Kraanad. Käsitsi kontrollitavad koormuse käsitlemise seadmed KONSOLIDEERITUD TEKST

Cranes - Manually controlled load manipulating devices CONSOLIDATED TEXT

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 14238:2004+A1:2009 sisaldab Euroopa standardi EN 14238:2004+A1:2009 ingliskeelset teksti.	This Estonian standard EVS-EN 14238:2004+A1:2009 consists of the English text of the European standard EN 14238:2004+A1:2009.
Standard on kinnitatud Eesti Standardikeskuse 30.09.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
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English Version

Cranes - Manually controlled load manipulating devices

Appareils de levage à charge suspendue - Manipulateurs de charge à contrôle manuel

Krane - Handgeführte Manipulatoren

This European Standard was approved by CEN on 21 May 2004 and includes Amendment 1 approved by CEN on 16 July 2009.

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Contents

page

Foreword

This document (EN 14238:2004+A1:2009) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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 includes Amendment 1, approved by CEN on 2009-07-16.

This document supersedes EN 14238:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

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).

⟨A1⟩ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

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

Introduction

This document is a harmonized standard to provide one means for manually controlled load manipulating devices to conform to the essential health and safety requirements of the Machinery Directive, as amended.

This document is a type C standard as stated in [A1] EN ISO 12100 [A1].

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

When provisions of this type C document are different from those are stated in type A or B documents, the provisions of this type C document take precedence over the provision of the other documents, for machines that have been designed and built according to the provisions of this type C document.

1 Scope

This document specifies requirements for manually controlled load manipulating devices (herein referred to as manipulators), powered by an energy other than human energy, to assist an operator in the handling of loads.

This document does not cover:

— mechanically operated balancers that are based on springs or counterweights;

— manipulating robots;

This document does not cover hazards related to the lifting of persons.

This document does not establish the additional requirements for:

— operation in severe conditions (e.g. extreme environmental conditions such as : freezer applications, high temperatures, corrosive environment, strong magnetic fields);

— operation subject to special rules;

— handling of loads the nature of which could lead to dangerous situations (e.g. molten metal, acids/alkalies, radiating materials, specially brittle loads);

— hazards occurring during construction, transportation, decommissioning and disposal.

The significant hazards covered by this document are identified in Clause 4. For hazards that are not significant, EN ISO 12100-2 applies.

This document is applicable to manipulators which are manufactured after the date of approval by CEN of this standard.

2 Normative references

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

EN 294, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

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

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

EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

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

〚A1〛 *deleted text* 〚A1〛

EN 12077-2, *Cranes safety — Requirements for health and safety — Limiting and indicating devices*

EN 12644-1, *Cranes — Information for use and testing — Part 1: Instructions*

EN 13001-1, *Cranes — General design —Part 1: General principles and requirements*

EN 13001-2, *Cranes — General design — Part 2: Load effects*

EN 13155:2003, *Cranes — Safety — Non-fixed load lifting attachments*

EN 13557, *Cranes — Controls and control stations*

prEN 14492-2:2002, *Cranes — Power driven winches and hoists — Part 2: Power driven hoists*

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

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

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

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995)*

EN ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ (ISO 11202:1995)*

EN ISO 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1998)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ⟩A1⟨ EN ISO 12100-1:2003 ⟩A1⟨ and the following definitions apply.

3.1
operator
person using the manipulator

3.2
load holding device
device to pick up and hold the load.

An interchangeable load holding device is a device that can be changed by the operator

NOTE Load holding can be achieved for instance by:

— adhesion (suction pads, magnets etc.);

— gripping (clamps etc.);

— mechanical connection (hooks, forks, C-hooks, etc.).

3.3
balancing of a load
condition when a load is submitted to a vertical upward force equal to its weight and where additional external force is required to change the position of the load

3.4
control
actuating device which forms an interface between the operator and the manipulator control system

3.5
drift
uncontrolled and unintended movement of the manipulator and / or load

3.6
manipulator
powered machine, where the operator has to be in contact with the load or holding device, in order to guide and/or control the motion of the load to bring it to a position in space.

Manipulators include 3 basic functional elements:

– the load holding device;

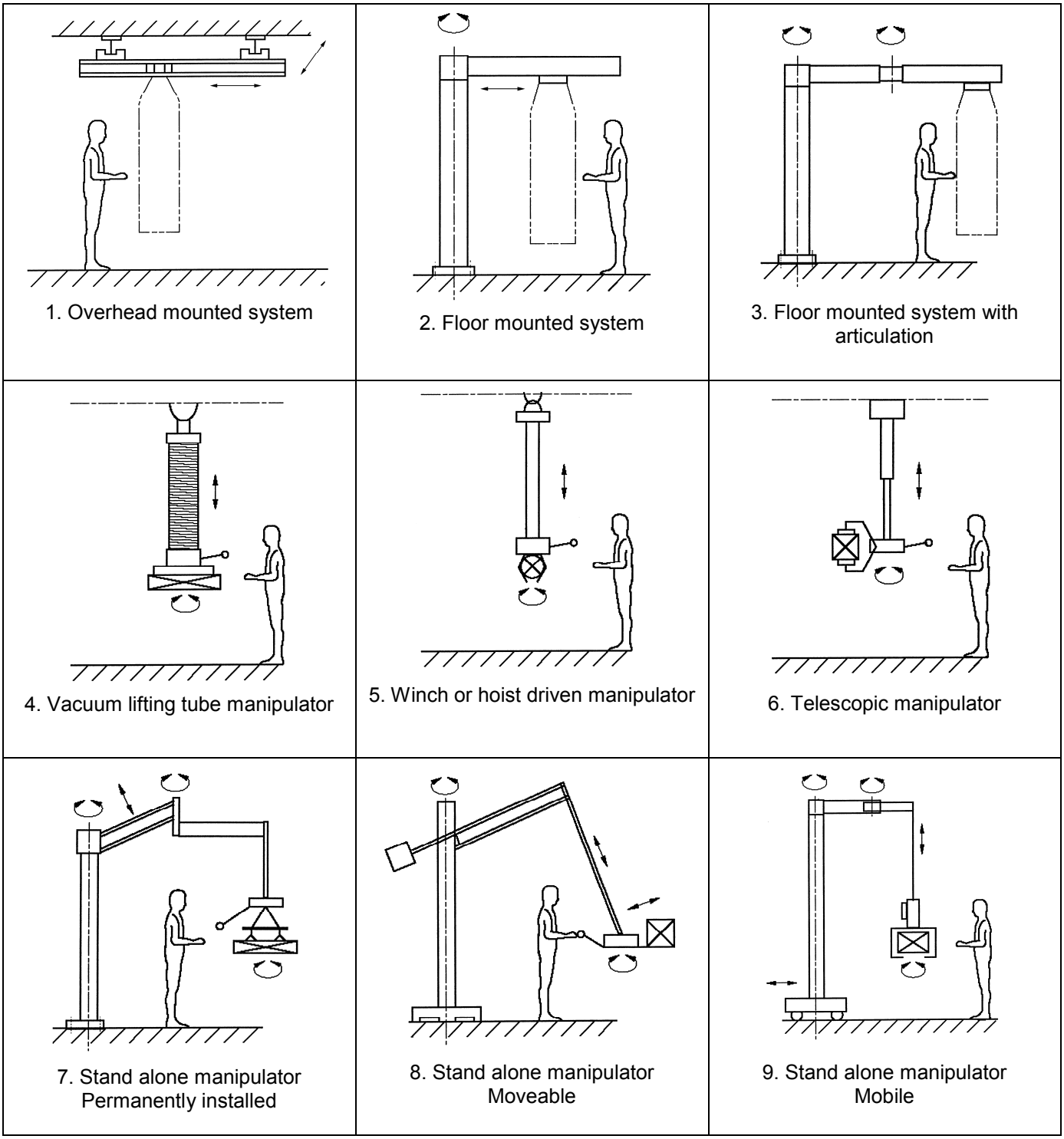
– devices to move and place the load in space;

– the supporting structure

NOTE Examples of manipulator systems are shown in Figure 1.

3.7
supporting structure
all parts of the manipulator that are affected by the force of the suspended load

3.8
working load limit (WLL)
Maximum load that the manipulator is designed to handle under specified operating conditions, e.g. characteristics of the load (e.g. shape, material), gripping points, configuration



Manipulating device Load

1 to 3: examples of supporting systems for horizontal motion;

4 to 6: examples of manipulating devices that can be suspended from supporting systems shown in 1 to 3;

7 to 9: examples of stand-alone manipulators.

Figure 1 - Examples of manipulators systems

4 List of significant hazards

Tables 1, 2 and 3 show a list of significant hazardous situations and hazardous events that could result in risks to persons during normal use and foreseeable misuse. It also contains the relevant Clauses in this standard that are necessary to reduce or eliminate the risks associated with those hazards.

Table 1 — List of significant hazards and associated requirements – General

Hazard (as listed in EN 1050:1996)		Relevant Clause(s) in this standard
1	Mechanical hazards due to:	
a)	Shape	5.2.2
e)	Inadequacy of mechanical strength	5.2.1, 5.2.13, 6.3.2.1, 6.3.2.2
	- accumulation of energy inside the machinery, e.g.:	
h)	The effect of vacuum	5.2.6, 5.3, 5.4.2.1, 5.4.2.2, 5.4.2.3
1.1 and 1.2	Crushing, shearing hazards etc.	5.2.2, 5.4.1
1.9	High pressure fluid injection or ejection hazard	5.2.5, 5.2.6, 5.4.2.1, 5.4.2.2, 5.4.2.3, 5.4.4.1, 5.4.4.2, 5.4.4.3, 5.6.1
2	Electrical hazards	5.2.7, 5.4.3.1, 5.4.3.2, 5.4.3.3, 5.4.3.4
2.1	Contact of persons with live parts (direct contact)	5.2.7, 5.4.3.1, 5.4.3.2, 5.4.3.3, 5.4.3.4
4	Hazards generated by noise, resulting in:	5.6.6, 7.2.1.j, Annex A
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	5.6.6, 7.2.1.j, Annex A
4.2	Interference with speech communication, acoustic signals, etc.	5.6.6, 7.2.1.j, Annex A
8	Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:	5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.6.4
8.7	Inadequate design, location or identification of manual controls	5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.6.4
10	Unexpected start-up, unexpected overrun / overspeed (or any similar function) from:	5.5.1, 5.5.3, 5.6.2, 5.6.3
11	Impossibility of stopping the machine	5.5.2
13	Failure of the power supply	5.4.2.2, 5.4.2.3, 5.4.3.3, 5.4.3.4, 5.4.4.3, 5.6.3
17	Falling or ejected objects or fluids	5.2.3, 5.2.5, 5.2.6, 5.3, 5.4.1.1, 5.4.1.3

Table 2 — Additional hazards, hazardous situations and hazardous events due to mobility

Hazard (as listed in EN 1050:1996)		Relevant Clause(s) in this standard
20 (1 - 6)	Relating to the travelling function	7.2. 7.3.1.1
21 (1 - 10)	Linked to the work position on the machine	5.6.1, 5.6.4, 7.2
22	Due to the control system	5.5, 7.2
23	Lack of stability	5.2.3
24	Due to the power source and to the transmission of power	5.4.2, 5.4.3, 5.4.4
25.3	Lack or inadequacy of visual or acoustic warning means	5.4.2.2, 5.4.3.3, 5.4.4.3, 5.6.3
26	Insufficient instructions for the driver / operator	7.2

Table 3 — Additional hazards, hazardous situations and hazardous events due to lifting

Hazard (as listed in EN 1050:1996)		Relevant Clause(s) in this standard
27	Mechanical hazards and hazardous events:	
27.1	From load falls, collisions, machine tipping caused by:	5.2.13, 5.3, 5.4, 7.3.2
27.1.1	Lack of stability	5.2.3
27.1.2	Uncontrolled loading - overloading - overturning moments exceeded	5.2.3, 5.3, 5.6.2, 5.6.5
27.1.5	Inadequate holding of devices/accessories	5.4.1, 5.4.2, 5.4.3, 5.4.4, 7.3.2
27.4	From insufficient mechanical strength of parts	5.2.1, 5.3, 6.3.1, 6.3.2, 6.3.3
27.6	From inadequate selection/integration into the machine of chains, ropes, lifting accessories and their inadequate integration into the machine	5.2.13
27.8	From abnormal conditions of assembly/testing/use/maintenance	6.3, 7.2

5 Safety requirements and/or protective measures

5.1 General

Machinery shall comply with the safety requirements and/or measures of this Clause. In addition, the machine shall be designed according to the principles of EN ISO 12100 for hazards relevant but not significant which are not dealt with by this document.

5.2 Supporting structure of the manipulator

5.2.1 Mechanical strength

The fatigue requirements in EN 13001 parts 1 and 2 shall apply.

When the intended cycle use is less than 20 000 cycles, the structure can be designed in such a way that:

— with a static load of at least two times the working load limit, no permanent deformation shall occur;

— with a static load of at least three times the working load limit, even if there is permanent deformation, there shall be no breaking of the structure.

5.2.2 Shape of components

Parts accessible by the operator shall not include any sharp edges or angles which can cause injuries.

Safety distances shall be met as specified in EN 294, EN 349 and EN 811 if no other means to prevent risks from danger zones is specified by the manufacturer.

NOTE The method given in EN ISO 12100-1: 2003 Table 2 should be used to specify other means.

5.2.3 Stability of manipulators mounted on a self-stable base

Manipulators shall remain stable in all their configurations of use.

Manipulators shall be designed in such a way that the distance (D) of centre of gravity (G) of the whole manipulator, including the load and the base, to column axis is not more than 2/3 of the distance L (see Figure 2 below).

In order to prevent the manipulator from overturning in case of overload, stability shall be calculated applying the maximum lifting force of the vertical drive.

If no other measures are taken against overturning, the load to be considered is the WLL + 80kg (representing the average weight of an operator).

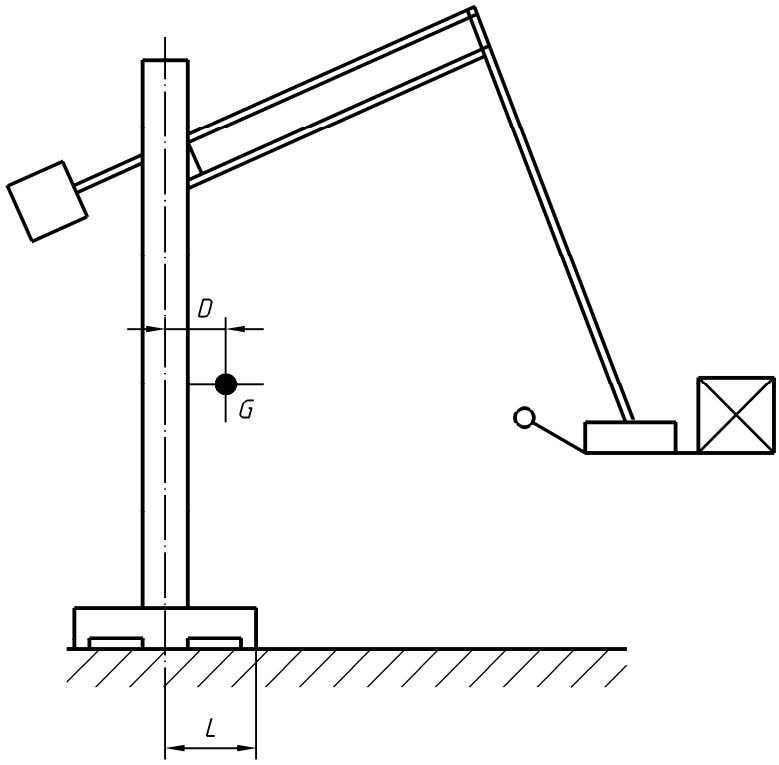


Figure 2 - Stability

Key
L = Minimum tilting distance from column axis
D = Distance of the centre of gravity G to the column axis
G = Centre of gravity of the whole manipulator

5.2.4 Drift

Manipulators shall support the load without drift.

5.2.5 Hydraulic systems and components

Hydraulic components shall be in accordance with EN 982.

5.2.6 Pneumatic systems and components

Pneumatic components shall be in accordance with EN 983.

5.2.7 Electrical systems and components

Electrical components shall be in accordance with EN 60204-32.

5.2.8 Gearbox

Gearboxes shall be in accordance with the safety requirements of prEN 14492-2:2002, 5.5.

5.2.9 Rope drives

Rope drives shall be in accordance with the safety requirements of prEN 14492-2:2002, 5.7.

5.2.10 Chain drives

Chain drives shall be in accordance with the safety requirements of prEN 14492-2:2002, 5.8.

5.2.11 Belt drives

Belt drives shall be in accordance with the safety requirements of prEN 14492-2:2002, 5.9.

5.2.12 Trolleys

Trolleys shall be in accordance with the safety requirements of prEN 14492-2:2002, 5.12.

5.2.13 Load suspension elements

The minimum working coefficients of the suspension elements and their load-bearing end parts shall be as follows:

— chain: 4 times the working load limit;

— wire rope: 5 times the working load limit;

— accessories (hooks, shackles, etc.): 4 times the working load limit;

— textile rope and webbing: 7 times the working load limit.

These coefficients may be increased depending on the conditions of use declared by the manufacturer in the information for use.

5.3 Vacuum lifting tubes

The vacuum lifting tube manipulators shall be designed to avoid any crushing, shearing, puncture, implosion and leakage of vacuum hoses under the conditions of use specified by the manufacturer.

Means shall be provided at the vacuum lifting tube upper end to prevent any risk of uncoupling (e.g. hook with safety catch). Over-stretching of the vacuum lifting tube shall be prevented (e.g. rope within the lifting tube).

The fully extended vacuum lifting tube shall not lose its cylindrical shape under the following conditions:

— if the minimum working pressure is equal to, or over 0,4 absolute bar, the vacuum lifting tube shall withstand a pressure of 0,75 times the minimum working pressure;

— if the minimum working pressure is below 0,4 absolute bar, the vacuum lifting tube shall withstand a pressure of 0,6 times the minimum working pressure.

The effective surface area of the suction foot under vacuum shall be equal to a minimum of 2 times the cross sectional area of the vacuum lifting tube.

The connection between the hose and the non-contractable parts shall be such that the hose cannot be damaged.

The hose shall be attached in such a way that it cannot slip on the connection.

Supporting structures including a lifting tube will comply with 5.2, except the vacuum hose itself that will not have to comply with 5.2.1.

5.4 Load holding devices

5.4.1 General requirements

5.4.1.1 Securing the load

Load holding devices shall be such that, when used according to the specifications of the manufacturer of the manipulator, the load can be safely transferred.

The transmission of the necessary holding forces between the load and load holding device shall be safeguarded during the whole manipulating process, taking into account the configuration and the rigidity of the specified loads. The forces occurring due to acceleration shall be taken into account. For vacuum lifters, lifting magnets, tongs, grabs, clamps and expanding mandrels this requirement is met if the requirements of 5.4.2, 5.4.3 and 5.4.4 are fulfilled.

5.4.1.2 Load holding devices

Load holding devices shall be compatible with the rest of the manipulator. The connection between an exchangeable load holding device and the manipulation machine shall be such that the correct connection can be clearly identified. The connection shall be made in such a way that prevents unintended disconnection.

5.4.1.3 Load holding devices composed of adjustable components

If the load holding device is equipped with one or more adjustable components (e.g. lifting beams with several load hooks), it shall be equipped with end stops to prevent unintended dropping of the components. The adjustable components shall incorporate features that prevent unintended detachment.

5.4.2 Vacuum load holding devices

5.4.2.1 Holding force

Vacuum load holding devices shall provide a holding force of at least 2 times the force necessary to lift the WLL in all load holding configurations and foreseeable accelerations.

The manufacturer shall state the required minimum friction factor in the instructions for use, if handling with the suction pad(s) in inclined or vertical position is foreseen.

Vacuum load holding devices shall be such that the lifting operation can only start when the necessary vacuum is established and maintained.

5.4.2.2 Pressure failure

In order to prevent risks due to the case of vacuum drop to the danger range during operation, the manipulator shall be in accordance with 5.2.2.5 of EN 13155:2003.

The manipulator shall be capable of automatically put down the load safely or shall be fitted with a pressure measuring device clearly showing the working range and the danger range to the operator in his normal operating position

When vacuum losses cannot be compensated, there shall be an automatic device to warn that the danger range has been reached. The warning signal shall be optical or acoustic, depending upon the circumstances of use for the vacuum holding device.

5.4.2.3 Power failure

Vacuum load holding devices shall be equipped with devices to warn the operator in the case of power failure.

In case of power failure, the manipulator shall be capable of retaining the load for a duration of at least 2 minutes or shall be capable of being lowered safely before it is released.

When the warning device indicates power failure or that the danger range is reached safe operation to put down the load shall be possible.

5.4.3 Lifting magnets

5.4.3.1 Holding force

The effective holding force of lifting magnets shall be at least:

- 2 times the force necessary to lift the WLL for electrical lifting magnets, at nominal voltage and stabilized temperature in operating conditions;
- 3 times the force necessary to lift the WLL for permanent magnets,

in all the load holding configurations.

The manufacturer shall state the minimum friction factor in his instructions for use, if handling with magnets in inclined or vertical position is foreseen.

5.4.3.2 State of magnetization

The state of magnetization (on/off) shall be clearly indicated to the operator. For magnets with variable power control, the indicator shall distinguish between full and partial magnetisation.

5.4.3.3 Power supply for mains-fed electrical lifting magnets

Mains-fed electrical lifting magnets shall be equipped with a stand-by battery in case the mains supply fails, to maintain the magnetism. The failure of the mains supply shall be indicated by an automatic visual and/or audible warning device to the operator.

5.4.3.4 Exhausting of battery

Batteries for lifting magnets and stand-by batteries shall be equipped with a device which indicates when the capacity of the battery has reached a minimum level for a use. When the capacity falls below this level, the pick up of another load shall be automatically prevented.

When the warning device indicates power failure or that the danger range is reached, safe operation to lower the load shall be possible.

5.4.4 Tongs, grabs, clamps and expanding mandrels

5.4.4.1 Holding force

The holding force of friction-type locking clamps and expanding mandrels shall be at least 2 times the force necessary to lift the WLL.

5.4.4.2 Hydraulically or pneumatically operated tongs, grabs, clamps and expanding mandrels

Tongs, grabs, clamps and expanding mandrels, where the holding force depends on hydraulic or pneumatic pressure, shall be such that the lifting operation can only start when the necessary gripping pressure is reached and maintained.

5.4.4.3 Power failure for hydraulically or pneumatically operated tongs, grabs, clamps and expanding mandrels

In the case of power failure whilst holding the load, the holding force shall be maintained for at least 2 minutes, or the load shall be capable of being lowered safely before it is released.

Such manipulators shall be equipped with acoustic or visual devices to warn the operator in the case of power failure.

5.5 Controls

5.5.1 Controls shall be in accordance with EN 13557.

Controls with non hold-to-run operation are allowed for lifting and lowering of vacuum lifting tubes.

5.5.2 Manipulators shall be equipped with an emergency stop device acting on all power driven movements of the load with the following exceptions:

- pneumatic or hydraulically driven movements for hoisting, travelling, swivelling and tilting;
- manipulators where the force resulting from unintended movement will not cause injury.

5.5.3 Features shall be provided so that the suspended load cannot be released by unintentional or accidental operation according to EN ISO 12100-1:2003 3.26.1 and 3.26.4, e.g. dual, 2 hand or 2 mechanical controls.

5.5.4 Features shall be provided when necessary so that the risk for the operator due to mechanical gripping of the load is prevented, e.g. 2 hand controls, or covers.

5.6 Protection against risks and damage

5.6.1 General

Hydraulic, pneumatic and electrical lines shall be arranged and protected so that damage due to normal operational movements is avoided.

Manipulator parts, the safety of which can be impaired by wear, corrosion or other influences, shall be accessible so that their condition can be checked.

5.6.2 Speed

The speed of powered movements shall be such that the operator can maintain control of the load. The risk of uncontrolled movements cannot be eliminated in all cases if the movement is powered with pneumatic cylinders or vacuum lifting tubes. Accelerated movements will occur e.g. when the suspended load is released instantaneously or gets disengaged with an obstacle. The manufacturer shall state these hazardous situations in his information for use and give advice to the operator how to avoid residual risk.

In the case of damage to the load causing a reduction in the suspended weight, there shall be measures to limit the manipulator’s speed.

5.6.3 Failure of power supply

Failure of power supply, either for lifting or holding the load, shall not result in additional hazards or risks. To comply with this requirement at least one of the following measures shall be provided to prevent uncontrolled movement of the load:

— a facility to lower the load safely without risk of detaching the load;

— load immobilization and holding;

— vacuum lifters with pressure reservoir, vacuum reservoir, flywheel) to hold the load for a time period long enough to leave the danger zone or take securing measures, as defined in 5.4.2.3, 5.4.3.3, and 5.4.4.3.

When the holding of the load is limited in duration (e.g. because of expiration of the energy source), the load shall be capable of being lowered safely or the operator shall be warned by an automatic warning device.

5.6.4 Motion limiters

A motion limiter shall be provided when an unlimited motion would induce a risk. Motion limiters shall comply with EN 12077-2.

Motion limiters shall prevent damage to parts of the manipulator. The effect of operating motion limiters shall not result in the disengagement of parts of the manipulator or the load.

A lowering limiter shall be provided if the lowest possible travel of the load (normally the ground level) is outside the safe limit of vertical motion.

5.6.5 Load limiters

Manipulators with a WLL of 1 000 kg or above, or an overturning moment of 40 000 Nm or above due to the load shall be equipped with a rated capacity limiting and indicating device according to EN 12077-2.

5.6.6 Noise emission reduction and determination

5.6.6.1 Noise reduction at source at the design stage

Main sources of noise in manipulators are:

— hoisting mechanism (motor, gear, brakes);

— trolley traversing mechanism (motor, gear, brakes, especially rail/wheel contact);

— electrical cubicles;

— external devices, e.g. motor fans;

— hydraulic pumps, either on the trolley or in the load lifting attachment (especially the grabs);

— turbines;

— vacuum pumps;

— suction feet;

— pneumatic motors;

— control valves.

Typical measures to reduce noise are:

- selection of low noise components;
- use of exhaust silencers for valves, pumps, cylinders…

Other measures of identical or better efficiency can be used.

When designing a manipulator, the manufacturer shall take account of the methodology of low-noise design described in EN ISO 11688-1.

NOTE 1 EN ISO 11688-2 gives useful information on noise generation mechanisms in machinery.

NOTE 2 Normally noise is not a significant hazard for manipulators. Noise can be a significant hazard in cases where the operator position is situated close to a component, the power level or operational speed of which is high.

5.6.6.2 Noise reduction by protective measures

Typical measures are:

— the use of sound insulating covers and enclosures around noisy components;

— place the noisy components away from the operator's position.

Other measures can be used.

6 Verification of the safety requirements and/or measures

6.1 General

Conformity to the safety requirements and/or measures (given in Clause 5) shall be verified by the methods detailed in Table 4, by applying one of the modes described in 6.2, and using the methods described in 6.3.

Verification may be carried out either during manufacturing, assembly or taking into service.

6.2 Modes of verification

6.2.1 Type verification

Verification carried out on one or several samples of a manipulator before it is series produced.

6.2.2 Individual verification

Verification carried out on each manipulator before commissioning. For individual verification destructive testing need not be applied.

6.3 Methods of verification

6.3.1 Verification by calculation

Verification by calculation is carried out during design of a manipulator applying appropriate standards to ensure compliance with requirements.

6.3.2 Verification by testing

6.3.2.1 General

Tests shall be carried out on a manipulator equipped with its load holding devices.

6.3.2.2 Static test

All manipulators shall be submitted before their placement on the market to a test consisting of suspending a load of 1,25 times the maximum load specified by the manufacturer for 10 minutes (2 minutes for turbine powered manipulators).

The test shall be considered to be successful if no crack, permanent deformation or damage is visible, no connection has loosened or been damaged and if the manipulator's operation is not affected.

6.3.2.3 Dynamic test

Before its commissioning, each manipulator shall be submitted to a dynamic operational test with a load of 1,1 times the maximum load specified by the manufacturer.

This test shall be carried out for each motion of the manipulator with repeated starts and stops throughout the working range of the manipulator.

The test shall be considered successful if the manipulator has been found to perform all its functions and if the examination subsequent to the test reveals no damage to mechanisms or structural components, and no connection has been loosened or been damaged.

6.3.3 Verification by inspection

6.3.3.1 Inspection of characteristics

Verify visually that the various constituent parts of the manipulator comply with the requirements of this standard.

6.3.3.2 Visual inspection

Check that all the manipulator components have been correctly assembled and operate normally.

Table 4 — Methods to be used to verify conformity with the safety requirements and/or measures

		Method of verification	
Clause	**Requirements**	**Type verification**	**Individual verification**
5.2.1	Mechanical strength	Calculation	Static test
5.2.2	Shape of components	Visual inspection	Visual inspection
5.2.3	Stability	Calculation	Dynamic test
5.2.4	Drift	Dynamic test	Dynamic test
5.2.5	Hydraulic systems and components	Inspection of characteristics	Inspection of characteristics
5.2.6	Pneumatic systems and components	Inspection of characteristics	Inspection of characteristics
5.2.7	Electrical systems and components	Inspection of characteristics	Inspection of characteristics
5.2.8	Gearbox	Inspection of characteristics	Inspection of characteristics
5.2.9	Rope drives	Inspection of characteristics	Inspection of characteristics
5.2.10	Chain drives	Inspection of characteristics	Inspection of characteristics
5.2.11	Belt drives	Inspection of characteristics	Inspection of characteristics
5.2.12	Trolleys	Inspection of characteristics	Inspection of characteristics
5.2.13	Load suspension elements	Static test of components	Inspection of characteristics
5.3	Vacuum lifting tubes	Static test of components	Dynamic test
5.4.1.1	Securing the load	Dynamic test	Dynamic test
5.4.1.2	Load holding devices	Dynamic test	Dynamic test
5.4.1.3	Load holding devices composed of adjustable components	Dynamic test	Dynamic test
5.4.2.1	Holding force	Calculation	Dynamic test
5.4.2.2	Pressure failure	Dynamic test	Dynamic test
5.4.2.3	Power failure	Dynamic test	Dynamic test
5.4.3.1	Holding force	Calculation	Dynamic test
5.4.3.2	State of magnetization	Visual inspection	Visual inspection
5.4.3.3	Power supply for mains-fed electrical lifting magnets	Inspection of characteristics	Dynamic test

5.4.3.4	Exhausting of battery	Dynamic test	Inspection of characteristics
5.4.4.1	Holding force	Calculation	Dynamic test
5.4.4.2	Hydraulically or pneumatically operated tongs, grabs, clamps and expanding mandrels	Dynamic test	Dynamic test
5.4.4.3	Power failure for hydraulically or pneumatically operated tongs, grabs, clamps and expanding mandrels	Dynamic test	Dynamic test
5.5.1		Inspection of characteristics	Inspection of characteristics
5.5.2		Inspection of characteristics	Inspection of characteristics
5.5.3		Inspection of characteristics	Inspection of characteristics
5.5.4		Inspection of characteristics	Inspection of characteristics
5.6.1	General	Visual inspection	Visual inspection
5.6.2	Speed	Dynamic test	Dynamic test
5.6.3	Failure of power supply	Dynamic test	Dynamic test
5.6.4	Motion limiters	Dynamic test	Dynamic test
5.6.5	Rated capacity limiters	Test with 1.25 WLL	Test with 1.25 WLL
5.6.6	Noise	Dynamic test with WLL (Annex A)	Dynamic test with WLL (Annex A)

7 Information for use

7.1 General

The information for use shall warn the user (in accordance with the requirements of EN ISO 12100-2 A1, 6.5 A1) about residual risks which cannot be eliminated or sufficiently reduced by design.

NOTE Attention is drawn to EN ISO 12100-1 and EN ISO 12100-2.The information for use shall advise precautions how to protect against residual risks.

7.2 Instruction handbook

7.2.1 General

To allow purchasers to safely select, install, use and maintain their manipulators during their intended lifetime, the manufacturer shall provide the following essential information.

a) brief description of the manipulator, its intended use and its performance;

b) description of the putting into service;

c) instructions for safe use;

d) instructions for handling/transporting the manipulator (giving the mass of the manipulator and its various parts where they are likely to be transported separately);

e) the characteristics of removable attachments which may be fitted to the manipulator (if any);

f) description of the nature of loads which may be handled;

g) description of the operating range of the machine;

h) description of the physical parameters of the load;

i) fitting, securing, coupling/uncoupling and adjustment of the manipulator;

j) stability (if applicable);

k) if necessary, operation in special atmospheres (moisture, explosive, saline, etc.);

l) special training of operators;

m) instructions to reduce the risks when a very close distance is required between the operator and the load;

n) reference to Annex A of this standard shall be given

– If the value of the A-weighted emission sound pressure level at the operator position is lower than 70dB, this fact shall be indicated;

– If the value of the A-weighted emission sound pressure level at the operator position exceeds 70 dB, this value shall be stated;

– If the value of the A-weighted emission sound pressure level at the operator position exceeds ⟩A1⟨ 80 dB ⟩A1⟨, the A-weighted sound power level shall be determined according to Annex A and stated (see 7.2.1. o).

o) if the determination of the A-weighted sound power level is required, the value shall be given;

p) the recommendation for operators and servicemen to wear hearing protection when the manipulator is used in a noisy environment or the A-weighted emission sound pressure level at the operator position due to the manipulator exceeds ⟩A1⟨ 80 dB ⟩A1⟨.

⟩A1⟨ NOTE Information on noise emission should also be provided in the sales literature. ⟩A1⟨

7.2.2 Guidance for maintenance

The manufacturer shall provide the user with the necessary information to ensure the proper maintenance and servicing of the manipulator, including:

a) instructions for periodic maintenance;

b) instructions for troubleshooting;

c) precautions to be taken during repairs;

d) use of original spare parts;

e) maintenance documentation.

7.2.3 Inspections and checks

The manufacturer shall indicate the inspections and checks that are necessary, i.e.:

a) before commissioning;

b) after repair or recoupling;

c) during the manipulator's lifetime.

The manufacturer shall also include a list of the parts which require special operation and checking.

7.3 Marking, signs (pictograms), written warnings

7.3.1 Minimum marking

7.3.1.1 Manipulator

All manipulators shall have a clearly visible permanent identification plate giving at least the following information:

a) the name and address of the manufacturer or his authorised representative;

b) designation of series or type;

c) serial number, if any;

d) ▌A1⟩ the year of construction, that is the year in which the manufacturing process is completed. It is prohibited to pre-date or post-date the machinery when affixing the CE marking; ⟨A1▐

e) the working load limit in kg specified by the manufacturer;

f) self mass, for self-stable and mobile manipulators;

g) the necessary voltages and fluid pressures.

7.3.1.2 Removable load holding devices

The identification plate of the removable load holding device's manufacturer shall remain on the removable load holding device. It shall not be confused with the plate specified in 7.3.1.1.

7.3.2 Additional marking

In addition to 7.3.1, the manufacturer shall affix clearly identified markings, signs and written warnings giving basic safety instructions such as:

a) for vacuum tubes, the lowest admissible absolute working pressure shall be given;

b) persons are forbidden to walk or stand in the danger zone presented by the manipulator;

c) the working load limit in kg specified by the manufacturer;

d) the operator shall read the instruction handbook provided by the manipulator's manufacturer.

These markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the parts of the function (s) of the machine which they are related to. Readily understandable signs (pictograms) shall be used in preference to written warnings.

Information printed directly on the supporting structure shall be permanent and remain legible throughout the expected life of the manipulator.

7.4 Further information

Guidance specific to the equipment supplied and its use shall be contained in an instruction handbook. Further information can be obtained from EN 12644-1.

Annex A
(normative)

Noise test code

A.1 Scope

This noise test code specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of the noise emission characteristics of manipulators.

Noise emission characteristics include emission sound pressure levels at operator's positions. The determination of these quantities is necessary for:

— manufacturers to declare the noise emitted;

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

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

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

— a measurement method (A.4) of the sound pressure level at the operator's position;

— if there is a need, a method for determining the A-weighted sound power level.

A.2 Description of machinery family

This Annex is applicable to individual manipulator in the scope of this standard as fully assembled in the intended working configuration, including the load lifting attachment.

A.3 Emission sound pressure level measurement

A.3.1 General

The A-weighted emission sound pressure level at the operator’s position shall be measured according to EN ISO 11201:1995 (grade 2 method) or EN ISO 11202:1995 (grade 3 method). The measurement shall be done on the manufacturer’s premises. If this is not possible, then the test shall be carried out on site.

A.3.2 Measurement point

The measurement shall be made at the operator’s position, at a height of 1,6 m from the floor.

A.4 Determination of the A-weighted sound power level

If the A-weighted sound power level is determined, this shall be performed according to EN ISO 3744:1995 (grade 2 method) or EN ISO 3746:1995 (grade 3 method). The measurement surface shall be a parallelepiped. The measurement distance shall be taken equal to 1 m.

A.5 Installation and mounting conditions

The manipulator shall be installed in its operating conditions as it is intended to be used. If many positions of the operator are possible, the measurement shall be operated in the highest noise emission condition.

The sound alarm signals shall be disconnected during the noise measurements.

A.6 Operating conditions

The sound pressure level shall be determined over a complete operating cycle of the manipulator.

For manipulators dedicated to a specific task (e.g. lifting bags from a position to another, holding a windscreen from a table to the car-body…) the cycle to be considered starts with whatever position of the current cycle, and ends with the same position of the following cycle.

For other manipulators, the cycle to be considered shall hold starts, stops, and motions covering all the range permitted by the manipulator.

A.7 Information to be recorded

A1 The average A-weighted sound pressure level over the operating cycle specified in A.6 shall be measured, and recorded according to clause 12 of EN ISO 11201:1995 or EN ISO 11202:1995.

If determined, the value of the A-weighted sound power level shall be recorded according to Clause 9 of EN ISO 3744:1994 or EN ISO 3746:1995.

The C-weighted peak emission sound pressure level of manipulators is typically so low that it need not be measured and recorded. A1

A.8 Information to be reported

A1 The test report shall comply with Clause 13 of EN ISO 11201:1995 or EN ISO 11202:1995 and, if the A-weighted sound power level is determined, with Clause 10 of EN ISO 3744:1995 or EN ISO 3746:1995. A1

A.9 Declaration and verification of noise emission values

A1 The declaration and verification of noise emission values shall be made in accordance with EN ISO 4871:1996. The declaration shall be a dual-number declaration as defined in EN ISO 4871:1996. Table A.1 gives an example of noise declaration. A1

Table A.1 – Example of declaration of the A-weighted emission sound pressure level at the operator's position of a manipulator

Model number, operating conditions and other identifying information: Type, Model, rated capacity, etc.	
A-weighted emission sound pressure level at the operator's position	L_{pA} = 75 dB
Uncertainty K_A	K_A = 2,5 dB
Measurements have been carried out according to EN ISO 11201 and Annex A of ▌A1⟩ EN 14238:2005 ⟨A1▐. Operator's position: at the control's position when the load holding device is the closest position to the supporting pillar.	

In case of verification of the noise emission values of an individual manipulator obtained according to this Annex, the measurements shall be conducted by using the same mounting, installation and operating conditions and test configuration as those used for the initial determination of noise emission values.

Annex B
(informative)

Selection of suitable set of crane standards for a given application

Is there a product standard in the following list that suits the application?	
prEN 13000:1997	Cranes – Mobile cranes
prEN 14439:2002	Cranes – Tower cranes
pr EN 14985	Cranes – Slewing jib cranes
pr EN 15011	Cranes – Bridge and gantry cranes
prEN 13852-1:2000	Cranes – Offshore cranes – Part 1: General purpose offshore cranes
prEN 13852-2:2002	Cranes – Offshore cranes – Part 2: Floating cranes
prEN 14492-1	Cranes – Power driven winches and hoists – Part 1: Power driven winches
prEN 14492-2:2002	Cranes – Power driven winches and hoists – Part 2: Power driven hoists
EN 12999:2002	Cranes – Loader cranes
prEN 13157:1998	Cranes – Safety – Hand powered cranes
EN 13155:2003	Cranes – Non-fixed load lifting attachments
prEN 14238:2001	Cranes – Manually controlled load manipulating devices

YES

Use it directly, plus the standards that are referred to

NO

Use the following:	
CEN/TC 147 N 435	Cranes — Terminology
EN 13001-1:1997	Cranes — General design — Part 1: General principles and requirements
EN 13001-2:1997	Cranes — General design — Part 2: Load effects
prCEN/TS 13001-3-1:2003	Cranes — General design — Part 3.1: Limit states and proof of competence of steel structures
prCEN/TS 13001-3-2:2003	Cranes — General design — Part 3.2: Limit states and proof of competence of wire ropes and reeving systems
prCEN/TS 13001-3-3	Cranes — General design — Part 3.3: Limit states and proof of competence of wheel / rail contacts
prCEN/TS 13001-3-4	Cranes — General design — Part 3.4: Limit states and proof of competence of machinery
prEN 13135-1:2003	Cranes — Safety — Design — Requirements for equipment — Part 1: Electrotechnical equipment
prEN 13135-2:2003	Cranes — Safety — Design — Requirements for equipment — Part 2: Non-electrotechnical equipment
EN 13557:2003	Cranes — Controls and control stations
EN 12077-2	Cranes safety — Requirements for health and safety — Part 2: Limiting and indicating devices
prEN 13586:1999	Cranes — Access
prEN 14502-1:2002	Cranes — Equipment for the lifting of persons — Part 1: Suspended baskets
prEN 14502-2:2002	Cranes — Equipment for the lifting of persons — Part 2: Elevating control stations
prEN 14502-3	Cranes — Equipment for the lifting of persons — Part 3: Spreader beams
EN 12644-1:2001	Cranes — Information for use and testing — Part 1: Instructions
EN 12644-2:2000	Cranes — Information for use and testing — Part 2: Marking
prEN 12644-3:1997	Cranes — Information for use and testing — Part 3: Fitness for purpose

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC, amended by Directive 98/79/EC

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

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.

Annex ZB
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/CE

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. A1

Bibliography

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