade 2 “engineering”). This is the expanded measurement uncertainty as defined in EN ISO 11201:2010, Clause 11. The total uncertainty may be larger if the sound emission of the machine is unstable (see EN ISO 11201:2010, Clause 11 and C.3).

C.3.2 Workstations

C.3.2.1 Remote-controlled machines

Where the machine is remote-controlled, the A-weighted sound pressure levels shall be measured on a path surrounding the machine at a distance of 1,00 m from the surface of the machinery and at a height of 1,60 m from the floor or access platform. The distance between two microphone positions on the path shall be maximum 2,00 m. The final result shall be the highest value of the A-weighted emission sound-pressure levels determined and the position where it is obtained.

C.3.2.2 Machines with defined workstations

Where the machine has defined workstations specified by the manufacturer in the Instruction Handbook, the measurement points shall be at the workstations at a height of 1,60 m from the floor or access platform and in a distance of 1,00 m from the surface of the machine.

C.4 Operating conditions

C.4.1 Operating conditions during test

The test shall be carried out under normal operating conditions including all sources of noise normally present when the machine is in operation.

NOTE 1 Since noise emission depends on the corresponding operation mode of the machines, the operating conditions are specified in order to obtain comparable measuring results.

The test shall be carried out with a simulated load using water.

NOTE 2 Noise emission with water is representative of that with concrete or mortar. The use of water ensures repeatability, reproducibility and consequently comparability of results.

The operating conditions shall be identical for the determination of both sound power levels and emission sound pressure levels at workstations and for declaration purposes.

The machine shall be set up and operated according to the manufacturer's Instruction Handbook.

C.4.2 Test under load

For combustion engines, the medium pump shall be operated under maximum retrievable power at maximum volume output and at maximum operational rpm of the engine defined by the manufacturer. For electrical motors, the medium pump shall be operated under maximum retrievable power at maximum volume output and at maximum current consumption of the motor defined by the manufacturer.

For combustion engines and electrical motors, the operating pressure with water is created by using an adjustable throttle valve in the delivery line. To avoid the influence of additional noise from the throttle valve, e.g. encapsulate the valve or locate it far from the measurement points.

The conveying system shall be operated with water. Noise test of spiral pumps shall also be with water, but the drive unit of the dosing equipment for dry material shall be switched off.

C.4.3 Period of observation

The period of observation at each microphone position shall at least be 15 s.

C.5 Information to be recorded during the test

The information to be recorded shall be in accordance with EN ISO 3744:2010 and EN ISO 11201:2010 or EN ISO 11204:2010.

C.6 Information to be reported

The test report shall be in accordance with EN ISO 3744:2010 and EN ISO 11201:2010 or EN ISO 11204:2010.

C.7 Declaration and verification of noise emission values

The noise declaration shall contain the following information:

a) For remote-controlled machines:

   1) highest of the A-weighted emission sound pressure levels at the workstations defined in C.3.2.1;

   2) position where the highest A-weighted emission sound pressure level has been obtained;

b) For other machines:

   1) the A-weighted emission sound pressure levels at the workstations specified in C.3.2.2;

c) For all machines:

   1) the A-weighted sound power level. For concrete pumps, the shape of the measurement surface used shall be indicated;

   2) for both the emission sound pressure level and sound power level, the declared values shall have the format of a single-number declaration as defined in EN ISO 4871:2009, i.e. the measured value and the associated uncertainty are added up to form one single value (see C.2 and C.3);

   3) description of the operating point (pressure and volume flow) during measurement (see C.4.2);

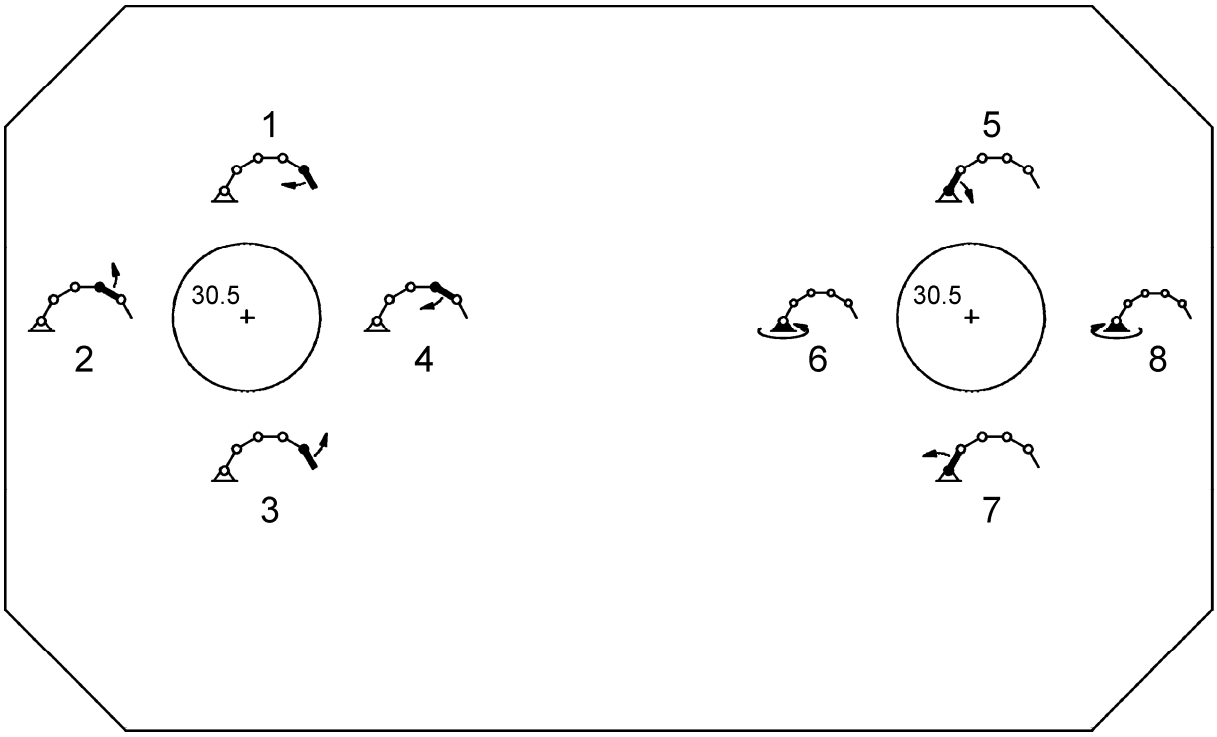
   4) the reference to this noise test code and the indication of the B-standards for measurement that have been used (i.e. EN ISO 11201:2010 with grade 2 or EN ISO 11204:2010, and EN ISO 3744:2010). Any

deviations from this noise test code or the B-standards used shall be described and the reasons for such deviations shall be indicated.

If undertaken, the verification shall be conducted by using the same mounting and operating conditions as those used for the initial determination of noise emission values.

Annex D
(normative)

Remote control – Function allocation



Lifting and lowering the last concrete-placing boom sections before the end hose

Slewing the concrete-placing boom
Lifting, lowering the first concrete-placing boom sections

Key

1 last section down
2 second to last section up
3 last section up
4 second to last section down
5 section 1 down
6 slew left
7 section 1 up
8 slew right

Independent of the number of boom sections, the functions listed in the key above shall be defined.

Figure D.1 — Remote control

Annex ZA
(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 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union 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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