SLOVENSKI STANDARD
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Regalna dvigala in oprema - Varnostne zahteve

Rail dependent storage and retrieval equipment - Safety requirements

Regalbediengeräte - Sicherheit

Transtockeurs - Sécurité

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Rail dependent storage and retrieval equipment - Safety requirements

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Foreword

This document (EN 528:2008) has been prepared by Technical Committee CEN/TC 149 “Power-operated warehouse equipment”, 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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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This European Standard supersedes EN 528:1996.

EN 528:1996 can be further applied until 12/2009.

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) 98/37/EC and 2006/42/EC.

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

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 the United Kingdom.

Introduction

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

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

When provisions of this type C standard are different from those that are stated in type A or type 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.

While producing this standard it was assumed that:

a) only competent persons operate the machine;

b) components without specific requirements are:

   1) designed in accordance with the usual engineering practice and calculation codes, including all failure modes;

   2) of suitable mechanical and electrical construction;

   3) made of materials with adequate strength and of suitable quality;

c) harmful materials, such as asbestos are not used as part of the machine;

d) components are kept in good repair and working order, so that the required characteristics remain despite wear;

e) by design of the load bearing elements, safe operation of the machine is assured for loading ranging from zero to 100 % of the rated possibilities;

f) discussions have taken place between the user and the supplier concerning particular conditions for the use and places of use of the machinery;

g) working area is adequately lit;

h) places of installation allow a safe use of the machine.

1 Scope

This standard applies to all types of S/R machines, restricted to the rails on which they travel within and outside the aisles, which embody lifting means and may embody lateral handling facilities, for the storage and retrieval of unit loads and/or long goods such as bar materials and/or for order picking or similar duties. Also included is the transfer equipment used to change between aisles. Control of machines may range from manual to fully automatic.

This standard does not apply to free ranging industrial trucks or robots.

References in this standard to racking, buildings and systems only apply where it is necessary to assess the hazards and risks at their interfaces with S/R machines.

This standard deals with all significant hazards relevant to rail dependent storage and retrieval equipment, when they are used as intended under the conditions foreseen by the manufacturer (see Clause 4).

This standard applies to machines and equipment that are manufactured after the date of issue of this standard.

Illustrations of examples of machines and transfer equipment to which this standard applies are shown in Annex A.

Safety requirements and/or measures in this standard apply to equipment used under indoor conditions. However, additional risk assessments and safety measures need to be considered for uses in severe conditions, e.g. freezer applications, high temperatures, loads, the nature of which could lead to a dangerous situation (e.g. especially brittle loads, explosives), earthquake effects and also contact with foodstuff. Hazards during decommissioning are not covered.

This European Standard also deals with the technical requirements for electromagnetic compatibility (EMC).

Noise emitted by these machines is not considered as significant but as a relevant hazard. This means that the manufacturer of the machine is obliged to carry out noise reduction and indicate the noise level.

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 81-1:1998, *Safety rules for the construction and installation of lifts — Part 1: Electric lifts*

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

EN 363, *Personal fall protection equipment — Personal fall protection systems*

EN 574, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

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

EN 795, *Protection against falls from a height — Anchor devices — Requirements and testing*

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

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

EN 999, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*

EN 1037, *Safety of machinery — Prevention of unexpected start-up*

EN 1263-1, *Safety nets — Part 1: Safety requirements, test methods*

EN 1263-2, *Safety nets — Part 2: Safety requirements for the positioning limits*

EN 1760-1, *Safety of machinery — Pressure sensitive protective devices — Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors*

EN 1760-2, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars*

EN 1760-3, *Safety of machinery — Pressure sensitive protective devices — Part 3: General principles for the design and testing of pressure sensitive bumpers, plates, wires and similar devices*

EN 12385-4, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

EN 13411-3, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*

EN 13411-6, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*

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

EN 60947-5-1:2004, *Low voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:2003)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2005)*

EN 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*

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

EN ISO 11202, *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 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

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

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

EN ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

EN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2004)*

ISO 4308-1, *Cranes and lifting appliances — Selection of wire ropes — Part 1: General*

3 Terms and definitions

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

3.1
control position
every place, from where the machine can be controlled, including external control position (3.2.), emergency control position (3.3) and onboard control position (3.4)

3.2
external control position
control position placed in a safe area, out of the working area of the S/R machine, from where the movements of the machine can be controlled

3.3
emergency control position
position on the machine or inside the danger area of the machine, from where the machine can be controlled in case of fault clearing (emergency) or maintenance works

3.4
onboard control position
protected position on the machine, from where the movements of the machine can be controlled (includes S/R machines according to Clause 6 (with on-board operators))

3.5
operators work area
area on or off the machine where order picking, stocktaking or similar work is carried out

3.6
load handling device
part of the machine for carrying the specified loads

3.7
deterring/impeding device
any physical obstacle which, without totally preventing access to a danger zone, reduces the probability of access to this zone by offering an obstruction to free access

3.8
rated load
maximum load which the machine has been designed to carry, excluding the mass of operator(s) and any part of the machine

3.9
test load
rated load plus additional load for test purposes

3.10
rated speed
maximum speed of the machine for which it has been designed and for which normal operation is guaranteed by the vendor

3.11
safety gear
mechanical device for stopping and maintaining stationary the lifting carriage in case of overspeed in the downward direction

3.12
specified load
load with specified characteristics (mass, dimensions, pallet or container, packaging, etc.) which the machine has been designed to carry

3.13
transfer device
device which is used for transferring a S/R machine from one aisle to another and which is not integral with the S/R machine

3.14
maintenance position
position on or off the machine for safe maintenance and repair

3.15
key
device that can be mechanical, electrical, magnetic or similar with unique characteristics

3.16
maximum working pressure
maximum pressure corresponding to the setting of the pressure relief valve

3.17
operating pressure
pressure under which the system is designed to work

3.18
satellite vehicle
individual vehicle connected to the lifting carriage of the machine and used for transferring loads into or out of the rack structure

3.19
load transfer area
area where loads are transferred into or out of the machine operating area

3.20
work station
place where persons carry out their duties

3.21
traffic area
area that personnel use for travel from one place to another

3.22
system axes
directions, in which the sr-machine can move

NOTE x = aisle length direction; y = aisle vertical direction; z = aisle lateral direction

4 List of significant and relevant hazards

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

Table 1 — List of significant and relevant hazards

Hazards		Corresponding requirements	
4.1	**Mechanical hazards**		
4.1.1	Crushing from collapse of racking due to contact with the machine	5.4.6.6	Unintentional lowering
		5.6.2	End stops
		5.6.3	Limitation of forces
		5.6.5	Load handling interlocks
		5.10.2	Safety clearances
4.1.2	Shearing of a person on board between moving machine and racking	5.9.2	Maintenance position
		6.3.2/7.2	Safeguard of the operator
4.1.3	Cutting due to broken glass	6.2.2.3	Safety glass
		6.2.2.10	
		6.2.4.2	Protected lighting
4.1.4	Drawing-in or trapping of a person in a maintenance position when machine operated by a driver	5.9.5	Communication
4.1.5	Impact from: a) Fall of objects from operator's position b) Collision between machine and persons	6.2.2.3	Floor of the onboard control position
		5.9.6	Protection from operating machines
		5.10.3	Limiting access
		5.10.4	Load entry/exit
		5.10.6	Escape
		6.6	Protection of operators in an aisle containing two or more manually operated machines
		10.4.6	Operator check of aisle
		10.4.7	No unauthorised access to the aisles
		10.4.8	Permit to work system
		10.5.2.9	No danger from second machine
4.1.6	Loss of stability	5.5.5 5.8.5	Stability
		5.6.1	Load stability
4.1.7	Slip, trip or fall on operator's platform	5.10.3.2. c)	Access door interlock
		6.2.2.3	Horizontal slip-resistant floor

Table 1 *(continued)*

Hazards		Corresponding requirements	
4.1.8	Handling of machine	5.1	Lifting points
		8.1	Erection and dismantling
4.1.9	Falling objects	5.4.7.2	No separation of lifting carriage
		5.4.8.2	No rack and pinion disengagement
		6.2.2.8	Overhead protection
4.1.10	Fall of person from elevated operator position	6.2.1.4	Prevention of falls from access means
		6.2.2.3	Floor design
		6.2.2.4	Safe guard
		6.2.2.5	Guards
		6.2.2.6	Permanent fixed guards
		6.2.2.7	Operator's position door opening
		10.4.15	Operator entering or leaving the machine in position
		10.4.20	Person on load handling device
4.1.11	Defective stopping	5.5.1.1.c)	Emergency braking system
4.1.12	Uncontrolled movements (including unintended movements)	5.3.5	Control devices for powered movements
		5.3.9	Safety requirements related to EMC
		5.4.6.5	Prevention of lowering of the onboard control position
4.1.13	Load falls	5.4.2	Limitation of lifting and lowering movement
		5.4.6.7	Auxiliary hoist valve
		5.6.1	Load stability
		5.6.6	Auxiliary handling equipment
		5.6.7	Load position monitoring
		5.10.5	Load movement over persons
		5.10.7	No unintentional load movement
		5.10.8	Protection from falling loads
		7.4.3	Lead-screw drives (safety nut)
		10.4.10	No overloading
		10.4.11	Load remains on load handling device
		10.4.12	No projection of goods into aisle
		10.4.18	No handling of faulty loads
4.1.14	Collisions	5.5.2.c)	Speed reducing system
		5.5.3.d)	Limitation of travel
4.1.15	Tipping of machine	5.4.3.1	Overload protection

Table 1 *(continued)*

Hazards		Corresponding requirements	
		5.5.2	Speed reducing system
		5.5.4	Anti-derailment device
		5.5.5	Stability
		5.6.5	Load handling interlocks
		5.8.1	Machine position on transfer device
		5.8.3	Transfer device movement
		5.8.4	Machine interlocking before transfer
		5.8.5	Stability of transfer device
		6.4.1	Overload protection
4.1.16	Lifting of persons resulting in: a) plummeting of onboard control position b) falling from onboard control position	5.4.4	Safety gear
		5.4.6	Hydraulic lowering control valve
		5.4.7	Lead-screw drives (safety nut)
		5.4.8	Rack and pinion drives
		5.9.2	Protection of maintenance position
		6.2.2	Onboard control position design
		10.4.4	Correct numbers of persons on machine
4.1.17	Derailment of machine	5.5.4	Anti-derailment device
4.1.18	Insufficient strength of parts	5	Compliance with EN standards
4.1.19	Inadequate design of pulleys and drums	5.4.5.1.4 5.4.5.1.5 5.4.5.1.9 5.4.5.1.10	Pulley and drum design requirements
4.1.20	Inadequate selection of suspension elements	5.4.5.1 5.4.5.2 5.4.5.3	Rope, belt and chain selection criteria
4.1.21	Lowering by friction brake	5.4.1	Hoist unit brake
4.2	**Electrical hazards**		
4.2.1	Electrical contact with live conductors	5.1	Compliance with EN standards
		5.7.1	Electrical supply conditions
		5.7.3	Environment
		5.7.4	Supply disconnecting device
4.2.2	Electrostatic phenomena	Not applicable	
4.2.3	Thermal radiation	Not applicable	
4.2.4	External influences	Not applicable	
4.2.5	Lightning	Not applicable	