SLOVENSKI STANDARD
SIST EN 528:2021+A1:2022

01-oktober-2022

Regalna dvigala in oprema - Varnostne zahteve

Rail dependent storage and retrieval equipment - Safety requirements for S/R machines

Regalbediengeräte - Sicherheitsanforderungen

Transtockeurs - Prescriptions de sécurité

Ta slovenski standard je istoveten z: **EN 528:2021+A1:2022**

ICS:

53.080	Skladiščna oprema	Storage equipment

SIST EN 528:2021+A1:2022 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 528:2021+A1

July 2022

ICS 53.080

Supersedes EN 528:2021

English Version

Rail dependent storage and retrieval equipment - Safety requirements for S/R machines

Transtockeurs - Prescriptions de sécurité

Regalbediengeräte - Sicherheitsanforderungen

This European Standard was approved by CEN on 4 January 2021 and includes Amendment 1 approved by CEN on 4 May 2022.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 528:2021+A1:2022 E

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European foreword

This document (EN 528:2021+A1:2022) 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of an identical text or by endorsement, at the latest by January 2023, and conflicting national standards shall be withdrawn at the latest by January 2023.

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

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

This document includes Amendment 1 approved by CEN on 4 May 2022.

This document supersedes ▌A1⟩ EN 528:2021 ⟨A1▌.

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

The main changes compared to the previous edition EN 528:2008 are as follows:

— clearer / more understandable Annex C dealing with preventing access to dangerous movements across the load entry/exit points;

— Annex ZA has been updated by introducing the generic template for Annex ZA amended in accordance with decision of EU commission;

— revision and adaption of Annex B Performance level according to EN ISO 13849-1:2015;

— the scope has been stated more precisely;

— more readable and clearer text in standard due to avoidness of separate chapters for automatic and manual machines;

— amendment or rather change of the following definitions (3):

  — on-board control position (3.4), permanent on-board control position (3.5), load entry / exit points (3.7), working place (3.8), pick and deposit station (3.9), restricted area (3.11), danger area (3.12), satellite vehicle (3.15), powered access cabin (3.20), climb assistance system (3.21), rated speed (3.22), normal operation (3.25), deleted definition 3.22 and renamed following definitions;

— speed limitation (4.9.4) has been updated and been stated more precisely;

— where a powered access cabin is provided, it shall comply with the requirements for control positions (4.9.7.2);

— Detachable ladders may be used up to a maximum height of 3 m (4.9.7);

— safety gear required for lifting carriages, that are designed to carry person(s) (4.4.4.1);

— the ratio of the minimum breaking force to the maximum static force for all types of suspension elements to the lifting of persons has been reduced from 10 to 8 (4.4.5.1);

— requirements for additional person(s) on the lifting carriage has been stated more precisely (4.9.2.2);

— ladder along the mast shall be fitted with a guided type of a fall arresters according with EN 353-1:2014+A1:2017 and anchor points at the transition points (4.9.3);

— prevention against load falling into adjacent automatically operated aisles: Safety level (PLr) is not more depending on the frequency of access to the aisle (4.10.7.3);

— physical safety backstops shall be dimensioned according to the loads that occur (4.10.7);

— information on the planned dismantling of the installation is required in information for use (6.8).

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, 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.

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

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

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

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

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

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

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

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

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

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 ensured 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 document is applicable to all types of Storage and Retrieval (S/R) machines, restricted to the rails on which they travel within and outside the aisles for the storage and retrieval of unit loads and/or long goods such as bar materials and/or for order picking or similar duties. These machines embody lifting means along a mast and may include lateral handling facilities. Also included is the transfer equipment used to change between aisles. Control of machines may range from manual to fully automatic.

S/R-machine-related satellite vehicles according to definition 3.15 are included as a load-handling-device (LHD).

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 document deals with all significant hazards relevant to rail dependent storage and retrieval equipment, when they are used under the conditions intended by the manufacturer including reasonably foreseeable misuse (see Annex F "List of significant hazards").

This document is applicable to machines and equipment that are manufactured after the date of issue of this document. A transition period of 12 months is proposed.

Figures 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. extremely 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.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 81-50:2020, *Safety rules for the construction and installation of lifts — Examinations and tests — Part 50: Design rules, calculations, examinations and tests of lift components*

EN 341:2011, *Personal fall protection equipment — Descender devices for rescue*

EN 353-1:2014+A1:2017, *Personal fall protection equipment — Guided type fall arresters including an anchor line — Part 1: Guided type fall arresters including a rigid anchor line*

EN 358:2018, *Personal protective equipment for work positioning and prevention of falls from a height — Belts and lanyards for work positioning or restraint*

EN 361:2002, *Personal protective equipment against falls from a height — Full body harnesses*

EN 363:2018, *Personal fall protection equipment — Personal fall protection systems*

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

EN 795:2012, *Personal fall protection equipment — Anchor devices*

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

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

EN 12385-4:2002+A1:2008, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

EN 13501-1:2018, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

〚A1〛 EN 14449:2005, *Glass in building — Laminated glass and laminated safety glass — Product standard* 〚A1〛

EN 60204-32:2008, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*

EN IEC 61000-6-2:2019, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2016)*

EN 61496-1:2013, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

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 7731:2008, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731:2003)*

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

EN ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design (ISO 13850:2015)*

EN ISO 13851:2019, *Safety of machinery — Two-hand control devices — Principles for design and selection (ISO 13851:2019)*

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 13856-1:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors (ISO 13856-1:2013)*

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

EN ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection (ISO 14119:2013)*

EN ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

EN ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access (ISO 14122-1:2016)*

EN ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2016)*

EN ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2016)*

EN ISO 14122-4:2016, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2016)*

ISO 16625:2013, *Cranes and hoists — Selection of wire ropes, drums and sheaves*

3 Terms and definitions

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

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

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

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

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 on-board control position (3.4)

3.2
external control position
control position placed outside of the operational 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
on-board control position
protected position on the machine, from where the movements of the machine can be controlled (includes permanent on-board-control position as defined in 3.5)

3.5
permanent on-board control position
protected position on the machine, from where the movements of the machine can be controlled, intended to be used by an on-board operator in the normal operation

Note 1 to entry: Permanent on-board control is fitted e.g. for on-board picking.

3.6
maintenance position
position on or off the S/R machine intended for maintenance and repair

3.7
load entry / exit points
points where loads were transferred into or out of the restricted area or danger area

3.8
working place
place where persons carry out their duties

3.9
pick and deposit station
location where a load can be picked up from or deposited to the conveyor by the S/R-machine

Note1 to entry: Within the document "pick and deposit" is abbreviated as "P&D"

3.10
traffic area
area, which is accessible to or reachable without opening a guard, activating a trip device or using additional means

3.11
restricted area
enclosed area where only authorized operators who are especially skilled to do maintenance, trouble shooting and repairing work have access to

Note 1 to entry: See also Annex D.

3.12
danger area
area where persons can be exposed to danger during operation of the machine

3.13
load handling device
part of the S/R machine for carrying the specified loads (including one or more satellite vehicles, related to the S/R machine)

Note1 to entry: Within the document "load handling device" is abbreviated as "LHD".

3.14
transfer device
device for transferring a S/R machine from one aisle to another and which is not integral with the S/R machine

3.15
satellite vehicle
vehicle intended for transferring loads into or out of the rack structure by leaving the S/R machine

Note 1 to entry: There may be one or more satellite-vehicles per S/R machine.

3.16
lifting carriage
part of the machine moving vertically along the mast and carrying both load handling device and load; it may also carry (depending on type of machine) an on-board control position or an emergency control position

3.17
rated load
maximum load which the machine has been designed to carry, excluding the mass of operator(s) and any part of the machine

3.18
test load
rated load plus additional load for test purposes

3.19
specified load
load with specified characteristics (mass, dimensions, pallet or container, packaging, etc.) which the machine has been designed to carry

3.20
powered access cabin
enclosed cabin moving independently from the lifting carriage along the mast in order to provide access to and egress from the lifting carriage and/or maintenance platforms

Note 1 to entry: The on-board control position may be installed within this powered access cabin.

3.21
climb assistance system
powered device used in conjunction with a full body harness in order to ease climbing by providing a defined lifting force (below person`s weight) along the access ladder

3.22
rated speed
maximum speed of the machine for which it has been designed and for which normal operation is guaranteed by the manufacturer

3.23
safety gear
mechanical device for stopping and maintaining stationary the lifting carriage in case of overspeed in the downward direction

3.24
key
opening or switching device that can be mechanical, electrical, magnetic or similar with unique characteristics

3.25
normal operation
operating condition where the S/R machine is operating in accordance with the manufacturer's instructions primarily for the storage, retrieval and reorganisation of specified loads

3.26
system axes
directions, in which the S/R machine can move

Note 1 to entry: x = aisle length direction; y = aisle vertical direction; z = aisle lateral direction.

4 Safety requirements and/or protective/risk reduction measures

4.1 General

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

In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

Means of access shall comply with EN ISO 14122:2016 parts 1 to 4 except as otherwise specified in this document.

In the design of machines and sub-assemblies provisions for lifting shall be considered. Safety distances shall comply with EN ISO 13857:2019 apart from the deviations stated in this standard.

Guards shall comply with EN ISO 14120:2015 and interlocking devices shall comply with EN ISO 14119:2013 apart from the deviations stated in this standard.

4.2 Control position

4.2.1 General

Depending on the intended use of the machine the following control position are required:

— S/R machines with one or more on-board operators shall have a permanent on-board control position as described in 3.5;

— in the case of fully automatically controlled machines an on-board control position is not required, but an emergency control position as described in 3.3 shall be provided for each machine.

4.2.2 Access to and egress from the permanent on-board control position

Means of access shall be provided to enter and leave a permanent on-board control position in the normal parking position, in accordance with EN ISO 14122:2016 parts 1 to 4.

Leaving in an emergency shall be possible from all positions by using a ladder as described in 4.9.7 or a descending device for rescue in accordance with EN 341:2011.

4.2.3 Floor of the on-board control position

The floor of the on-board control position shall be within 5° of the horizontal and slip resistant.

The floor shall be designed in accordance with EN ISO 14122-2:2016, 4.2.5.

If glazing is provided for the floor, it shall comply with A1) EN 14449:2005 (A1.

Where grated flooring is provided, the holes or openings shall not allow a 30 mm diameter sphere to pass through. The area of each opening shall in no case exceed 900 mm^2.

4.2.4 Design and dimensioning of permanent on-board control position

4.2.4.1 Ergonomic principles

Ergonomic principles shall be incorporated where practicable within the confines of the S/R machine design, in accordance with 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.

The permanent on-board control position shall be arranged and designed so that the operator has a clear view of his/her immediate working area. If glass is fitted it shall be of the laminated safety glass type.