
Varnostna pravila za konstruiranje in vgradnjo tekočih stopnic in trakov za osebe

Safety rules for the construction and installation of escalators and moving walks

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ICS

Will supersede EN 115:1995

English version

Safety rules for the construction and installation of escalators and moving walks

Règles de sécurité pour la construction et l'installation des
escaliers mécaniques et trottoirs roulants

Sicherheitsregeln für die Konstruktion und den Einbau von
Fahrtreppen und Fahrsteigen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 10.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Foreword

This document (prEN 115:2005) has been prepared by Technical Committee CEN/TC 10 "Lifts, escalators and moving walks", the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 115:1995.

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.

Considering that EN 115:1995 had given rise to requests for interpretation and this standard did not fully comply with EN 414 (today CEN Guide 414 "Safety of machinery - Rules for the drafting and presentation of safety standards"), CEN/TC 10 asked its working group 2 to revise EN 115:1995: This task was completed by CEN/TC 10/WG 2 in 2005 after 19 working meetings by

- taking into account the interpretations;
- taking over the agreed upon points from the work carried out by ISO/TC 178/WG 5;
- adapting the requirements to the state of the art using the risk assessment methodology as given in ISO/TS 14798:2000;
- improving the references to other standards according to the progress in that field;
- covering the requirements of CEN Guide 414 by creating a new structure which addresses the safety rules for the machine and provides requirements in the normative annexes and information in the informative annexes;
- increasing the measures against foreseeable misuse;
- reviewing the safety requirements for escalators and moving walks.

The date of withdrawal (DOW) of EN 115:1995 and its amendments EN 115/A1:1998 and EN 115/A2:2004 shall be 2 years after the date of availability (DAV) of the revised standard.

Introduction

This standard is a Type C Standard as stated in EN ISO 12100-2.

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

When the provisions of this C standard are different from those which 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.

The purpose of this standard is to define safety requirements for escalators and moving walks in order to safeguard people and objects against risks of accidents during installation, operation, maintenance and inspection work.

It is assumed that negotiations have been made for each contract between the customer and the supplier/installer (see also Annex A) about:

- a) intended use of the escalator or moving walk;
- b) environmental conditions;
- c) civil engineering problems;
- d) other aspects related to the place of installation.

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(0.5.2) If escalators or moving walks are intended to be operated under special conditions, such as directly exposed to the weather or explosive atmosphere, or in exceptional cases serve as emergency exits, appropriate design criteria, components, materials and instructions for use should be used that satisfy the particular conditions.

(0.8) An Interpretation Committee has been established to clarify, if necessary, the spirit in which the clauses of the standard have been drafted and to specify the requirements appropriate to particular cases. (new)The formats of an interpretation request and the interpretation are given in Annex K.

1 Scope

1.1 This standard is applicable for new escalators and moving walks (pallet or belt type) as defined in clause 3.

This standard deals with all significant hazards, hazardous situations and events relevant to escalators and moving walks when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see clause 4).

1.2 Existing escalators and moving walks are not subject to this standard. It is, however, recommended that they be adapted to this standard.

This document is not applicable to escalators and moving walks which are manufactured before the date of its publication as EN.

1.3 If some dimensions of this standard cannot be kept due to structural conditions in existing buildings, it has to be defined in the individual case which alternative requirements are necessary.

NOTE In addition, see information for use.

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 418:1992, *Safety of machinery; emergency stop equipment, functional aspects; principles for design* (Note: To be replaced by EN ISO 13850 (2004-07)).

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EN 954-1:1996, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design* (Note: To be replaced by prEN ISO 13849-1 (2004-04)).

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

EN 10025:1993, *Hot rolled products of non-alloy structural steels; technical delivery conditions (includes amendment A1:1993)* (Note: To be replaced by prEN 10025-1 (2004-06), prEN 10025-2 (2003-11)).

prEN 10083-1:2003, *Steels for quenching and tempering - Part 1: General technical delivery conditions* (Note: Intended as replacement for EN 10083-1+A1 (1996-08)).

EN 12015:2004, *Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks - Emission*.

EN 12016:2004, *Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks - Immunity*.

EN 13015:2001, *Maintenance for lifts and escalators - Rules for maintenance instructions*.

EN 13501-1:2002, *Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests*.

EN 60068-2-6:1994, *Environmental testing - Part 2: Tests - Tests Fc: Vibration (sinusoidal)* (IEC 60068-2-6:1995 + Corrigendum 1995).

EN 60068-2-14:1999, *Environmental testing - Part 2: Tests - Test N: Change of temperature* (IEC 60068-2-14:1984 + A1:1986).

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EN 60068-2-27:1993, *Basic environmental testing procedures - Part 2: Tests - Test Ea and guidance: Shock* (IEC 60068-2-27:1987).

EN 60204-1:1998, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements* (IEC 60204-1:1997) (Note: To be replaced by prEN 60204-1 (2003-07)).

EN 60249-2 series of standards, *Base materials for printed circuits - Part 2: Specifications; (IEC 60249-2 series of standards)*.

EN 60269-1:1998, *Low-voltage fuses - Part 1: General requirements* (IEC 60269-1:1998).

EN 60439-1:1999, *Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies* (IEC 60439-1:1999).

EN 60529:1991, *Degrees of protection provided by enclosures (IP code)* (IEC 60529:1989).

EN 60664-1:2003, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests* (IEC 60664-1:1992 + A1:2000 + A2:2002).

EN 60747-5-5:200X, *Discrete semiconductor devices and integrated circuits -- Part 5-5: Optoelectronic devices; Photocouplers, optocouplers*.

EN 60947-4-1:2001, *Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters; Electromechanical contactors and motor-starters* (IEC 60947-4-1:2000 (Note: To be amended by EN 60947-4-1/prA2 (2004-04))).

EN 60947-4-1/A1:2002, *Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters; Electromechanical contactors and motor-starters; Amendment A1* (IEC 60947-4-1:2000/A1:2002).

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 61558-1:1997, *Safety of power transformers, power supply units and similar - Part 1: General requirements and tests* (IEC 61558-1:1997, modified).

EN 62326-1:2002, *Printed boards - Part 1: Generic specification* (IEC 62326-1:2002).

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 13849-2:2003, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation* (ISO 13849-2:2003).

IEC 60249-3-1:1981, *Base materials for printed circuits - Part 3: Special materials used in connection with printed circuits - Specification No. 1: Prepreg for use as bonding sheet material in the fabrication of multilayer printed boards*.

IEC 60249-3-3:1991, *Base materials for printed circuits - Part 3: Special materials used in connection with printed circuits - Specification 3: Permanent polymer coating materials (solder resist) for use in the fabrication of printed boards*.

ISO 3864-1:2002, *Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs in workplaces and public areas* (Note: Corrected and reprinted in 2003-12).

ISO/DIS 18738-2 (in preparation), *Escalators and moving walks – Part 2: Measurement of ride quality*.

HD 21.3 S3:1995, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 3: Non-sheathed cables for fixed wiring (IEC 60227-3:1993, modified).*

HD 21.4 S2:1990, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 4: Sheathed cables for fixed wiring.*

HD 21.5 S3:1994, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 5: Flexible cables (cords) (IEC 60227-5:1979, modified).*

HD 22.4 S4:2004, *Cables of rated voltages up to and including 450/750 V and having crosslinked insulation - Part 4: Cords and flexible cables.*

HD 384.4.41 S2:1996, *Electrical installations of buildings - Part 4: Protection for safety - Chapter 41: Protection against electric shock; incl. Amendment A1 (IEC 60364-4-41:1992/A2:1999, modified).*

3 Terms and definitions - Symbols and abbreviations

3.1 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 12100-1 and the following apply.

3.1.1

angle of inclination

maximum angle to the horizontal in which the steps, the pallets or the belt move

3.1.2

balustrade

part of the escalator/moving walk which ensures the user's safety by providing stability, protecting from moving parts and supporting the handrail

3.1.3

balustrade decking

transverse member of the balustrade which meets the handrail guidance profile and which forms the top cover of the balustrade

3.1.4

brake load

load on the step/pallet/belt which the brake system is designed to stop the escalator/moving walk

3.1.5

comb/comb plate

pronged section at each landing that meshes with the grooves in the user carrying surface with a platform at each landing to which the combs are attached

3.1.6

escalator

power-driven, inclined, continuous moving stairway used for raising or lowering persons in which the user carrying surface (e.g. steps) remains horizontal

NOTE Escalators are in all cases machines and cannot be considered as a fixed staircase.

3.1.7

exterior panel

part of the exterior side of the enclosure of an escalator or moving walk

3.1.8

fail safe circuit

programmable and/or electronic system with safety functions

3.1.9

handrail

power-driven moving rail for persons to grip while using the escalator or moving walk

3.1.10

interior panel

panel located between the skirting or lower inner decking and the handrail guidance profile or balustrade decking

3.1.11

lower inner decking 2

profile that connects the skirting with the interior panel when they do not meet at a common point

3.1.12

maximum capacity

maximum flow of persons that can be achieved under operational conditions

3.1.13

moving walk

power-driven installation for the conveyance of persons in which the user carrying surface remains parallel to its direction of motion and is uninterrupted (e.g. pallets, belt)

NOTE Moving walks are in all cases machines even when they are out of operation.

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3.1.14

newel

end of the balustrade

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3.1.15

nominal speed

speed in the direction of the moving steps, pallets or the belt, when operating the equipment under no load condition (i.e. without persons), stated by the manufacturer as that for which the escalator or moving walk has been designed

NOTE Rated speed is the speed the escalator/moving walk moves under rated load conditions.

3.1.16

rated load

load which the equipment is designed to move (for maximum capacity see Annex G)

3.1.17

safety circuit

electric interconnection consisting of safety switches and/or fail safe circuits

3.1.18

skirting

vertical part of the balustrade interfacing with the steps, pallets or belt

3.1.19

skirt deflector

device to minimise the risk of trapping between the step and the skirting

3.1.20**stand-by operation**

mode in which an escalator/moving walk can be stopped or operated under no load condition with any speed below the nominal speed

3.2 Symbols and abbreviations

The following symbols and corresponding units of measurement are used in this standard.

Table 1 — Symbols and corresponding units of measurement used in this standard

Symbol	Designation	Unit
b_1	Distance between the handrail centre lines	m
b_2	Width of the handrail	mm
b_3	Distance between skirting and lower inner decking	mm
b_4	Horizontal part of the lower inner decking that directly joins the interior panel	mm
b_5	Distance between the handrail and the edge of the balustrade	mm
b_6', b_6''	Distance between the handrail profile and guide or cover profiles	mm
b_7	Width of the grooves	mm
b_8	Web width	mm
b_9	Distance between the centre line of the handrail and an obstacle	m
b_{10}	Horizontal distance between the outer edge of the handrail and walls or other obstacles	mm
b_{11}	Horizontal distance between the handrails of adjacent escalators/moving walks	mm
b_{12}	Vertical distance between the lower edge of the handrail and walls or other obstacles	mm
b_{13}	Width of the balustrade decking	mm
b_{14}	Combined balustrade decking width	mm
b_{15}	Horizontal distance between the building structure (wall) and the centreline of the handrail	mm
b_{16}	Horizontal distance between the centrelines of the handrails of adjacent escalators/moving walks	mm
b_{17}	Horizontal distance of the anti-slide device to the outer edge of the handrail	mm
c	Maximum capacity	persons/h
h_1	Vertical distance between the handrail and step nose or pallet surface or belt surface	m
h_2	Vertical distance between top edge of skirting or bottom edge of cover joints and the tread surface of the steps, pallets or belt	mm
h_3	Distance between the entry of handrail into the newel and the floor	m
h_4	Free height above the steps, pallets or belt	m
h_5	Vertical obstruction	m
h_6	Clearance between the upper edge of the tread surface and the root of the comb teeth	mm
h_7	Depth of the grooves	mm
h_8	Mesh depth of the comb into the grooves of the tread	mm

Symbol	Designation	Unit
h_9	Vertical distance between floor and lower end of the anti-climbing device	mm
h_{10}	Vertical distance between top of the handrail and upper end of the access restriction device	mm
h_{11}	Height of the ant-slide device	mm
h_{12}	Free height above handrails	mm
L_1	Root of the comb teeth	-
l_1	Distance between supports	m
L_2	Comb intersection line	-
l_2	Newel including the handrail in longitudinal direction measured from the comb intersection line	m
l_3	Straight portion of the handrail in the direction of landing measured from the comb intersection line	m
l_4	Horizontal distance between the furthest point reached by the handrail and the point of entry into the newel	m
v	Nominal speed	m/s
x_1	Step height	m
y_1	Step depth	m
z_1	Nominal width for the load carrying area (step, pallet or belt)	m
z_2	Distance between skirting	m
z_3	Transverse distance between the supporting rollers	mm
α	Angle of inclination of the escalator or moving walk	°(degree)
β	Design angle of the teeth of the comb	°(degree)
γ	Angle of inclination between the lower inner decking and the interior panel	°(degree)
δ	Slope of the balustrade decking	°(degree)
μ	Friction coefficient	-

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 escalators and moving walks and which require action to eliminate or reduce the risk. These significant hazards are based upon EN 1050.

4.1 Mechanical hazards

Mechanical hazards on escalators and moving walks and in their immediate vicinity can occur because of the design of the machine or access to it.

These include:

- contact with moving machinery parts (e.g. driving unit, handrail drive) normally not accessible to the public;
- crushing of fingers between handrail and balustrade;

- impact on bodies caused by collision with building structures (wall, roof, criss-cross arrangement), or with persons on adjacent escalators/moving walks;
- drawing-in at handrail entry into the balustrade;
- trapping between skirting and steps, between comb and step/pallet;
- trapping between step and step or pallet and pallet.

4.2 Electrical hazards

Electrical hazardous situations can occur due to:

- contact of persons (workers) with live parts;
- inadequate emergency stops;
- wrong assembly of electrical components;
- electrostatic phenomena;
- external influences on electrical equipment.

4.3 Radiation hazards

4.3.1 Electromagnetic radiation generated by the machine

Electromagnetic radiation can be emitted by the escalator or moving walk during normal operation.

4.3.2 Electromagnetic radiation received from outside

Immission of low frequency radiation, radio frequency radiation, and microwaves can occur.

4.4 Fire hazard

Fire hazards can be generated by accumulation of combustible material inside the truss, by the isolation material for cables and overloading of drives.

4.5 Hazards generated by neglecting ergonomic principles in machinery design

Hazardous situation can occur because of:

- neglecting ergonomic dimensions for the users (e.g. height of balustrade, width of handrail);
- inadequate lighting in the working places and access to it;
- insufficient space in working places;
- missing lifting equipment for heavy loads.

4.6 Failure of control circuit

Hazardous situation can occur because of:

- no stopping in case of dangerous situations;

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- short circuit of electrical wiring;
- overload of electrical wiring;
- unexpected start of machine after an interruption;
- unexpected reversal of drive;
- excessive speed;
- excessive deceleration during stopping.

4.7 Break-up during operation

Even if the design of an escalator or moving walks follows the requirements of EN 115, there are specific hazards which can occur due to

- greater than specified user and structural loads on the truss;
- loads greater than specified onto the balustrade;
- loads greater than specified on the steps/pallets by unforeseeable misuse;
- loads greater than specified on the drive unit.

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4.8 Slip, trip and fall of persons

Most of the dangerous situations on escalators and moving walks are caused by slipping and falling of persons.

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This includes:

- slipping on steps/pallets/belt, on the comb plate;
- falling caused by handrail speed deviation (incl. standstill);
- falling caused by change of the direction of movement;
- falling caused by increased acceleration/deceleration;
- falling caused by unexpected start or over-speed of the machine;
- falling caused by inadequate lighting at the landings.

4.9 Particular hazards in combination with this type of machine

Many hazards are specific for that type of machine. These include

- missing steps or pallets after maintenance/repair work;
- misuse by transporting others items than persons (e.g. shopping or luggage trolleys);
- climbing on the outside of the balustrade;
- climbing over the balustrade;

- surfing on the handrail;
- storage of merchandise adjacent to the balustrade,
- creation of traffic jam at blocked landings or intermediate exits of consecutive escalators or moving walks;
- disturbance of the person flow in connected escalators/moving walks;
- lifting by the handrail at the newel ends and falling over adjacent fixed barrier or the balustrade of the escalator/moving walk.

5 Safety requirements and/or protective measures

5.1 General

Escalators and moving walks shall comply with the safety requirements and/or protective measures of this clause. In addition, escalators and moving walks shall be designed according to the principles of EN ISO 12100-2 for relevant but not significant hazards, which are not dealt with by this standard (e.g. sharp edges).

Where, for elucidation of the text, an example is given this shall not be considered as the only possible design. Any other solution leading to the same result is permissible if it is ensured that with an equivalent function the same safety level exists.

Certain escalators and moving walks are subject to special operational and environmental conditions. For these cases some additional recommendations are defined (see Annex G.2).

5.2 Supporting structure (truss) and enclosure

5.2.1 General

5.2.1.1 All mechanically moving parts of the escalator or moving walk shall be completely enclosed within imperforate panels or walls. Exempt from this are the accessible steps, the accessible pallets, the accessible belt and that part of the handrail available for the user. Apertures for ventilation are permitted (see also 5.2.1.5)

5.2.1.2 The exterior panels shall withstand a force of 250 N at any point at right angles on an area of 25 cm². The supporting structure and fixing points shall be designed in that way to carry at least twice the dead load of the enclosure.

5.2.1.3 It is permissible to omit an enclosure of the mechanically moved parts if other measures (such as rooms with locked doors accessible to authorised personnel only) make a hazard to the public impossible.

5.2.1.4 Accumulation of materials (e.g. grease, oil, dust, paper) represents a fire risk. Therefore it shall be possible to clean the inner part of the escalator/moving walk.

5.2.1.5 Ventilation apertures shall be built or arranged in such a way that it is not possible to pass a straight rigid rod 10 mm in diameter through the enclosure. It shall not be possible to touch any moving part through a ventilation aperture.

5.2.1.6 Any exterior panels which are designed to be opened (e. g. for cleaning purposes) shall be provided with a safety device according to Table 6 n).