

مؤسسة المواصفات والمقاييس الأردنية

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معالي الأكرم
عطوفة المحترم
سعادة المحترم

تحية طيبة وبعد،،

أرجو سيادتكم التكرم بالعلم بأن أسلوب العمل الفني المتبع في وضع المواصفات القياسية والقواعد الفنية الأردنية يقتضي تعميم مشروع التصويت على الجهات ذات العلاقة، وذلك لإبداء الرأي والتصويت عليه تمهيداً لعرضه على مجلس الإدارة لاعتماده كمواصفة قياسية أو قاعدة فنية أردنية.

لذا أرجو أن أرفق لكم طياً نسخة عن مشروع التصويت للمواصفة القياسية الأردنية ١٨١٤-٢٠١٥ الخاصة بسلامة الادراج الكهربائية والمماشي المتحركة، الجزء ١: البناء والتركيب، والذي أعدته اللجنة الفنية الدائمة لقطاع الاجهزة والمعدات الكهربائية الخاصة بالمباني رقم (٥٢).

يرجى التكرم بعرض هذا المشروع على المختصين لديكم وموافاتنا بردكم عليه خلال شهرين من تاريخه، وذلك باستخدام بطاقة التصويت المرفقة، علماً بأن عدم الرد خلال المدة يعتبر موافقة من قبلكم على المشروع المذكور.

وتفضلوا سيادتكم بقبول فائق الاحترام،،،

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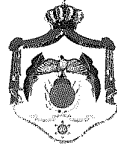
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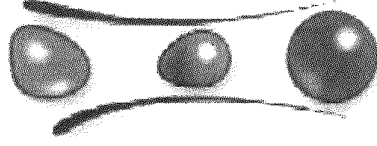
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ع ت ١٨١٤-١/٢٠١٥ أوروبية ١١٥-١/٢٠٠٨

First edition

الإصدار الأول

مشروع تصويت

(تبني معدل)

سلامة الأدراج الكهربائية والمماشي المتحركة

الجزء ١ : البناء والتركيب

Safety of escalators and moving walks

Part 1: Construction and installation

مؤسسة المواصفات والمقاييس

المملكة الأردنية الهاشمية

هذه الوثيقة مشروع تصويت تم توزيعه لإبداء الرأي والملاحظات. لذلك فهو عرضة للتغيير والتبديل ولا يجوز الرجوع اليه كمواصفة قياسية أردنية الا بعد اعتماده من قبل مجلس

الإدارة.

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Foreword

Jordan Standards & Metrology Organization is the national standardization body in Jordan. The work of preparing Jordanian Standards is normally carried out by technical committees composed of the interested parties, which are involved in the scope of the standard. All the interested parties have the right to vote on the draft Jordanian Standard during the enquiry stage, taking into consideration the importance of harmonizing Jordanian Standards with the international, regional or national standards (as much as possible) for the purpose of eliminating technical barriers to trade and facilitating the international trade.

Jordanian Standards are drafted in accordance with the rules given in the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian Standards^{*}.

The permanent technical committee for electrical equipment and devices for buildings 52 has studied the prepared project of the Jordanian Standard 1814-1:2015 related to "**Safety of escalators and moving walks, Part 1: Construction and installation**", and has recommended to approve the amended project as a Jordanian Standard 1814-1:2015 "**Safety of escalators and moving walks, Part 1: Construction and installation**", according to article 5 paragraph A clause 12 of Standards and Metrology Law No. 22/2000.

This part of Jordanian Standard 1814-1:2015 is a modified adoption of European standard 115-1:2008, "**Safety of escalators and moving walks, Part 1: Construction and installation**", using reprint method, double vertical bars in the margins (||) are used to indicate the incorporation of the amendments A1:2010 and/or technical corrigenda A1:2010 which is issued by the European committee for standardization into the text of the Jordanian Standard, and single vertical dotted bars (·) in the margins are used to indicate the applicable editorial modifications of the European standard which have been changed. Each variation is cross-referenced to the clause of the European standard together with reasons for these deviations in annex (NA).

For the purposes of this Jordanian standard, the following editorial changes also have been made:

- Substitution of "this European standard" by "this Jordanian standard".
- Deletion of text in one or several languages from a multilingual International Standard.
- Inclusion of technical corrigenda or amendments issued to the International Standard.

^{*} under amendment

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0- Introduction

0-1 General

0-1-1 This Jordanian Standard is a Type C standard as stated in EN ISO 12100-1.

0-1-2 The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this Jordanian standard.

0-1-3 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.

0-2 General remarks

0-2-1 The purpose of this Jordanian 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.

0-2-2 The contents of this Jordanian Standard are based on the assumption that persons using escalators and moving walks are able to do so unaided. However, physical and sensory abilities in a population can vary over a wide range, escalators and moving walks are also likely to be used by persons with a range of other disabilities.

0-2-3 Some individuals, in particular older people, might have more than one impairment. Some individuals are not able to use an escalator or moving walk independently and rely on assistance/support being provided by a companion. Furthermore some individuals can be encumbered by objects or be responsible for other persons, which can affect their mobility. The extent to which an individual is incapacitated by impairments and encumbrances often depends on the usability of products, facilities and the environment.

0-2-4 The use of wheelchairs on escalators and moving walks can lead to dangerous situations which cannot be mitigated by machine designs and therefore should not be permitted.

0-2-5 The use of lifts is the preferred method of vertical travel for most people with disabilities and in particular wheelchair users and persons with guide dogs.

0-2-6 Additional signs should be provided to indicate the location of other facilities, these facilities should be in close proximity to the escalators and moving walks and easy to find.

0-2-7 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.

0-2-8 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.

* under amendment

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Safety of escalators and moving walks

Part 1: Construction and installation

1- Scope

1-1 This Jordanian Standard is applicable for new escalators and moving walks (pallet or belt type) as defined in clause 3.

This Jordanian 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 This Jordanian Standard does not deal with hazards arising from seismic activities.

1-3 This Jordanian Standard is not applicable to escalators and moving walks which were manufactured before the date of its publication as Jordanian Standard. It is, however, recommended that existing installations be adapted to this Jordanian 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.

- ISO 3864-1, Graphical symbols – Safety colours and safety signs, Part 1: Design principles for safety signs workplaces and public areas (Note: Corrected and reprinted in 2003-12).
- ISO 3864-3, Graphical symbols – Safety colours and safety signs, Part 3: Design principles for graphical symbols for use in safety signs.
- ISO 7010, Graphical symbols -- Safety colours and safety signs -- Registered safety signs.
- IEC 60747-5-5, Semiconductor devices – Discrete devices, Part 5-5: Optoelectronic devices – safety signs in workplaces and public areas (Note This Jordanian Standard is intended to be published unmodified as an EN 60747-5-5).
- EN 1929-2, Basket trolleys, Part 2: Requirements, tests and inspection for basket trolleys with or without a child carrying facility, intended to be used on passenger conveyors.
- EN 1929-4, Basket trolleys, Part 4: Requirements and tests for basket trolleys with additional goods carrying facility(ies), with or without a child carrying facility, intended to be used on passenger conveyors.
- EN 1993-1-1, Eurocode 3: Design of steel structures, Part 1-1: General rules and rules for buildings.
- EN 10025-1, Hot rolled products of structural steels, Part 1: General technical delivery conditions.
- EN 10025-2, Hot rolled products of structural steels, Part 2: Technical delivery conditions for non-alloy structural steels.
- EN 10025-3, Hot rolled products of structural steels, Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels.
- EN 10025-4, Hot rolled products of structural steels, Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels.
- EN 10025-5, Hot rolled products of structural steels, Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance.
- EN 10025-6, Hot rolled products of structural steels, Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition.
- EN 10083-1, Steels for quenching and tempering, Part 1: General technical delivery

conditions.

- EN 10083-2, Steels for quenching and tempering, Part 2: Technical delivery conditions for non alloy steels.
- EN 10083-3, Steels for quenching and tempering, Part 3: Technical delivery conditions for alloy steels.
- EN 12015, Electromagnetic compatibility, Product family standard for lifts, escalators and moving walks – Emission.
- EN 12016, 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 13501-1:2007, Fire classification of construction products and building elements, Part 1: Classification using data from reaction to fire tests.
- EN 60068-2-6:1995, Environmental testing, Part 2: Tests – Tests F_c : Vibration (sinusoidal) (IEC 60068-2-6:1995 + Corrigendum 1995).
- EN 60068-2-14, Environmental testing, Part 2: Tests – Test N: Change of temperature (IEC 60068-2-14:1984 + A1:1986).
- EN 60068-2-27:1993, Basic environmental testing procedures, Part 2: Tests – Test Ea and guidance: Shock (IEC 60068-2-27:1987).
- EN 60068-2-29, Basic environmental testing procedures, Part 2: Tests. Test Eb and guidance: Bump (IEC 60068-2-29:1987).
- EN 60204-1:2006, Safety of machinery – Electrical equipment of machines, Part 1: General requirements (IEC 60204-1:2005, modified).
- EN 60269-1, Low-voltage fuses, Part 1: General requirements (IEC 60269-1:2006).
- 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, Degrees of protection provided by enclosures (IP code) (IEC 60529:1989).
- EN 60664-1:2007, Insulation coordination for equipment within low-voltage systems, Part 1: Principles, requirements and tests (IEC 60664-1:2007).
- EN 60947-4-1, Low-voltage switchgear and controlgear, Part 4-1: Contactors and motor-starters – electromechanical contactors and motor-starters (IEC 60947-4-1:2000).
- EN 60947-5-1, Low-voltage switchgear and controlgear, Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices (IEC 60947-5-1:2003).
- EN 61249 series, Materials for printed boards and other interconnecting structures (IEC 61249 series).
- EN 61558-1:2005, Safety of power transformers, power supplies, reactors and similar products, Part 1: General requirements and tests (IEC 61558-1:2005).
- EN 62061, Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061:2005).
- EN 62326-1, 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 13850, Safety of machinery – Emergency stop – Principles for design (ISO 13850:2006).
- EN ISO 13857:2006, Safety of machinery – Safety distances to prevent hazard zones being reached by the upper and lower limbs (ISO 13857:2008).

- HD 21.3 S3, 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, 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, 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, Cables of rated voltages up to and including 450/750 V and having crosslinked insulation, Part 4: Cords and flexible cables.
- HD 60364-4-41, Low-voltage electrical installations, Part 4-41: Protection for safety – Protection against electric shock (IEC 60364- 4-41:2005, modified).

3- Terms and definitions - Symbols and abbreviations

3-1 Terms and definitions

For the purposes of this Jordanian Standard, the terms and definitions given in EN ISO 12100-1:2003 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

3-1-5-1

comb

pronged section at each landing that meshes with the grooves

3-1-5-2

comb plate

platform at each landing to which the combs are attached

3-1-6

electrical safety system

safety related part of the electrical control system as an arrangement of safety circuits and monitoring devices

3-1-7

electrical safety devices

part of a safety circuit consisting of safety switches and/or fail safe circuits

3-1-8

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 machines - even when they are out of operation - and cannot be considered as fixed staircases.

3-1-9

exterior panel

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

3-1-10

fail safe circuit

safety related electrical and/or electronic system with defined failure mode behaviour

3-1-11

handrail

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

3-1-12

interior panel

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

3-1-13

3-1-13-1

lower inner decking

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

3-1-13-2

lower outer decking

profile that connects the exterior panels with the interior panel

3-1-14

machinery

escalator or moving walk machine(s) mechanisms and associated equipment

3-1-15

machinery spaces

space(s) inside or outside of the truss where the machinery as a whole or in parts is placed

3-1-16

maximum capacity

maximum flow of persons that can be achieved under operational conditions

3-1-17

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 machines - even when they are out of operation – and should not be used as a fixed access.

3-1-18

newel

end of the balustrade

3-1-19

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.

3-1-20

programmable electronic system in safety related applications for escalators and moving walks (PESSRAE)

system for control, protection or monitoring based on one or more programmable electronic devices, including all elements of the system such as power supplies, sensors and other input devices, data highways and other communication paths, and actuators and other output devices, used in safety related applications as listed in Table 6

3-1-21

rated load

load which the equipment is designed to move

Note: For maximum capacity, see Annex H.

3-1-22

rise

vertical distance between the upper and lower finished floor levels

3-1-23

safety circuit

part of the electric safety system consisting of electrical safety devices

3-1-24

safety integrity level (SIL)

discrete level for specifying the safety integrity requirements of the safety functions to be allocated to the PESSRAE

Note: In this Jordanian Standard SIL 1 is representing the lowest level and SIL 3 the highest, even when it does not make use of SIL 3.

3-1-25

skirting

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

3-1-26

skirt deflector

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

3-1-27

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

3-1-28

system reaction time

sum of the following two values:

- time period between the occurrence of a fault in the PESSRAE and the initiation of the corresponding action on the escalator/moving walk.
- time period for the escalator/moving walk to respond to the action, maintaining a safe state.

3-2 Symbols and abbreviations

The following symbols and corresponding units of measurement of the following Table 1 are used in this Jordanian Standard

Table 1 – Symbols and corresponding units of measurement used in this Jordanian Standard

Symbol	Designation	Unit	Figure
b_1	Distance between the handrail centre lines	m	3
b_2	Width of the handrail	mm	3
b_3	Horizontal distance between skirting and interior panel	mm	3
b_4	Width of the horizontal part of the lower inner decking that directly joins the interior panel	mm	3
b_5	Horizontal distance between the inner edge of the handrail and the top edge of the interior panel	mm	3
b_6', b_6''	Horizontal distance between the handrail profile and guide or cover profiles	mm	3
b_7	Width of the grooves	mm	2

Table 1 – (Continued)

Symbol	Designation	Unit	Figure
b_8	Web width	mm	2
b_9	Horizontal distance between the outer edge of the handrail and a non-continuous obstruction, e.g. roof intersection, column	mm	A-1
b_{10}	Horizontal distance between the outer edge of the handrail and a continuous obstruction, e.g. wall	mm	A-1
b_{11}	Horizontal distance between the handrails of adjacent escalators/moving walks	mm	A-1
b_{12}	Vertical distance between the lower edge of the handrail and the balustrade decking	mm	3
b_{13}	Width of the lower outer decking	mm	4
b_{14}	Horizontal distance between the outer edges of interior panels on adjacent escalators or moving walks	mm	4
b_{15}	Horizontal distance between the building structure (wall) and the centreline of the handrail	mm	4
b_{16}	Horizontal distance between the centrelines of the handrails of adjacent escalators/moving walks	mm	4
b_{17}	Horizontal distance of the anti-slide device to the outer edge of the handrail	mm	4
h_1	Vertical distance between the top of the handrail and step nose or pallet surface or belt surface	m	2, 3
h_2	Vertical distance between top edge of skirting or bottom edge of cover joints and the line of the step nose or the tread surface of the pallets or belt	mm	3
h_3	Distance between the entry of handrail into the newel and the floor	m	2,3
h_4	Free height above any point of step surfaces, pallets or belt over the area between both outer edges of the handrails	m	2, A-1
h_5	Height of the deflector	m	2, 4

h_6	Clearance between the upper edge of the tread surface and the root of the comb teeth	mm	2
h_7	Depth of the grooves	mm	2
h_8	Mesh depth of the comb into the grooves of the tread	mm	2
h_9	Vertical distance between floor and lower end of the anti-climbing device	mm	4
h_{10}	Vertical distance between lower edge of the handrail and upper end of the access restriction device	mm	4
h_{11}	Height of the anti-slide device	mm	4
h_{12}	Height of the upper edge of the free space outside the handrail	mm	A-1
h_{13}	Vertical distance between the upper and lower finished floor levels	m	2
L_1	Root of the comb teeth	-	2
l_1	Horizontal distance between supports	m	2
L_2	Comb intersection line	-	2

Table 1 – (Continued)

Symbol	Designation	Unit	Figure
l_2	Distance between the furthest point reached by the handrail and the comb intersection line measured parallel to the tread surface	m	2
l_3	Length of the straight portion of the handrail in the direction of landing measured from the comb intersection line	m	2
l_4	Distance between the furthest point reached by the handrail and the point of entry into the newel measured parallel to the tread surface	m	2
l_5	Length of anti-climbing device on the lower outer decking	mm	4
v	Nominal speed	m/s	-
x_1	Step height	m	5
y_1	Step depth	m	5
z_1	Nominal width for the load carrying area (step, pallet or belt)	m	3, 5
z_2	Horizontal distance between skirting	m	3
z_3	Transverse distance between the supporting rollers	mm	8
α	Angle of inclination of the escalator or moving walk	°(degree)	2
β	Design angle of the teeth of the comb	°(degree)	2
γ	Cross-sectional angle of inclination of the lower inner decking	°(degree)	3
μ	Friction coefficient	-	-

4- List of significant hazards

4-1 General

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this Jordanian 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 ISO 14121-1 [2].

4-2 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 (see clauses 5-2-1-1, 5-2-1-2, 5-2-1-3, 5-2-1-5, 5-2-1-6, 5-2-3, 5-2-4, 5-8-1, 5-8-4, 5-12-2-5, A-3-2, A-3-3).
- crushing and shearing of fingers between handrail and balustrade and between balustrades (see clauses 5-5-2-5, 5-6-2).
- cutting hazard caused by adjacent cover profile parts (see clause 5-5-2-4).
- impact on bodies caused by collision with building structures (wall, roof, criss-cross arrangement), or with persons on adjacent escalators/moving walks (see clauses A-2-1, A-2-2, A-2-3, A-2-4).
- drawing-in at handrail entry into the balustrade (see clauses 5-6-4-3, 5-6-5).
- trapping between skirting and steps, between comb and step/pallet (see clauses 5-3-4, 5-3-5, 5-4-2-1, 5-4-2-2, 5-5-3, 5-5-5, 5-7-2-5, 5-7-3 and Figure G-2).
- trapping between the floor and the handrail (see clauses 5-6-4-1, 5-6-4-2).
- trapping between step and step or pallet and pallet (see clause 5-3-2).

4-3 Electric hazards

Electric hazardous situations can occur due to:

- contact of persons with live parts (see clauses 5-8-3-3, 5-11-1-3).
- indirect contact (see clauses 5-11-1-4, A-4).
- inadequate emergency stops (see clause 5-12-2-2-3).
- wrong assembly of electric components (see clause 5-11-5-4).
- electrostatic phenomena (see clause 5-11-7).
- external influences on electric equipment (see clauses 5-12-1-2-1-4, 5-12-1-2-1-5, 5-12-1-2-2-3).

4-4 Radiation hazards

4-4-1 Electromagnetic radiation generated by the machine

Electromagnetic radiation can be emitted by the escalator or moving walk during normal operation (see clauses 5-11-1-2-3, 5-12-1-2-1-5).

4-4-2 Electromagnetic radiation received from outside

Immission of low frequency radiation, radio frequency radiation, and microwaves can occur (see clauses 5-11-1-2-3, 5-12-1-2-1-5).

4-5 Fire hazard

Fire hazards can be generated by accumulation of combustible material inside the truss, by the insulation material for cables and overloading of drives (see clauses 5-2-1-4, 5-9).

4-6 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) (see clauses 5-5-2-1, 5-6-2, 5-6-3).
- inadequate lighting in the working places and access to them (see clauses 5-8-3-1, 5-8-3-2, A-3-4, A-3-5).
- insufficient space in working places (see clauses 5-8-2-1, 5-8-2-2, 5-8-2-3, A-3-6, A-3-7, A-3-8).
- missing lifting equipment for heavy loads (see clauses 5-8-2-2, 5-10).

4-7 Hazard generated by failure of control circuit

Hazardous situation can occur because of:

- no stopping in case of dangerous situations (see clauses 5-11-2, 5-12-1).
- short circuit of electric wiring (see clauses 5-11-1-4, 5-11-6).
- overload of electric wiring (see clauses 5-11-3, 5-11-5, 5-4-1-5, 5-12-1, 5-12-2).
- unexpected start of machine after an interruption (see clauses 5-4-1-5, 5-12-2).
- unexpected reversal of drive (see clauses 5-4-2-3, 5-12-1).
- excessive speed (see clauses 5-4-2-3, 5-12-1).
- excessive deceleration during stopping (see clause 5-12-1).

4-8 Hazards generated by break-up during operation

Even if the design of an escalator or moving walks follows the requirements of this Jordanian standard, there are specific hazards which can occur due to:

- greater than specified user and structural loads on the truss (see clause 5-2-5).
- loads greater than specified onto the balustrade (see clauses 5-5-2-3, 5-5-2-4).
- loads greater than specified on the steps/pallets by unforeseeable misuse (see clause 5-3-3).
- loads greater than specified on the drive unit (see clauses 5-4-1-3, 5-4-3, 5-4-4).

4-9 Slipping, tripping and falling hazards

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

These include:

- slipping on steps/pallets/belt, on the comb plate and floor plate (see clauses 5-3-1, 5-5-4, 5-7-1).
- falling caused by handrail speed deviation (incl. standstill) (see clause 5-6-1, Figure G-1, Figure G-3).
- falling caused by change of the direction of movement (see clause 5-4-2-3).
- falling caused by increased acceleration/deceleration (see clauses 5-2-2, 5-4-1-1, 5-4-1-2, 5-4-2-1, 5-7-2-1, 5-7-2-2, 5-7-2-3, 5-7-2-4).
- falling caused by unexpected start or over-speed of the machine (see clause 5-4-1-5).
- falling caused by inadequate lighting at the landings (see clauses A-2-8, A-2-9).

4-10 Hazards specific for this type of machine

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

- missing steps or pallets (see clause 5-3-6).
- trapping by hand winding device (see clause 5-4-1-4).
- misuse by transporting others items than persons (e.g. shopping or luggage trolleys, push chairs) (see clause 7-4-1 d), Figure G-4, Annex I).
- climbing on the outside of the balustrade (see clause 5-5-2-2).
- sliding between balustrades (see clause 5-5-2-2).
- climbing over the balustrade (see clause 5-5-2-6).
- surfing on the handrail (see clause 5-5-2-2).
- storage of merchandise adjacent to the balustrade (see clause 7-4-1 d)).
- creation of traffic jam at blocked landings or intermediate exits of consecutive escalators or moving walks (see clauses A-2-5, A-2-6).
- disturbance of the person flow in connected escalators/moving walks (see clauses A-2-5, A-2-6).
- lifting by the handrail at the newel ends and falling over adjacent fixed barrier or the balustrade of the escalator/moving walk (see clause A-2-7).

Note: For the actual type of machinery, noise is not considered as a significant nor relevant hazard.

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 Jordanian standard.

Certain escalators and moving walks are subject to special operational and environmental conditions. For these cases some additional recommendations are defined (see clause H-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 clause 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 without breakage or deflection resulting in any gap. The fixing 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 to comply with EN ISO 13857:2006, Table 5. However it shall not be possible to pass a straight rigid rod 10 mm in diameter through the enclosure and 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 an electric safety device according to Table 6 n).

5-2-2 Angle of inclination

The angle of inclination α of the escalator shall not exceed 30°, but for rises h_{13} not exceeding 6m and a nominal speed not exceeding 0,50 m/s the angle of inclination is permitted to be increased up to 35° (see α in Figure 2). The angle of inclination of moving walks shall not exceed 12°.

5-2-3 Access to the interior

Machinery spaces inside the truss shall only be accessible to authorised persons (e.g. by key, access control).

5-2-4 Inspection covers and floor plates

Inspection covers and floor plates shall be provided with a control device according to Table 6 n).

It shall only be possible to open inspection covers and floor plates by a key or a tool suited for that purpose.

If rooms behind inspection covers and floor plates can be entered, it shall be possible to open them from the inside without a key or a tool even when locked.

Inspection covers and floor plates shall be imperforate. Inspection covers shall conform to the same conditions as required for the location where they are installed.

5-2-5 Structural design

The supporting structure shall be designed in a way that it can support the dead weight of the escalator or moving walk plus a rated load of 5000 N/m². It shall be calculated in accordance with EN 1993-1-1.

Note: Load carrying area = (nominal width z_1 (see Figure 3) of the escalator or moving walk) \times (distance l_1 between the supports) (see Figure 2).

Based on the rated load, the maximum calculated or measured deflection shall not exceed $1/750$ of the distance l_1 between the supports.

5-3 Steps, pallets, belt

5-3-1 General

In the user carrying area of the escalator, the step treads shall be horizontal with a tolerance of $\pm 1^\circ$ in the direction of travel.

Note 1: The maximum permissible height between two consecutive steps at the landings is defined in clause 5-3-4 and clause 5-7-2-1.

Tread surfaces for escalators and moving walks shall provide a secure foothold.

Note 2: For definition of materials and test methods, see Annex J.

5-3-2 Dimensions

5-3-2-1 General

For escalators and moving walks the nominal width z_1 shall be not less than 0,58 m and not exceed 1,10 m. For moving walks with an angle of inclination up to 6° widths up to 1,65 m are permitted.

5-3-2-2 Step treads and pallets (see Figure 2, detail X and Figure 5)

5-3-2-2-1 The step height x_1 shall not exceed 0,24 m.

5-3-2-2-2 The step depth y_1 shall be not less than 0,38 m.

5-3-2-2-3 The surface of the step treads and pallets shall have grooves in the direction of movement with which the teeth of the combs mesh.

5-3-2-2-4 The step risers shall be cleated and the surface of the cleat shall be smooth. The ends of the step tread shall mesh with the cleating of the next step riser.

5-3-2-2-5 The width b_7 of the grooves shall be at least 5 mm and not exceed 7 mm.

5-3-2-2-6 The depth h_7 of the grooves shall be not less than 10 mm.

5-3-2-2-7 The web width b_8 shall be at least 2,5 mm and not exceed 5 mm.

5-3-2-2-8 The step treads and step risers or pallets shall not finish with a groove at their side edges.

5-3-2-2-9 The edge between the surface of the step tread and the riser shall have any sharpness relieved.

5-3-2-3 Belts (see Figure 2, detail X)

5-3-2-3-1 The belts shall have grooves in the direction of travel with which the teeth of the comb mesh.

5-3-2-3-2 The width b_7 of the grooves shall be at least 4,5 mm and not exceed 7 mm, and shall be measured at the tread surface of the belt.

5-3-2-3-3 The depth h_7 of the grooves shall be not less than 5 mm.

5-3-2-3-4 The web width b_8 shall be at least 4,5 mm and not exceed 8 mm and shall be measured at the tread surface of the belt.

5-3-2-3-5 The belt shall not finish with a groove at the side edge of the belt.

Splicing of the treadway belt shall be such as to provide a continuous unbroken treadway surface.

5-3-3 Structural design

5-3-3-1 General

The materials shall retain their strength characteristics during their specified life cycle taking into account the environmental conditions, e.g. temperature, ultra violet radiation, humidity, corrosion.

The steps, pallets and the belt shall be designed to withstand all possible loading and distortion effects, which may be imposed by the tracking, guiding and driving system during normal operation and shall be designed to support an equally distributed load corresponding to 6000 N/m^2

Note: 6000 N/m^2 is derived from a static load of 5000 N/m^2 (see clause 5-2-5) plus an impact factor of 1,2.

To establish the dimensions of the belt and its supporting system, an area of effective width $\times 1,0$ m shall be taken as a basis for this corresponding load (in addition the requirements of clause 5-3-3-2-4 shall be complied with).

Assembled steps and pallets shall be designed such that all component parts e.g. inserts or fixings are securely attached and do not become loose during their life cycle. The inserts and fixings shall withstand the reaction force of operating the comb/comb plate electric safety device (Table 6 g)).

5-3-3-2 Static test

5-3-3-2-1 Steps

5-3-3-2-1-1 The step shall be tested for deflection with a single force of 3 000 N (including weight of the plate) applied perpendicular to the tread surface on a steel plate 0,20 m \times 0,30 m in size and at least 25 mm thick, in the centre of the tread surface. The edge of the plate being 0,20 m long shall be arranged parallel to the front edge of the step, the edge of the plate being 0,30 m long at right angles to the front edge of the step.

5-3-3-2-1-2 During this test, the deflection measured at the tread surface shall be not more than 4 mm. There shall be no permanent deformation (initial setting tolerances are permitted).

5-3-3-2-1-3 The step shall be tested as a whole together with rollers (not rotating), axles or stub shafts (if existing) in a horizontal position (horizontal support) and at the maximum inclination (inclined support) for which the step is to be applied.

5-3-3-2-1-4 For all inclinations smaller than the maximum inclination permitted, a new test is not required. A test of the installed step, i.e. together with the guide rails and the supporting structure of the escalator, is also not necessary.

5-3-3-2-2 Step riser

The riser shall not deflect by more than 4 mm, when subjected to a single load of 1500 N applied normal to the surface, on an area of 25 cm², using a square or round steel plate, minimum thickness 25 mm, shaped to fit the risers curvature. This load shall be applied in three positions across the width of the riser, on the centre line, in the middle and at both ends. There shall be no permanent deformation.

5-3-3-2-3 Pallets

5-3-3-2-3-1 The pallet shall be tested for deflection with a single force which, for a pallet area of 1 m², shall be 7 500 N (including weight of the plate). The force shall be applied perpendicular to the tread surface on a steel plate 0,30 m \times 0,45 m in size and at least 25 mm thick, in the centre of the tread surface, and the edge of the plate being 0,45 m long shall be arranged parallel to the lateral edge of the pallet.

5-3-3-2-3-2 For pallets with smaller or larger areas, the force and the loading area shall be changed proportionally, whereby for the loading area the ratio of edge length shall be 1:1,5. however, the force shall be not below 3 000 N (including weight of the plate), the size of the plate be not smaller than 0,20 m \times 0,30 m and its thickness be not less than 25 mm.

5-3-3-2-3-3 For pallets with a depth smaller then 0,30 m the plate width shall be 0,20 m and the length of the plate shall be the depth of the pallet.

5-3-3-2-3-4 During this test the deflection measured at the tread surface shall be not more than 4 mm. There shall be no permanent deformation (initial setting tolerances are permitted).

5-3-3-2-3-5 The pallet shall be tested as a whole together with rollers (not rotating), axles or stub shafts (if existing) in a horizontal position. A test of the installed pallet, i.e. together with the guide rails and the supporting structure of the moving walk, is not required.

5-3-3-2-4 Belts

With the belt tensioned to suit operational conditions, a single force of 750 N (including weight of

the plate) shall be applied on a steel plate 0,15 m × 0,25 m × 0,025 m in size. The plate shall be placed centrally between the edge supporting rollers in such a way that its longitudinal axis is parallel to the longitudinal axis of the belt. The deflection at the centre shall not exceed 0,01 z_3 where z_3 is the transverse distance between the supporting rollers (see z_3 in Figure 8).

5-3-3-3 Dynamic tests

5-3-3-3-1 Steps

5-3-3-3-1-1 Load test

—The step shall be tested at the maximum inclination (inclined support) for which it is to be applied, together with rollers (not rotating), axles or stub shafts (if existing). It shall be subjected to a load pulsating between 500 N and 3 000 N at one frequency between 5 Hz and 20 Hz for at least 5×10^6 cycles whereby an undisturbed sinusoidal force flow shall be achieved. The load shall be applied perpendicular to the tread surface on a steel plate 0,20 m × 0,30 m in size and at least 25 mm thick, arranged as specified in clause 5-3-3-2-1, in the centre of the tread surface.

—After the test the step shall show no indication of crack initiation.

—Permanent deformation shall not be greater than 4 mm, measured at the tread surface. Steps or their component parts, e.g. inserts or fixings, shall be securely attached and not become loose.

—If rollers are damaged during the test, it is permissible to replace them.

5-3-3-3-1-2 Torsional test

—The step design shall be such that the structure can accommodate torsional loading equivalent to a ± 2 mm displacement of the trailer wheel centre, moving in an arc whose centre is the chain wheel centre. The ± 2 mm displacement is a relative to a trailer wheel to chain wheel centre distance of 400 mm. This ratio shall be maintained, when the 400 mm dimension is varied (see Annex F for test examples).

—The dynamic test shall be adjustable to ensure that the specified deflections above are achieved throughout the test. It shall be applied with one frequency between 5 Hz and 20 Hz for at least 5×10^6 cycles whereby an undisturbed sinusoidal force flow shall be achieved.

—After the test the step shall show no indication of crack initiation.

—Permanent deformation shall not be greater than 4 mm, measured at the tread surface. Steps or their component parts, e.g. inserts or fixings, shall be securely attached and not become loose.

5-3-3-3-2 Pallets

5-3-3-3-2-1 Load test

—The pallet, irrespective of its size, shall be tested in a horizontal position together with rollers (not rotating), axles or stub shafts (if existing). It shall be subjected to a load pulsating between 500 N and 3 000 N at one frequency between 5 Hz and 20 Hz for at least 5×10^6 cycles whereby an undisturbed sinusoidal force flow shall be achieved. It shall be applied perpendicular to the tread surface on a steel plate 0,20 m × 0,30 m in size and at least 25 mm thick, in the centre of the tread surface.

—For pallets with a smaller length than 0,30 m the plate width shall be 0,20 m and the length of the plate shall be the length of the pallet.

—After the test, the pallet shall show no indication of crack initiation.

—Permanent deformation shall not be greater than 4 mm, measured at the tread surface. Pallets or their component parts, e.g. inserts or fixings, shall be securely attached and not become loose.

—If rollers are damaged during the test, it is permissible to replace them.

5-3-3-3-2-2 Torsional test

—A torsional test is only required if the pallets are fitted with trailer rollers.

- The pallet design shall be such that the structure can accommodate torsional loading equivalent to a ± 2 mm displacement of the trailer wheel centre, moving in an arc whose centre is the chain wheel centre. The ± 2 mm displacement is related to a trailer wheel to chain wheel centre distance of 400 mm. This ratio shall be maintained, when the 400 mm dimension is varied (see Annex F for test examples).
- The dynamic load shall be adjusted to achieve a deflection with a tolerance of $\pm 5\%$ during the test. It shall be applied with one frequency between 5 Hz and 20 Hz for at least 5×10^6 sinusoidal force flow shall be achieved.cycles whereby an undisturbed
- For pallets with a smaller length than 0,30 m, the plate width shall be 0,20 m and the length of the plate shall be the length of the pallet.
- After the test, the pallet shall show no indication of crack initiation.
- Permanent deformation shall not be greater than 4 mm, measured at the tread surface. Pallets or their component parts, e.g. inserts or fixings, shall be securely attached and not become loose.

5-3-4 Guiding of steps, pallets and belt

- The lateral displacement of the steps or pallets out of their guiding system shall not exceed 4 mm at either side and 7 mm for the sum of clearances measured at both sides and the vertical displacement shall not exceed 4 mm for steps and pallets and 6 mm for belts.
- This requirement applies only to the usable area of the steps, pallets or belt.
- Treadway supports for belts shall be provided at intervals not exceeding 2 m along the centre line of the treadway. These supports shall be located at a level not more than 50 mm below the underside of the treadway when it is loaded under the conditions required by clause 5-3-3-2-4.

5-3-5 Clearance between steps or pallets

The clearance between two consecutive steps or pallets in any usable position measured at the tread surface shall not exceed 6 mm (see Figure 2, details Y, Z, Figure 6, detail S and Figure 7, detail U). Demarcation (e.g. groove in the step tread) shall be provided to highlight at the landings the rear edge of the steps.

In the area of the transition curves of moving walks with meshed front edges and rear edges of the pallets, this clearance is permitted to be increased to 8 mm (see Figure 7, detail V).

5-3-6 Missing step or pallet device

A missing step/pallet (see Table 6 k)) shall be detected and the escalator/moving walk stopped before the gap (resulting from the missing step/pallet) emerges from the comb. This shall be ensured by a device provided at each driving and return station.

5-4 Drive unit

5-4-1 Driving machine

5-4-1-1 General

A drive unit shall not operate more than one escalator or moving walk.

5-4-1-2 Speed

5-4-1-2-1 The nominal speed shall not deviate by more than $\pm 5\%$ at nominal frequency and nominal voltage.

5-4-1-2-2 The nominal speed of the escalator shall not exceed:

- 0,75 m/s for an escalator with an angle of inclination α up to 30° .
- 0,50 m/s for an escalator with an angle of inclination α of more than 30° up to 35° .

5-4-1-2-3 The nominal speed of moving walks shall be not higher than 0,75 m/s.

Deviating from the above a nominal speed up to 0,90 m/s is permitted provided the width of the pallets or the belt does not exceed 1,10 m, and at the landings, the pallets or the belt move horizontally for a length of at least 1,60 m before entering the combs.

The before mentioned requirements do not apply to moving walks with acceleration paths or

moving walk systems with direct transition to moving walks travelling at different speeds.

5-4-1-3 Link between operational brake and step, pallet or belt drive

5-4-1-3-1 For the link between the operational brake and the step, pallet or belt drive, preferably non-friction driving elements should be used such as shafts, gear wheels, multiplex chains, two or more single chains. Where friction elements are used such as trapezoidal belts (flat belts are not permitted) an auxiliary brake in accordance with clause 5-4-2-2 shall be used.

5-4-1-3-2 Safety factors of all driving elements shall be at least 5 for static calculations. In the case of trapezoidal belts, at least 3 belts shall be applied.

This safety factor is determined as the ratio between the breaking force of the driving element and the static force to which the driving element is subjected when the escalator or inclined moving walk carries the rated load (person weight) according to clause 5-2-5 together with the tension force of the tensioning device.

For horizontal moving walks the dynamic forces according to clauses 5-4-2-1-3-3 respectively 5-4-2-1-3-4 together with the tension force of the tensioning device shall be used to determine the safety factor.

5-4-1-4 Hand winding device

If a hand winding device is provided it shall be easily accessible and safe to operate (see clause 7-2-1-3 and clause 7-4-1 g) for instructions).

If the hand winding device is removable an electric safety device (see Table 6 q)) in conformity with clause 5-12-1-2-2 shall be actuated when or before the hand winding device is put on the machine. Crank handles or perforate hand wheels are not permitted.

5-4-1-5 Stopping the machine and checking its stopped position

Stopping the escalator or moving walk by means of the electric safety devices according to clause 5-12-1-2 shall be effected as follows:

The supply shall be interrupted by two independent contactors, the contacts of which shall be in series in the supply circuit. If, when the escalator or moving walk is stopped, one of the main contacts of one of the contactors has not opened, restarting shall be impossible.

5-4-2 Braking system

5-4-2-1 Operational brake

5-4-2-1-1 General

5-4-2-1-1-1 Escalators and moving walks shall have a braking system by means of which they can be brought to rest with a uniform deceleration and maintained stationary (operational braking). see also clause 5-12-1-2-4. There shall be no intentional delay in the application of the braking system.

If the stopping distance exceeds the maximum values of clause 5-4-2-1-3-2 and clause 5-4-2-1-3-4 by more than 20 %, a restart shall be possible only after the failure lock has been reset (see Table 6 o)). Before manual reset the brake system has to be investigated and corrective action has to be taken, if necessary (see also clause 7-4-1 e)).

A device shall be provided to monitor the lifting of the braking system after starting the escalator/moving walk (see also Table 6 l)).

5-4-2-1-1-2 The braking system shall operate automatically:

- a) in the event of loss of the voltage supply.
- b) in the event of loss of the voltage supply to the control circuits.

5-4-2-1-1-3 Operational braking shall be effected by an electro-mechanical brake or by other means.

Where no electro-mechanical operational brake is used, an auxiliary brake in accordance with clause 5-4-2-2 shall be provided.

5-4-2-1-1-4 Brakes that can be released by hand shall require continuous application of manual pressure to keep them open.

5-4-2-1-2 Electro-mechanical brake

—The normal lifting of the electro-mechanical brake shall be by a continuous flow of electric current.

—The braking operation shall be effective immediately after the electric brake circuit is opened.

—The brake force shall be generated by guided compression spring(s). Electrically generated self-excitation of the brake releasing device shall be impossible.

The interruption of the electricity supply shall be effected by at least two independent electric devices. They can be those which break the supply to the machine. If after the stop of the escalator or moving walk one of these electric devices has not opened, restarting shall be prevented (see also clause 5-4-1-5).

5-4-2-1-3 Brake load and stopping distances for operational brake

5-4-2-1-3-1 Determination of the brake load for escalators

Table 2 shall be applied for the determination of the brake load for escalators.

Table 2 – Determination of brake load for escalators

Nominal width z_1	Brake load per step
up to 0,60 m	60 kg
more than 0,60 m up to 0,80 m	90 kg
more than 0,80 m up to 1,10 m	120 kg

The number of steps to be considered is determined by "rise h_{13} divided by maximum visible height of the step riser" (see x_1 in Figure 5).

For the purpose of a test, the total brake load is permitted to be distributed over two-thirds of the number of steps thus obtained.

5-4-2-1-3-2 Stopping distances for the escalator

The stopping distances for unloaded and downward moving loaded escalators (see clause 5-4-2-1-3-1) shall be as given in Table 3.

Table 3 – Stopping distances for escalators

Nominal speed v	Stopping distance between
0,50 m/s	0,20 m and 1,00 m
0,65 m/s	0,30 m and 1,30 m
0,75 m/s	0,40 m and 1,50 m

For intermediate speeds the stopping distances shall be interpolated.

The stopping distances shall be measured from the time the electric stopping device is actuated.

The deceleration, measured on a downward moving escalator, in the direction of travel shall not exceed 1 m/s^2 during the operation of the braking system. The raw deceleration signal shall be band-limited using a 4,0 Hz two-pole Butterworth filter.

Note: It is recommended to achieve the shortest possible stopping distance within the given deceleration limit.

5-4-2-1-3-3 Determination of the brake load for moving walks

Table 4 shall be applied for the determination of the brake load for moving walks.

Table 4 – Determination of brake load for moving walks

Nominal width z_1	Brake load per 0,4 m length
up to 0,60 m	50 kg
more than 0,60 m up to 0,80 m	75 kg
more than 0,80 m up to 1,10 m	100 kg
more than 1,10 m up to 1,40 m	125 kg
more than 1,40 m up to 1,65 m	150 kg

To determine the brake load for moving walks which in their length overcome several inclinations (differences in level), only the downward running sections shall be considered.

5-4-2-1-3-4 Stopping distances for moving walks

–The stopping distances for unloaded and horizontally or downward moving loaded moving walks (see clause 5-4-2-1-3-3) shall be as given in Table 5.

Table 5 – Stopping distances for moving walks

Nominal speed v	Stopping distance between
0,50 m/s	0,20 m and 1,00 m
0,65 m/s	0,30 m and 1,30 m
0,75 m/s	0,40 m and 1,50 m
0,90 m/s	0,55 m and 1,70 m

–For intermediate speeds the stopping distances shall be interpolated.

–The stopping distances shall be measured from the time the electric device for stopping is actuated.

–The deceleration, measured on a downward moving or horizontal moving walk, in the direction of travel shall not exceed 1 m/s^2 during the operation of the braking system. The raw deceleration signal shall be band-limited using a 4,0 Hz two-pole Butterworth filter.

Note: It is recommended to achieve the shortest possible stopping distance within the given deceleration limit. For moving walks a brake test under no load will be sufficient.

–For loaded moving walks, the manufacturer shall prove the stopping distances by calculation (see clause 6-2-c)).

5-4-2-2 Auxiliary brake

5-4-2-2-1 Escalators and inclined moving walks shall be equipped with auxiliary brake(s) if

- a) the connection between the operational brake (see clause 5-4-2-1) and the driving sprockets of the steps/pallets or the drum of the belt is not accomplished by shafts, gear wheels, multiplex chains, or more than one single chain, or
- b) the operational brake is not an electro-mechanical brake according to clause 5-4-2-1-2, or
- c) the rise h_{13} exceeds 6 m (see also clause H-2).

The connection between the auxiliary brake and the driving sprockets of the steps/pallets or the drum of the belt shall be accomplished by shafts, gear wheels, multiplex chains or more than one single chain. It is not permissible for the connection to comprise friction drives, i.e. clutches.

5-4-2-2-2 The auxiliary braking system shall be dimensioned in such a way that escalators and moving walks travelling with brake load downward are brought to rest by effective retardation and

maintained stationary. The deceleration of 1 m/s^2 shall not be exceeded.

Upon operation of auxiliary brakes it is not necessary to keep the stopping distances defined for the operational brake (see clause 5-4-2-1-3-1).

5-4-2-2-3 Auxiliary brakes shall be of the mechanical (friction) type.

5-4-2-2-4 Auxiliary brakes shall become effective in either of the following conditions:

- a) before the speed exceeds a value of 1,4 times the nominal speed.
- b) by the time the steps and pallets or the belt change from the present direction of motion. Its operation shall positively open the control circuit.

5-4-2-2-5 Auxiliary brake(s) are permitted to operate together with the operational brake when in case of power failure or of an interruption of a safety circuit the stopping conditions according to clause 5-4-2-1-3-2 and clause 5-4-2-1-3-4 are kept. otherwise a simultaneous operation of the auxiliary and the operational braking system is only permitted under the conditions of clause 5-4-2-2-4.

5-4-2-3 Protection against risks of excessive speed and unintentional reversal of the direction of travel

5-4-2-3-1 Escalators and moving walks shall be equipped in such a way that they stop automatically before the speed exceeds a value of 1,2 times the nominal speed (see Table 6-c)). Where speed control devices are used for this purpose they shall have switched off the escalator or moving walk before the speed exceeds a value of 1,2 times the nominal speed.

It is permissible to disregard this requirement if the design prevents excessive speed.

5-4-2-3-2 Escalators and inclined ($\alpha \geq 6^\circ$) moving walks shall be equipped in such a way that they stop automatically by the time the steps and pallets or the belt change from the pre-set direction of travel (see Table 6 c)).

5-4-3 Steps and pallets drive

5-4-3-1 The steps of escalators shall be driven by at least two chains of which at least one shall be located on each side of the step.

The pallets of moving walks are permitted to be driven by only one chain if the parallel movement of the pallets in the usable area is ensured by other mechanical measures.

5-4-3-2 The step chain design shall be of nominally infinite fatigue life.

The safety factor against breaking of each chain shall be at least 5 (see clause 5-4-1-3-2) with respect to structural steel according to EN 10025-1 in combination with EN 10025-2, EN 10025-3, EN 10025-4, EN 10025-5 and EN 10025-6 and with respect to quenched and tempered steel according to EN 10083-1 in combination with EN 10083-2 and EN 10083-3. The step chain shall be subject to a tensile test.

When more than one chain is used it is assumed that the load is equally distributed over the chains.

5-4-3-3 The chains shall be tensioned continuously. The escalator/moving walk shall be stopped automatically before the tensioning device moves in excess of $\pm 20 \text{ mm}$ (see Table 6 e) and f)).

Springs working in tension are not permitted for the tensioning device. When weights are used for tensioning they shall be safely retained should their suspension break.

5-4-4 Belt drive

5-4-4-1 The factor of safety of the belt including splicing shall be at least 5 (see clause 5-4-1-3-2) for the dynamic forces according to clause 5-4-2-1-3-3 respectively clause 5-4-2-1-3-4. The calculation shall be carried out for the worst case.

5-4-4-2 The belt shall be driven by drums and be tensioned continuously and automatically. Springs working in tension are not permitted for the tensioning device. When weights are used for

tensioning they shall be safely retained should their suspension break.

5-5 Balustrade

5-5-1 General

Balustrades shall be installed on each side of the escalator or moving walk.

5-5-2 Dimensions of balustrade

5-5-2-1 In the inclined section the vertical height h_1 from step nose or pallet surface or belt surface to top of the handrail shall be not less than 0,90 m and not exceed 1,10 m (see Figures 2 and 3).

5-5-2-2 The balustrades shall have no parts on which a person would normally stand.

5-5-2-2-1 Appropriate measures shall be taken to discourage people from climbing on the outsides of the balustrade if there is a danger of people falling from them.

5-5-2-2-2 To ensure this, on escalators and moving walks devices (see 1 in Figure 4) shall be provided on the lower outer decking at a point $(1\ 000 \pm 50)$ mm above the floor level (see h_9 in Figure 4) where the bottom of the device intersects with the balustrade decking and shall extend to a length l_5 of at least 1000 mm parallel with the balustrade decking where no stepping is possible.

5-5-2-2-3 The device shall extend to at least a height in line with the top of the handrail not conflicting with the requirements of b_{10} and b_{12} .

5-5-2-2-4 Where escalators or moving walks are located adjacent to walls, devices (see 2 in Figure 4) to restrict access to the balustrade decking shall be provided at the top and bottom ends of these walls when the lower outer decking width b_{13} exceeds 125 mm. On adjacent parallel arrangements, this protection shall be provided when the combined balustrade decking width b_{14} exceeds 125 mm. The device shall extend to the height h_{10} .

5-5-2-2-5 All exposed fastener heads for the devices shall be of the vandal resistant type.

5-5-2-2-6 Where handrail level balustrade decking are provided between escalators/inclined moving walks and adjacent walls, anti-slide devices (see 3 in Figure 4) shall be provided on the balustrade decking when the distance b_{15} between the structure of the building (wall) and the centreline of the handrail is greater than 300 mm. These devices shall consist of objects fastened to the balustrade decking, no closer than 100 mm to the handrail (see b_{17}) and spaced no greater than 1 800 mm apart.

5-5-2-2-7 The height h_{11} shall be not less than 20 mm. The devices shall have no sharp corners or edges.

5-5-2-2-8 The above mentioned also applies to adjacent escalators/inclined moving walks when the distance b_{16} between the centrelines of the handrails is greater than 400 mm.

5-5-2-3 Balustrades shall be designed to resist the simultaneous application of a static lateral force of 600 N and a vertical force of 730 N, both equally distributed over a length of 1 m and acting on the top of the handrail guiding system in the same place.

5-5-2-4 The parts of the balustrade facing the steps, pallets or belt shall be smooth and flush.

5-5-2-4-1 Covers not in the direction of travel shall not project more than 3 mm. They shall be rigid and have rounded or bevelled edges. Covers of such nature are not permitted at the skirting.

5-5-2-4-2 Cover joints in the direction of travel (in particular between the skirting and the interior panel) shall be arranged and formed in such a manner as to eliminate any risk of harm caused by trapping.

5-5-2-4-3 Gaps between the interior panels of the balustrade shall be not wider than 4 mm. The edges shall be rounded off or bevelled.

5-5-2-4-4 When a force of 500 N is applied to the interior panel at any point of the panelling at right angles on an area of 25 cm², there shall be no gap greater than 4 mm and no permanent deformation.

5-5-2-4-5 If glass is used for the interior panel it shall be toughened glass. The minimum thickness

of 6 mm shall apply to single layer balustrades. When multi-layer glass balustrades are used, they shall be laminated toughened glass, the thickness of at least one layer shall also be not less than 6 mm.

5-5-2-5 The horizontal distance (measured at right angles to the direction of travel) between the interior panel at lower points shall be equal to or less than the horizontal distance measured at points higher up.

5-5-2-6 The lower inner decking and the interior panel shall have an angle of inclination γ of at least 25° to the horizontal (see Figure 3). This does not apply to the horizontal part of the lower inner decking that directly joins the interior panel (see b_4 in Figure 3).

5-5-2-6-1 The horizontal part b_4 up to the interior panel shall be less than 30 mm.

5-5-2-6-2 The width b_3 , measured horizontally, of each lower inner decking inclined at an angle of less than 45° to the horizontal shall be less than 0,12 m (see Figure 3).

5-5-3 Skirting

5-5-3-1 The skirting shall be vertical, plain and butt-jointed.

Note: However, special arrangements instead of butt-jointing (e.g. sliding joints) will possibly be necessary for long moving walks at the points where they pass over building expansion joints.

5-5-3-2 The perpendicular distance h_2 between top edge of skirting or bottom edge of projecting cover joints or the lower edge of the rigid part of skirt deflectors (for definition, see clause 3-1-26) and the line of the step nose or the tread surface of the pallets or belt shall be not less than 25 mm (see Figure 3).

5-5-3-3 The skirting shall yield not more than 4 mm under a single force of 1 500 N acting at the most unfavourable point at right angles to the surface over an area of 2 500 mm² using a square or round area. No permanent deformation shall result from this.

5-5-3-4 On escalators, the possibility of trapping between skirting and steps shall be minimised.

For this purpose, the following four conditions shall be fulfilled:

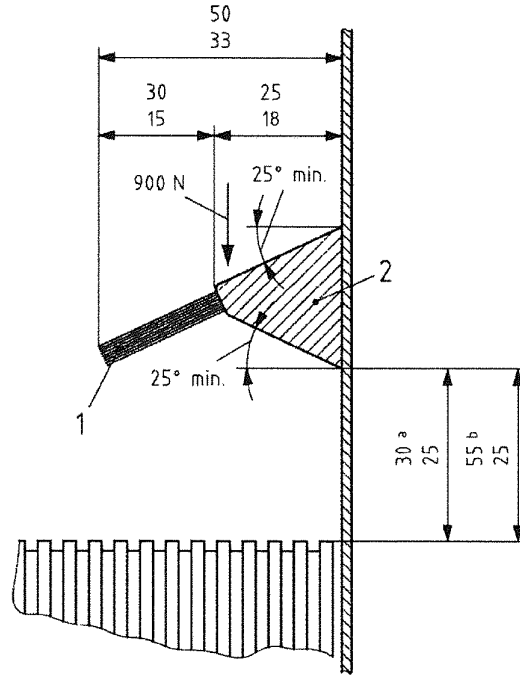
- a) sufficient rigidity of the skirting according to clause 5-5-3-3.
- b) clearances to be in accordance with clause 5-5-5-1.
- c) installation of skirt deflectors which fulfil the following requirements:
 - They shall consist of a rigid and a flexible part (e.g. brushes, rubber profiles).
 - They shall have a minimum projection of 33 mm and a maximum of 50 mm from the vertical face of the skirt panels.
 - They shall withstand a force of 900 N uniformly distributed on the projected area of the rigid part over a rectangular area of 600 mm² vertically to the line of attachment of the rigid part without detachment or permanent deformation.
 - The rigid parts shall have a horizontal projection of between 18 mm and 25 mm and withstand the defined strength requirements. The horizontal projection of the flexible part shall have a minimum of 15 mm and a maximum of 30 mm.
 - A distance of between 25 mm and 30 mm shall be provided between the lowest part of the underside of the rigid part and perpendicular to the line of the step nose, throughout the inclined portion of travel.
 - The distance between the lowest part of the underside of the rigid part of the skirt deflector and the top of any step cleat in the transition and horizontal areas shall be between 25 mm and 55 mm.
 - The lower surface of the rigid part shall be bevelled not less than 25° upward and the upper surface shall be bevelled not less than 25° downward from skirt panel.
 - The deflectors shall be designed with rounded edges. Fastening heads and joint connections shall not extend into the path of travel.

- The terminal end piece shall be tapered to give a flush interface with the skirting. The terminal end piece of any deflector device shall end not less than 50 mm and maximum 150 mm prior to the comb intersection line.

- If the skirt deflector is an extension of the lower inner decking, clause 5-5-2-6-2 applies. If the skirt deflector is attached or an integral part of the skirting, clause 5-5-3-1 apply.

d) use of suitable materials or suitable type of lining underneath the deflector device in order to achieve a coefficient of friction for leather (wet and dry), PVC(dry) and rubber (dry) less than 0,45.

Dimensions in millimetres



Key

1: flexible part

2: rigid part

a: in the inclined area

b: in the transition and horizontal areas

Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 1 – Requirements on skirt deflectors

5-5-4 Newel

5-5-4-1 The newel including the handrails shall project horizontally beyond the comb intersection line by at least 0,60 m in longitudinal direction (see L_2 and l_2 in Figure 2 and detail X).

5-5-4-2 The horizontal portion of the handrail shall continue longitudinally at the landings for a distance l_3 (see Figure 2) of at least 0,30 m past the comb intersection line (see L_2 in Figure 2 and detail X).

In the case of inclined moving walks without a horizontal section at the landings, the continuation of the handrail parallel to the angle of inclination is permitted.

5-5-5 Clearance between steps, pallets or belt and skirting

5-5-5-1 Where the skirting of escalators or moving walks is placed beside the steps and pallets or

the belt the horizontal clearance shall not exceed 4 mm at either side, and 7 mm for the sum of clearances measured at both sides at two directly opposite points.

5-5-5-2 Where the skirting of moving walks finishes above the pallets or the belt, the clearance shall not exceed 4 mm measured vertically from the tread surface. Motion of the pallets or the belt in lateral direction shall not cause a gap between the sides of the pallets or the belt and the vertical projection of the skirting.

5-6 Handrail system

5-6-1 General

On the top of each balustrade there shall be provided a handrail moving in the same direction and at a speed with a tolerance of - 0 % to + 2 % relative to the actual speed of the steps, pallets or belt under normal operating conditions.

A handrail speed monitoring device (see Table 6 m)) shall be provided and shall stop the escalator or moving walk in the event of a hand rail speed deviation of more than - 15 % to the actual speed for more than 15 s while the escalator or moving walk is in motion.

5-6-2 Profile and position

5-6-2-1 The handrail profiles and their guides on the balustrades shall be formed or enclosed in such a way that the possibility of pinching or trapping of fingers or hands is reduced.

The distance between the handrail profile and guide or cover profiles shall under no circumstances be wider than 8 mm (see b_6' and b_6'' in Figure 3, detail W).

5-6-2-2 The width b_2 of the handrail shall be between 70 mm and 100 mm (see Figure 3, detail W).

5-6-2-3 The distance b_5 between the handrail and the edge of the balustrade shall not exceed 50 mm (see Figure 3).

5-6-3 Distance between the handrail centre lines

The distance b_1 between the centre line of the handrails shall not exceed the distance between the skirting by more than 0,45 m (see b_1 and z_2 in Figure 3).

5-6-4 Handrail entry

5-6-4-1 The lowest point of entry of the handrail into the newel shall be at a distance h_3 from the finished floor level which shall be not less than 0,10 m and not exceed 0,25 m (see Figures 2 and 3).

5-6-4-2 The horizontal distance l_4 between the furthest point reached by the handrail and the point of entry into the newel shall be at least 0,30 m (see Figure 2). If l_4 is greater than $(l_2 - l_3 + 50 \text{ mm})$ the handrail shall enter into the balustrade at an angle of at least 20° measured to the horizontal.

5-6-4-3 At the point of entry of the handrail into the newel a guard shall be installed to prevent the pinching of fingers and hands.

A switch according to Table 6 i) shall be provided.

5-6-5 Guiding

The handrail shall be guided and tensioned in such a way that it will not leave its guides during normal use.

5-7 Landings

5-7-1 Surface properties

The landing area of escalators and moving walks (i.e. comb plate and floor plate) shall have a surface that provides a secure foothold for a minimum distance of 0,85 m measured from the root of the comb teeth (see L_1 in Figure 2 and detail X).

Note: For definition of materials and test methods, see Annex J.

Exempt from this are the combs mentioned in clause 5-7-3.

5-7-2 Configuration of steps, pallets and belts

5-7-2-1 At the landings, the steps of the escalator shall be guided in such a way that the front edges

of the steps leaving the comb and the rear edges of the steps entering the comb are moving horizontally for a length of at least 0,80 m measured from point L_1 (see Figure 2 and detail X).

At nominal speeds above 0,50 m/s and not more than 0,65 m/s or rises h_{13} above 6 m this length shall be at least 1,20 m, measured from point L_1 (see Figure 2 and detail X).

At nominal speeds above 0,65 m/s this length shall be at least 1,60 m measured from point L_1 (see Figure 2 and detail X).

A vertical difference in level between two consecutive steps of 4 mm is permitted.

5-7-2-2 For escalators, the radius of curvature in the upper transition from incline to horizontal shall be:

- at least 1,00 m for nominal speeds $v \leq 0,5$ m/s (inclination of max 35°).
- at least 1,50 m for nominal speeds $0,5 \text{ m/s} < v \leq 0,65$ m/s (inclination of max 30°).
- at least 2,60 m for nominal speeds $v > 0,65$ m/s (inclination of max 30°).

The radius of curvature in the lower transition from incline to horizontal of the escalator shall be at least 1,00 m up to 0,65 m/s the nominal speed and at least 2,00 m above 0,65 m/s.

5-7-2-3 For belt moving walks, the radius of curvature in the transition from incline to horizontal shall be at least 0,40 m.

For pallet moving walks, it is not necessary to determine the radius of curvature because, on account of the maximum permissible distance between two consecutive pallets (see clause 5-3-5), it will always be sufficiently large.

5-7-2-4 At the upper landings of moving walks with an inclination of more than 6° , the pallets or belt shall move for a length of at least 0,40 m at a maximum angle of 6° before entering or after leaving the comb.

Analogous to clause 5-7-2-1, for pallet moving walks the movement is specified as follows:

The front edge of the pallet leaving the comb and the rear edge of the pallet entering the comb shall move without changing the degree of angle over at least 0,40 m.

5-7-2-5 Provisions shall be made in the area of the combs to ensure the correct meshing (see clause 5-7-3-3) of the comb teeth with the grooves of the tread surface.

Belts shall be supported in this area in a suitable manner, e.g. by drums, rollers, sliding plates.

If any part of the step or pallet is sagging so that meshing of the combs is no longer ensured a safety device according to Table 6 j) shall be provided to stop the escalator or moving walk. This safety device shall be arranged before each transition curve at a sufficient distance before the comb intersection line to ensure that the step or pallet which has sagged does not reach the comb intersection line (see stopping distances defined in clause 5-4-2-1-3-2 and clause 5-4-2-1-3-4). The monitoring device may be applied at any point of the step or pallet.

5-7-3 Combs

5-7-3-1 General

Combs shall be fitted at both landings to facilitate the transition of users. The combs shall be easily replaceable.

5-7-3-2 Design

5-7-3-2-1 The teeth of the combs shall mesh with the grooves of the steps, pallets or belt (see clause 5-7-3-3). The width of the comb teeth shall be not less than 2,5 mm, measured at the tread surface (see Figure 2, detail X).

5-7-3-2-2 The ends of the combs shall be rounded off and so shaped as to minimise the risk of trapping between combs and steps, pallets or belt.

The radius of the teeth end shall be not greater than 2 mm.

5-7-3-2-3 The teeth of the comb shall have a form and inclination so that the feet of users, leaving

the escalator or moving walk, should not stub against them. The design angle β shown in Figure 2, detail X shall not exceed 35°.

5-7-3-2-4 The combs or their supporting structure shall be adjustable, to ensure correct meshing (see Figure 2, detail X).

5-7-3-2-5 The combs shall have such a design that upon trapping of foreign bodies either their teeth deflect and remain in mesh with the grooves of the steps, pallets or belt, or they break.

5-7-3-2-6 In the case of objects being trapped which are not dealt with by the means described in clause 5-7-3-2-5 and in the case of comb/step/pallet impact the escalator or moving walk shall be stopped automatically (see Table 6 g)).

5-7-3-3 Mesh depth of the combs into the grooves

5-7-3-3-1 The mesh depth h_8 of the combs into the grooves of the tread (see Figure 2, detail X) shall be at least 4 mm.

5-7-3-3-2 The clearance h_6 (see Figure 2, detail X) shall not exceed 4 mm.

5-8 Machinery spaces, driving station and return stations

5-8-1 General

These rooms/spaces shall be used only for accommodating the equipment necessary for the operation and maintenance and inspection of the escalator or moving walk.

Fire alarm systems, equipment for direct fire abatement and sprinkler heads, provided they are sufficiently protected against incidental damage, are permitted in these rooms provided they do not generate additional risks for maintenance operation.

Note: See clause 7-4-1 d) for maintenance requirements and inspection activities.

According to clause 5 of EN ISO 12100-2:2003, effective protection and guards shall be provided for moving and rotating parts if they are accessible and dangerous, in particular for:

- a) keys and screws in shafts.
- b) chains, belts.
- c) gears, gear wheels, sprockets.
- d) projecting motor shafts.
- e) speed governors not enclosed.
- f) step and pallet reversal in driving stations and/or return stations if these must be entered for maintenance purposes.
- g) hand wheels and brake drums.

5-8-2 Dimensions and equipment

5-8-2-1 In machinery spaces, especially in driving and return stations inside the truss, space with a sufficiently large standing area shall be kept free from permanently installed parts of any kind. The size of the standing area shall be at least 0,30 m² and the smaller side shall be at least 0,50 m long.

5-8-2-2 If the controller cabinet has to be moved or lifted for maintenance purposes, then suitable attachments for lifting shall be provided, e.g. eyebolts, handle.

5-8-2-3 Where the main drive or brake is arranged between the user side of the step, pallet or belt and the return line, a level standing area in the working zone of not less than 0,12 m² minimum dimension shall be not less than 0,30 m.

This standing area is permitted to be fixed or removable.

Note: For machinery spaces, see also clause A-3.

5-8-3 Lighting and socket outlets

5-8-3-1 The electric lighting and the socket outlets shall be independent of the power supply to the machine being fed either by a separate cable or a branch cable which is connected before the main switch of the escalator or moving walk. It shall be possible to break the supply of all phases by means of a separate switch (see clause 5-11-4-1).

5-8-3-2 Electric lighting installations in driving and return stations and machinery spaces inside the truss shall be by means of a portable lamp permanently available in one of these places. One or more socket outlets shall be provided in each of these places.

The light intensity shall be at least 200 lx in working areas.

5-8-3-3 Socket outlets shall be:

- a) either of type 2 P+PE (2 poles + earth conductor), 250 V, directly supplied by the mains, or
- b) of a type that is supplied at a safety extra low voltage in accordance with HD 60364-4-41.

5-8-4 Maintenance and repair stop switch

5-8-4-1 There shall be a stop switch in the driving and return station.

5-8-4-2 Escalators and moving walks with the driving unit arranged between the user side of the step, pallet or belt and the return line, or outside the return stations, shall have additional stop switches in the area of the driving unit.

5-8-4-3 The operation of these stop switches shall cause the disconnection of the power supply from the driving machine and allow the operational brake to become effective to stop the escalator or moving walk.

5-8-4-4 The stop switches shall be in accordance with EN ISO 13850 and achieve a category 0 stop. When activated it shall prevent the escalator or moving walk from starting.

5-8-4-5 The switching positions shall be marked clearly and permanently.

5-8-4-6 SPECIFIC CASE: A stop switch need not be provided in a machinery space if a main switch according to clause 5-11-4 is located therein.

5-9 Fire protection

Fire protection and building requirements differ from country to country and so far neither have been harmonised.

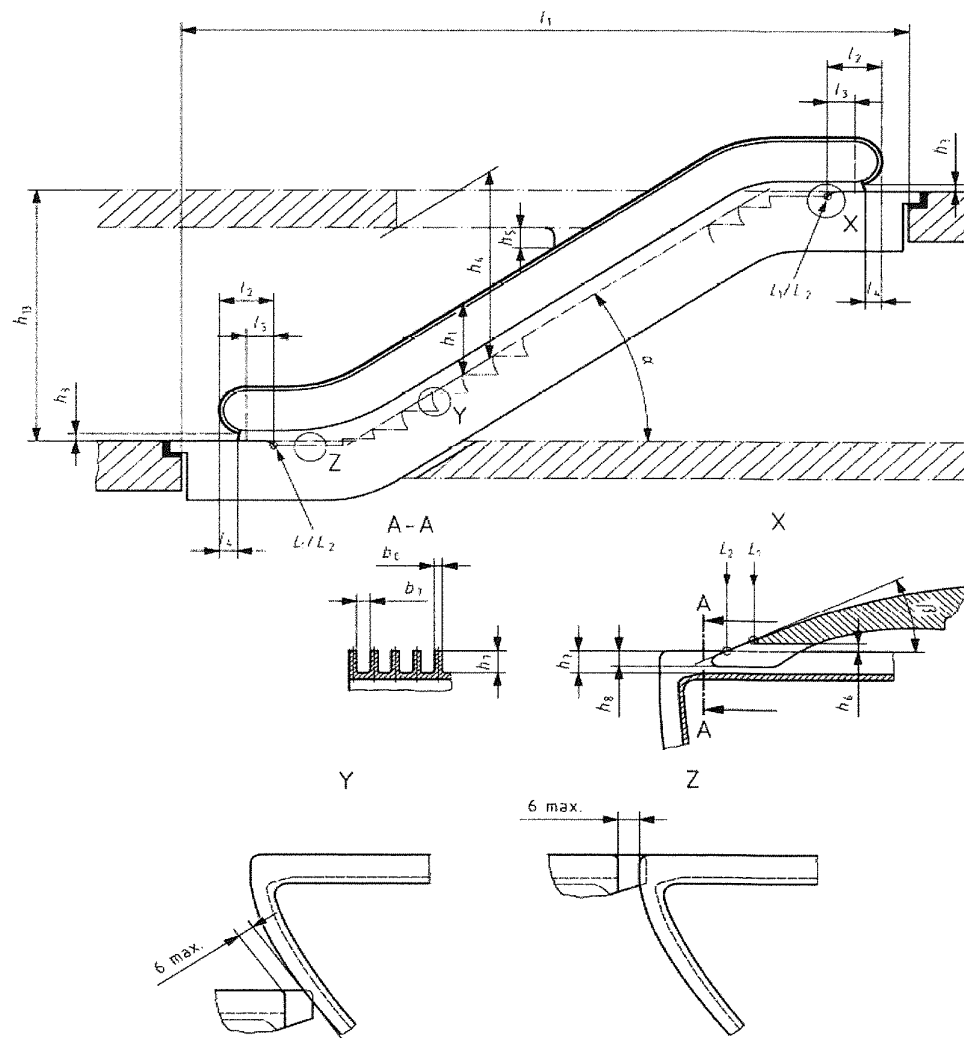
Therefore, this Jordanian Standard cannot include specific requirements for fire protection and building requirements. However, it is recommended that as far as possible, escalators and moving walks are made of materials that do not create an additional hazard in case of fire.

Outer and inner decking, truss, pallets/steps, track system shall be at least class C according to EN 13501-1:2007, clause 11-5.

5-10 Transportation

Complete escalators/moving walks or sub-assemblies or components of escalators/moving walks which cannot be handled by hand shall:

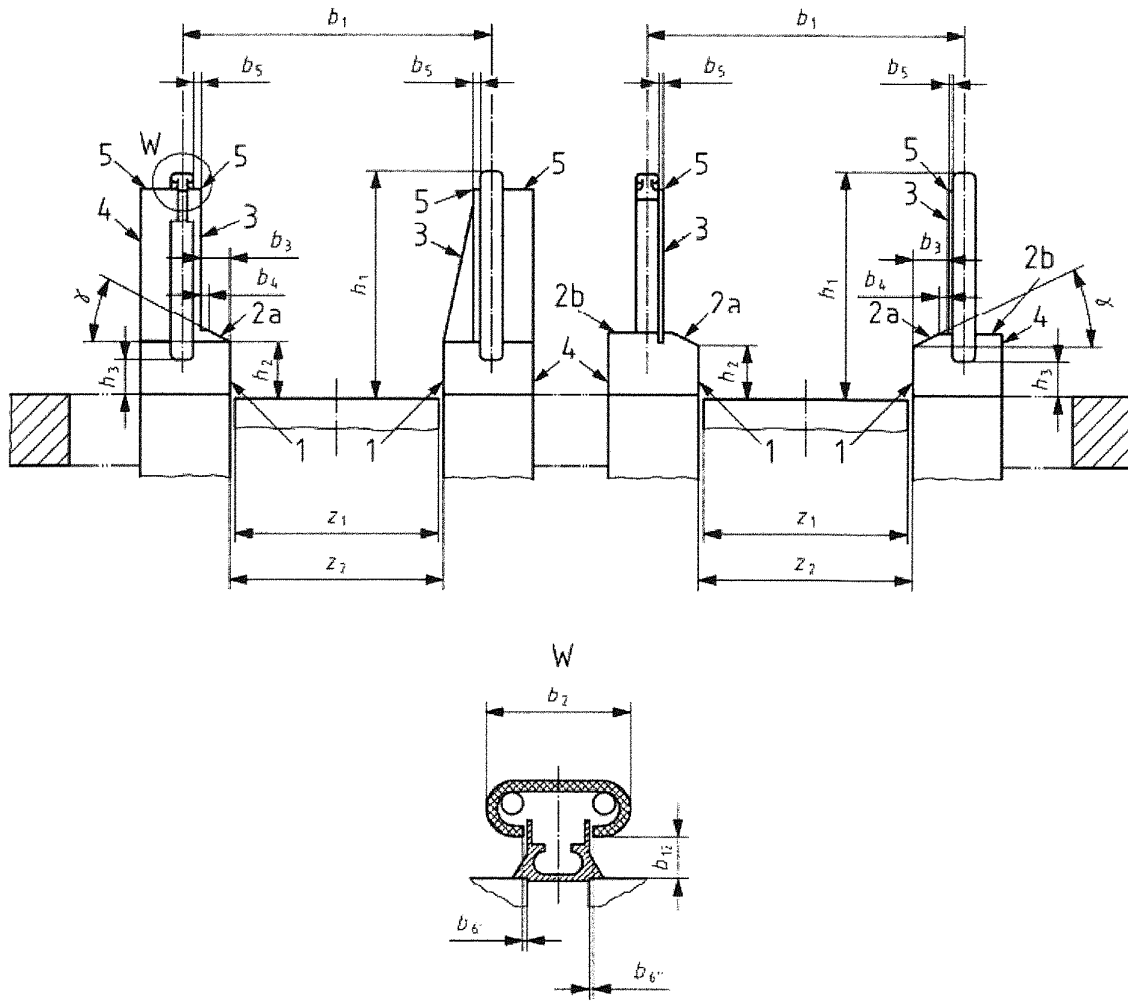
- a) either be equipped with fittings for movement by a lifting device or transportation means, or
- b) be designed in a way that such fittings can be attached (e.g. threaded holes), or
- c) be shaped in a way that the lifting device or transportation means can be attached easily.



Principal dimensions	Clause	Principal dimensions	Clause
b_7 : 5 mm to 7 mm (step treads and pallets)	5-3-2-2-5	$h_8 \geq 4$ mm	5-7-3-3-1
b_7 : 4,5 mm to 7 mm (belts)	5-3-2-3-2	h_{13} : Rise	-
b_8 : 2,5 mm to 5 mm (step treads and pallets)	5-3-2-2-7	L_1 : Root of the comb teeth	-
b_8 : 4,5 mm to 8 mm (belts)	5-3-2-3-4	L_2 : Comb intersection line	-
h_1 : 0,90 m to 1,10 m	5-5-2-1	l_1 : Distance between supports	-
h_3 : 0,10 m to 0,25 m	5-6-4-1	$l_2 \geq 0,60$ m	5-5-4-1
$h_4 \geq 2,30$ m	A-2-1	$l_3 \geq 0,30$ m	5-5-4-2
$h_5 \geq 0,30$ m	A-2-4	$l_4 \geq 0,30$ m	5-6-4-2
$h_6 \leq 4$ mm	5-7-3-3-2	α : Angle of inclination	-
$h_7 \geq 10$ mm (step treads and pallets)	5-3-2-2-6	$\beta \leq 35^\circ$	5-7-3-2-3
$h_7 \geq 5$ mm (belts)	5-3-2-3-3	-	-

Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 2 – Escalator (elevation), principal dimensions

**Key**

1: skirting (clause 5-5-3)

2a: lower inner decking (clause 5-5-2-6)

2b: lower outer decking (clause 5-5-2-2)

3: interior panel (clause 5-5-2-4)

4: exterior panel (clause 5-2-1-2)

5: balustrade decking (clause 5-5-2-2)

Principal dimensions	Clause	Principal dimensions	Clause	Principal dimensions	Clause
$b_1 \leq z_2 + 0,45 \text{ m}$	5-6-3	$b_6' + b_6'' \leq 8 \text{ mm}$	5-6-2-1	$z_2 = z_1 + 7 \text{ mm}$. distance between skirting	5-5-5-1
$b_2: 70 \text{ mm to } 100 \text{ mm}$	5-6-2-2	$b_{12} \geq 25 \text{ mm}$	A-2-2		
$b_3 < 0,12 \text{ m}$ (if γ less than 45°)	5-5-2-6-2	$h_1: 0,90 \text{ m to } 1,10 \text{ m}$	5-5-2-1	$\gamma \geq 25^\circ$	5-5-2-6
$b_4 < 30 \text{ mm}$	5-5-2-6-1	$h_2 \geq 25 \text{ mm}$	5-5-3-1		
$b_5 \leq 50 \text{ mm}$	5-6-2-3	$h_3: 0,10 \text{ m to } 0,25 \text{ m}$	5-6-4-1	-	-

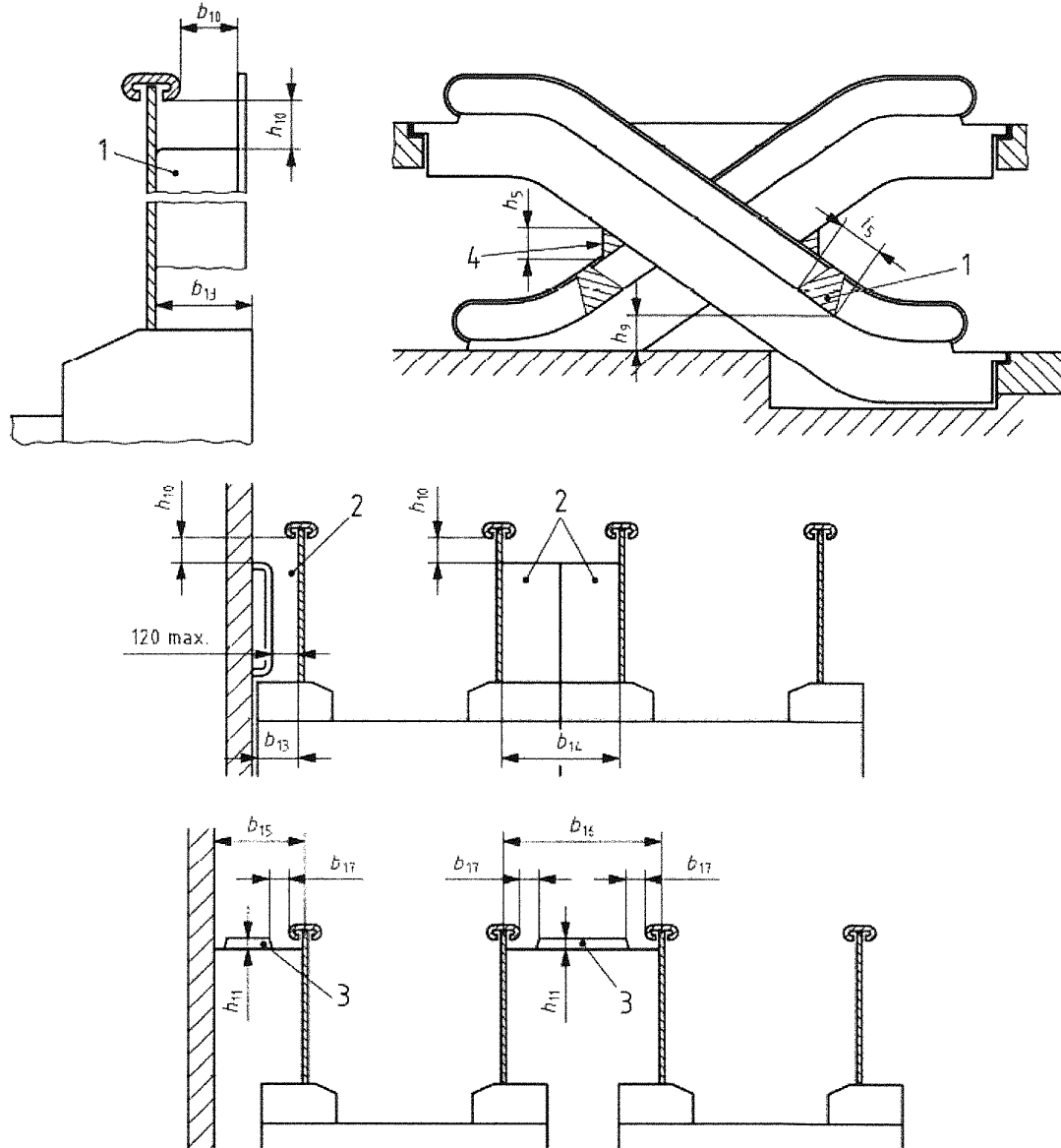
Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

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هذه الوثيقة مشروع تصويت تم توزيعه لإبداء الرأي والملاحظات. لذلك فهو عرضة للتغيير والتبديل ولا يجوز الرجوع اليه كمواصفة قياسية أردنية الا بعد اعتماده

من قبل مجلس الإدارة

Figure 3 – Escalator/moving walk (sectional view), principal dimensions

**Key**

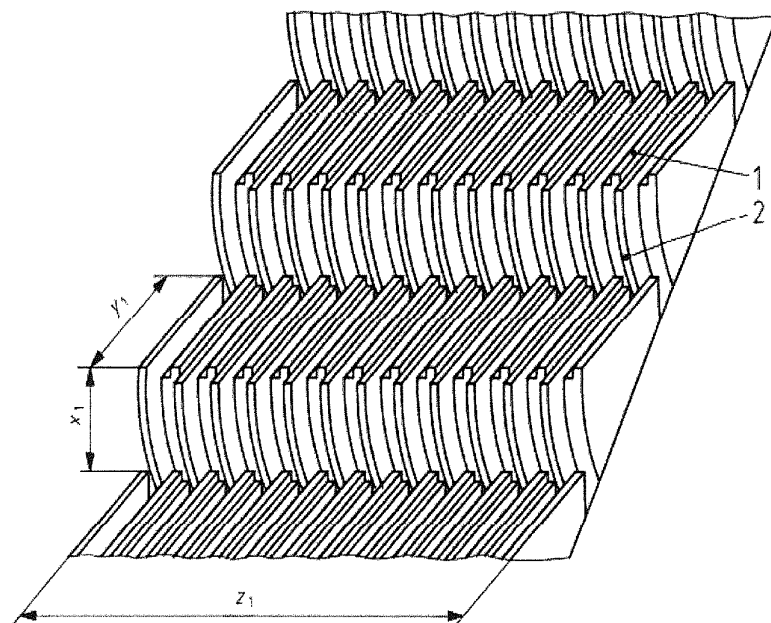
- 1: anti-climbing device (clause 5-5-2-2) 3: anti-slide device (clause 5-5-2-2)
 2: access restriction device (clause 5-5-2-2) 4: vertical deflector (clause A-2-4)

Principal dimensions	Clause	Principal dimensions	Clause
$b_{13}, b_{14}, b_{15}, b_{16}$	5-5-2-2	$h_{10} = 25 \text{ mm to } 150 \text{ mm}$	5-5-2-2
$b_{17} \geq 100 \text{ mm}$	5-5-2-2	$h_{11} \geq 20 \text{ mm}$	5-5-2-2
$h_5 \geq 0,30 \text{ m}$	A-2-4	$l_5 \geq 1\,000 \text{ mm}$	5-5-2-2

$h_9 = (1\ 000 \pm 50) \text{ mm}$	5-5-2-2	-	-
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Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 4 – Anti-misuse devices



Key

1: step treads

2: step risers

Principal dimensions	Clause
$x_1 \leq 0,24 \text{ m}$	5-3-2-2-1
$y_1 \geq 0,38 \text{ m}$	5-3-2-2-2
$z_1 \text{ 0,58 m to 1,10 m}$	5-3-2

Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 5 – Steps, principal dimensions

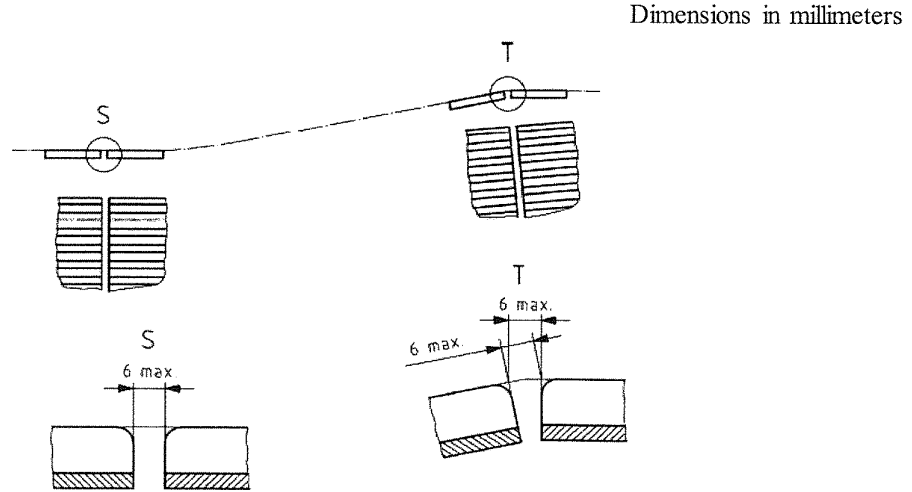


Figure 6 – Pallets, clearance and mesh depth (pallet type moving walk without meshed front and rear edges) in lower and upper landing and transition curves

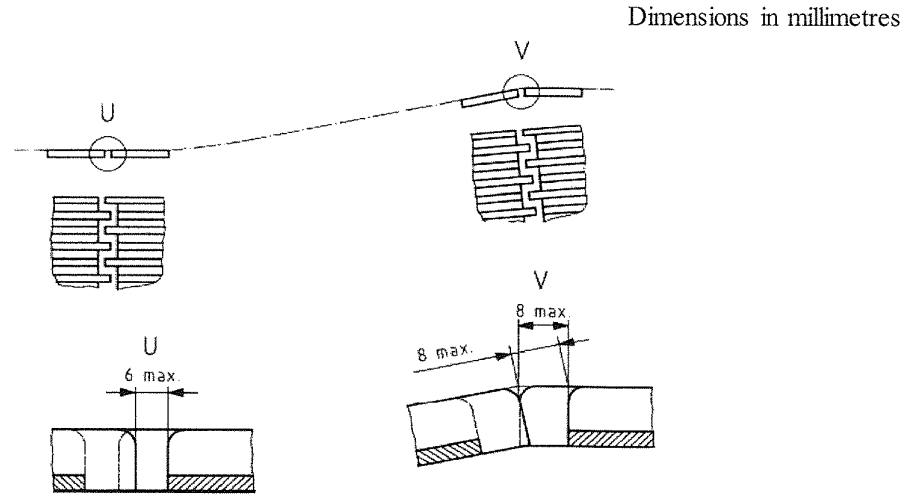
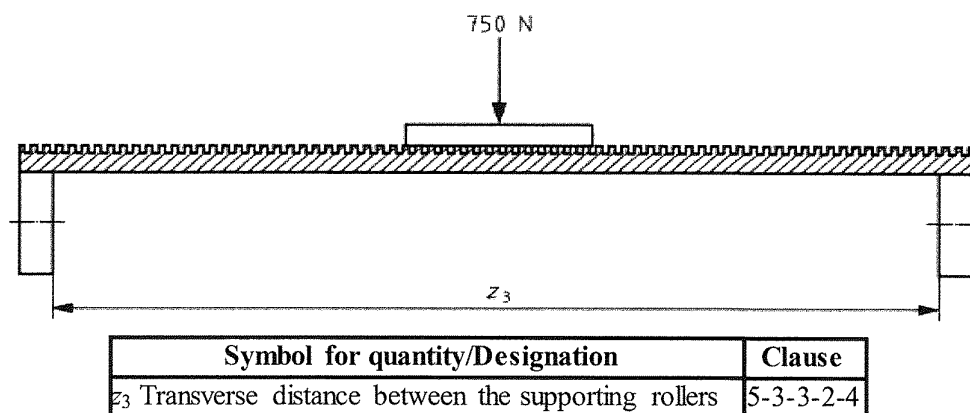


Figure 7 – Pallets, clearance and mesh depth (pallet type moving walk with meshed front and rear edges) in lower and upper landing and transition curves



Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 8 – Belt (sectional view), single force

5-11 Electric installations and appliances

5-11-1 General

5-11-1-1 Introduction

The electric installation of escalators or moving walks shall be so designed and manufactured as to ensure protection against hazards arising from the electric equipment or which may be caused by external influences on it, provided the equipment is used in applications for which it was made and is adequately maintained. Therefore, the electric equipment shall:

- comply with the requirements stated in the CENELEC harmonised standards.
- where no harmonised standards as referred to in a) exist, comply with the requirements of the International Electrotechnical Commission (IEC) and which are stated in the CENELEC harmonised documents.

Whenever one of these standards is used, its references are given, together with the limits within which it is used.

5-11-1-2 Limits of application

5-11-1-2-1 The requirements of this Jordanian Standard relating to the installation and to the constituent components of the electric equipment apply:

- to the main switch of each independent power circuit (e.g. machine, heating system) of the escalator or moving walk and dependent circuits.
- to the switch for the lighting circuit of the escalator or moving walk and dependent circuits.

The escalator or moving walk shall be considered as a whole, in the same way as a machine with its incorporated apparatus.

5-11-1-2-2 The electricity supply to the input terminals of the switches referred to in clause 5-11-1-2-1 and the electricity supply to the lighting of the machinery spaces, driving and return stations are not laid down by this Jordanian standard.

5-11-1-2-3 The electromagnetic compatibility shall comply with the requirements of EN 12015 and EN 12016.

5-11-1-3 Protection against direct contact

For protection against direct contact the requirements of EN 60204-1:2006, clause 6- shall apply.

5-11-1-4 Insulation resistance tests

For resistance of the insulation between conductors and between conductors and the earth, EN 60204-1:2006, clause 18-3 shall apply.

5-11-1-5 Voltage limit for control and safety circuits

For control and safety circuits, the value in direct current or the r.m.s. value in alternating current between conductors or between conductors and earth shall not exceed 250 V.

5-11-1-6 Conductor for neutral and earth-continuity

The earth-continuity conductor shall be in accordance with EN 60204-1:2006, Clause 8.

5-11-2 Contactors, relay contactors, components of fail safe circuits**5-11-2-1 Contactors and relay contactors**

5-11-2-1-1 To stop the driving machine (see clause 5-12-1-2-4) the main contactors shall belong to the following categories as defined in EN 60947-4-1.

- a) AC-3 for contactors of alternating current motors.
- b) DC-3 for contactors of direct current machines.

5-11-2-1-2 Relay contactors (see clause 5-12-1-2-4) shall belong to the following categories as defined in EN 60947-5-1:

- a) AC-15 for contactors in alternating current control circuits.
- b) DC-13 for contactors in direct current control circuits.

5-11-2-1-3 For both, the main contactors (see clause 5-11-2-1-1) and the relay contactors (see clause 5-11-2-1-2) it is permissible to assume, in the measures taken to comply with clause 5-12-1-1-2, that:

- a) if one of the break contacts (normally closed) is closed, all the make contacts are open.
- b) if one of the make contacts (normally open) is closed, all the break contacts are open.

5-11-2-2 Components of fail safe circuits

5-11-2-2-1 When devices according to clause 5-11-2-1-2 are used as relays in a fail safe circuit, the assumptions of clause 5-11-2-1-3 also apply.

5-11-2-2-2 If the relays used are such that the break and make contacts are never closed simultaneously for any position of the armature, the possibility of partial attraction of the armature is permitted to be disregarded (see clause 5-12-1-1-2 f)).

5-11-2-2-3 Devices connected after electric safety devices shall meet the requirements of clause 5-12-1-2-2-3 with regard to the creep distances and air gaps (not with regard to the separation distances).

This requirement does not apply to the devices mentioned in clause 5-11-2-1.

5-11-3 Protection of motors

5-11-3-1 Motors directly connected to the mains shall be protected against short-circuiting.

5-11-3-2 Motors directly connected to the mains shall be protected against overload by means of automatic circuit breakers with manual reset (except as provided for in clause 5-11-3-3) which shall cut off the supply to the motor in all live conductors (see EN 60947-4-1).

5-11-3-3 When the detection of overload operates on the basis of temperature increase in the windings of the motor, the protection device is permitted to close its contact automatically after sufficient cooling down has taken place. However, it shall only be possible to restart the escalator or moving walk under the conditions of clause 5-12-2-1.

5-11-3-4 The provisions of clause 5-11-3-2 and clause 5-11-3-3 apply to each winding if the motor has windings supplied by different circuits.

5-11-3-5 When the escalator or moving walk driving motors are supplied by d.c. generators driven by motors, the generator driving motors shall also be protected against overload.

5-11-4 Main switches

5-11-4-1 In the vicinity of the machine or in the return stations, or in the vicinity of the control devices, there shall be a main switch capable of breaking the supply to the motor, to the brake releasing device and to the control circuit in the live conductors.

This switch shall not cut the supply to the socket outlets or to the lighting circuits necessary for inspection and maintenance (see clause 5-8-3).

When separate supplies are provided for auxiliary equipment such as heating, balustrade lighting and comb lighting, it shall be possible to switch them off independently. The corresponding switches shall be located close to the main switch and be marked unambiguously.

5-11-4-2 The main switches as defined in clause 5-11-4-1 shall be capable of being locked or otherwise secured in the "isolated" position, with the use of a padlock or equivalent, to ensure no inadvertent operation by others (see EN 60204-1:2006, clause 5-3-3). The control mechanism of the main switch shall be easily and rapidly accessible after opening of the doors or trap doors.

5-11-4-3 Main switches shall be capable of interrupting the highest current involved in normal operating conditions of the escalator or moving walk. They shall comply with the requirements of Clause 5 of EN 60204-1:2006.

5-11-4-4 Where the main switches of several escalators or moving walks are positioned together it shall be possible to easily identify to which escalator or moving walk they refer.

5-11-5 Electric wiring

5-11-5-1 General

5-11-5-1-1 Cables shall be selected from those standardised by CENELEC and of a quality at least equivalent to that defined by the below mentioned standards of the CENELEC HD 21 and HD 22 series.

5-11-5-1-2 Conductors such as those in conformity with HD 21.3 S3, part 2 (HO7V-U and HO7V-R), part 3 (HO7V-K), part 4 (HO5V-U) and part 5 (HO5V-K) are permitted only in conduits, ducting, or similar fittings ensuring equivalent protection. When deviating from HD 21.3 S3, the nominal cross-sectional area of the conductors shall be not less than $0,75 \text{ mm}^2$.

5-11-5-1-3 Rigid cables, such as those in conformity with part 2 of HD 21.4 S2, are permitted only in visible mountings fixed to the walls, or in conduits, ducting or similar fittings.

5-11-5-1-4 Ordinary flexible cables, such as those in conformity with part 3 (HO5RR-F) of HD 22.4 S4 and part 5 (HO5VV-F) of HD 21.5 S3 are permitted only in conduits, ducting, similar fittings ensuring equivalent protection or in a position within the truss where it is not vulnerable to accidentally damage.

Flexible cables with a thick sheath such as those in conformity with part 5 of HD 22.4 S4 are permitted to be installed rigidly in the conditions defined in clause 5-11-5-1-3 and for connection to a movable appliance or if they are subject to vibrations.

Note: The requirements of clause 5-11-5-1-2 and clause 5-11-5-1-4 replace those in the guide to use appearing in HD 516 S2/A1 [3].

5-11-5-1-5 The requirements of clauses 5-11-5-1-2, 5-11-5-1-3 and 5-11-5-1-4 need not apply to the wiring of control or distribution devices in control cabinets or on control panels

a) either between different pieces of electric equipment, or

b) between these pieces of equipment and the connection terminals.

In these instances the requirements of EN 60439-1:1999, clause 7-8 apply.

5-11-5-2 Cross-sectional area of conductors

In order to provide mechanical strength the cross-sectional area of the conductors of safety circuits shall not be less than $0,75 \text{ mm}^2$.

5-11-5-3 Method of installation

5-11-5-3-1 The electric installation shall be provided with the indications necessary to make it easy to understand.

5-11-5-3-2 If, after the opening of the main switch or switches of the escalator or moving walk, some connection terminals remain live, they shall be clearly separated from terminals which are not live. If the voltage exceeds 50 V, they shall be suitably marked.

In these instances the requirements of EN 60204-1:2006, clause 5-3-5 and clause 16-2 apply.

5-11-5-3-3 In order to ensure continuity of mechanical protection, the protective enclosures of cables shall enter the casings of switches and appliances, or shall have proper glands at their ends.

5-11-5-4 Connectors

Connectors and devices of the plug-in type which are safety related and which can be extracted without the use of a tool shall be designed in such a way that it is impossible to re-insert them incorrectly.

5-11-6 Connecting terminals

Connection terminals, an accidental interconnection of which could lead to a dangerous situation of the escalator or moving walk, shall be clearly separated.

5-11-7 Protection against electrostatic loading

Means to discharge electrostatic loading shall be provided (e.g. brushes).

5-12 Protection against electric faults - controls

5-12-1 Protection against electric faults

5-12-1-1 General

5-12-1-1-1 Any single fault listed in clause 5-12-1-1-2 in the electric equipment of an escalator or moving walk, if it cannot be excluded under conditions described in clause 5-12-1-1-3 and/or Annex B, shall not, on its own, be the cause of a dangerous situation of the escalator or moving walk.

5-12-1-1-2 The following faults shall be envisaged:

- a) absence of voltage.
- b) voltage drop.
- c) loss of continuity of a conductor.
- d) fault to earth of a circuit.
- e) short circuit or open circuit, change of value or function in an electric component such as resistor, capacitor, transistor, lamp.
- f) non-attraction or incomplete attraction of the moving armature of a contactor or relay.
- g) non-separation of the moving armature of a contactor or relay.
- h) non-opening of a contact.
- i) non-closing of a contact.
- j) phase reversal.

5-12-1-1-3 The non-opening of a contact need not be considered in the case of safety switches conforming to clause 5-12-1-2-2.

5-12-1-1-4 The fault to earth of a circuit in which there is an electric safety device shall cause the immediate stopping of the driving machine (see Table 6 p)).

5-12-1-2 Electric safety devices

5-12-1-2-1 General requirements

5-12-1-2-1-1 The electric safety devices for the events listed in Table 6 shall prevent the driving machine from starting or cause the immediate stopping of the driving machine according to clause 5-12-1-2-4 and consist of:

- a) either one or more safety switches satisfying clause 5-12-1-2-2 directly disconnecting the supply to the contactors or their relay contactors, or

b) fail safe circuits satisfying clause 5-12-1-2-3 consisting of:

- 1) either one or more safety switches satisfying clause 5-12-1-2-2 not directly disconnecting the supply to the contactors or their relay contactors, or
- 2) contacts not satisfying the requirements of clause 5-12-1-2-2, or
- 3) other components in accordance with the requirements of Annex B.

c) programmable electronic systems in safety related applications in accordance with clause 5-12-1-2-6 directly disconnecting the supply to the contactors or their relay contactors.

5-12-1-2-1-2 No electric equipment shall be connected in parallel with an electric safety device with the exception of:

- a) electric safety devices in case of inspection mode (clause 5-12-2-5).
- b) connections to different points of the safety circuit for information about the status of electric safety devices. the devices used for that purpose shall fulfil the requirements of Annex B.

5-12-1-2-1-3 The effects of internal or external inductance or capacitance shall not cause failures of fail safe circuits.

5-12-1-2-1-4 An output signal emanating from a fail safe circuit shall not be altered by an extraneous signal emanating from another electric device placed further down the same circuit, which would cause a dangerous condition to result.

5-12-1-2-1-5 The construction and arrangement of the internal power supply units shall be such as to prevent the appearance of false signals at the outputs of electric safety devices due to the effects of switching.

In particular, voltage peaks arising from the operation of the escalator or moving walk or other equipment on the network shall not create inadmissible disturbances in electronic components (noise immunity) in compliance with EN 12015 and EN 12016.

5-12-1-2-2 Safety switches

5-12-1-2-2-1 The operation of a safety switch shall be by positive mechanical separation of the contacts. This positive mechanical separation shall even occur if the contacts are welded together.

Positive mechanical separation is achieved when all contacts are brought to their open position in such a way that for a significant part of the travel there are no resilient elements (e.g. springs) between the moving contacts and the part of the actuator to which the actuating force is applied. The design shall be such as to minimise the risk of a short-circuit resulting from a faulty component.

5-12-1-2-2-2 The safety switch shall be provided for a rated insulation voltage of 250 V if the enclosure provides a degree of protection of at least IP 4X (in accordance with EN 60529), or 500 V if the degree of protection of the enclosure is less than IP 4X.

Safety switches shall belong to the following categories as defined in EN 60947-5-1:

- a) AC-15 for safety switches in alternating current circuits.
- b) DC-13 for safety switches in direct current circuits.

5-12-1-2-2-3 If the protective enclosure is not at least of type IP 4X the air gaps shall be at least 3 mm and creep distances at least 4 mm.

After separation the distance for contacts shall be at least 4 mm.

5-12-1-2-2-4 In the case of multiple breaks, the individual distances for breaking contacts shall be at least 2 mm after separation.

5-12-1-2-2-5 Debris from the conductive material shall not lead to short-circuiting of contacts.

5-12-1-2-3 Fail safe circuits

5-12-1-2-3-1 Anyone of the faults envisaged in clause 5-12-1-1 shall not be on its own the cause of a dangerous situation.

5-12-1-2-3-2 Furthermore, the following conditions apply for the faults envisaged in clause 5-12-1-1:

-If one fault combined with a second fault can lead to a dangerous situation, the escalator or moving walk shall be stopped by the time the next operating sequence takes place in which the faulty element should participate.

The possibility of the second fault leading to a dangerous situation before the escalator or moving walk has been stopped by the sequence mentioned, is not considered.

-If the malfunction of the component which has caused the first fault cannot be detected by a change of state, appropriate measures shall ensure that the fault is detected and movement prevented at the latest when the escalator or moving walk is restarted according to clause 5-12-2-4.

The MTBF (mean time between failures) of the fail safe circuit shall be at least 2,5 years. This time was determined under the assumption that within a period of three months each escalator or each moving walk is restarted according to clause 5-12-2-4 at least once and, thus, is subject to a change of state.

5-12-1-2-3-3

-If two faults combined with a third fault can lead to a dangerous situation, the escalator or moving walk shall be stopped by the time the next operating sequence takes place in which one of the faulty elements should participate.

The possibility of the third fault leading to a dangerous situation before the escalator or moving walk has been stopped by the sequence mentioned, is not considered.

-If the malfunction of the components which have caused the two faults cannot be detected by a change of state, appropriate measures shall ensure that the faults are detected and movement is prevented at the latest when the escalator or moving walk is restarted according to clause 5-12-2-4.

The MTBF (mean time between failures) of the fail safe circuit shall be at least 2,5 years. This time was determined under the assumption that within a period of three months each escalator or each moving walk is restarted according to clause 5-12-2-4 at least once and, thus, is subject to a change of state.

5-12-1-2-3-4 A combination of more than three faults can be disregarded if

a) the fail safe circuit is built up of at least two channels, and their equal status is monitored by a control circuit. The control circuit shall be checked prior to a restart of the escalator or moving walk according to clause 5-12-2-4 (see also Annex C), or

b) the fail safe circuit is built-up of at least three channels, and their equal status is monitored by a control circuit.

If the requirements of a) or b) are not fulfilled, it is not permitted to interrupt the failure analysis but it shall be continued analogous to clause 5-12-1-2-3-3.

5-12-1-2-3-5 Drafting and assessing fail safe circuits shall be as shown in Figure C-1.

5-12-1-2-4 Operation of electric safety devices

When operated, an electric safety device shall prevent the setting in motion of the driving machine or immediately initiate its stopping. The operational brake shall be activated.

5-12-1-2-5 Actuation of electric safety devices

The components actuating the electric safety devices shall be selected and assembled so that they are able to function properly even under the mechanical stresses resulting from its continuous operation.

In the case of redundancy type fail safe circuit, it shall be ensured by mechanical or geometric arrangements of the transmitter elements that a mechanical fault cannot cause unnoticed loss of redundancy.

Transmitter elements of fail safe circuits shall fulfill the requirements of clause D-4-2 and clause D-4-3 if its malfunction is not detected.

5-12-1-2-6 Programmable electronic systems in safety related applications (PESSRAE)

Programmable electronic systems in safety related applications shall be designed in accordance with the requirements of EN 62061.

If a PESSRAE and a non safety related system share the same hardware, the requirements for PESSRAE shall be met.

5-12-2 Controls

5-12-2-1 Starting and making available for use the escalator or moving walk

5-12-2-1-1 Starting of the escalator or moving walk (or making it available for use when starting is automatic by a user passing a certain point) shall be effected by one or more switches available to authorised persons only (e.g. key-operated switches, switches with detachable lever, switches under lockable protective caps, remote start devices) and be reachable from an area outside the comb intersection line. Such switches shall not function concurrently as main switches described in clause 5-11-4. The person who operates the switch shall either be able to see the entire escalator or entire moving walk or shall have means of ensuring that nobody is using the escalator or moving walk before making this operation. The direction of travel shall be distinctly recognisable from the indication on the switch.

Any one of the faults envisaged in clause 5-12-1-1-2 in the electric equipment of the escalator or moving walk, if it cannot be excluded under conditions described in clause 5-12-1-1-3 and/or Annex B, shall not cause a start of the machine.

The starting switch(es) shall be located within reach of a stop switch.

For remote starting devices the requirements above shall apply.

Note: See clause 7-4-1 e) for the obligation of the maintainer to observe a complete revolution of the step/pallet band before making the escalator/moving walk available to the public after maintenance.

5-12-2-1-2 Escalators or moving walks which start or accelerate automatically by the entering of a user (stand-by operation) shall move with at least 0,2 times the nominal speed when the person reaches the comb intersection line and then accelerate less than 0,5 m/s².

Note: An average speed for a walking person of 1 m/s should be taken into account.

The requirements of clause 5-12-1-1 shall be met.

Constructional measures may be necessary to prevent circumvention of the control elements.

5-12-2-1-3 On escalators or moving walks which start automatically by the entering of a user, the direction of travel shall be predetermined, clearly visible to the user and marked distinctly on the escalator/moving walk (see clause 7-2-2).

In such cases where escalators or moving walks which start automatically by the entering of a user can be entered in the direction opposite its predetermined direction of travel, they shall start in the predetermined direction and conform to the requirements of clause 5-12-2-1-2. The running time shall be not less than 10 s.

5-12-2-2 Stopping

5-12-2-2-1 Stopping by operator, manually operated

Before stopping, the person shall have means of ensuring that nobody is using the escalator or moving walk, before making this operation. For remote stopping devices the same requirements apply.

5-12-2-2-2 Stopping, automatically operated

It is permitted to design the control in such a way that the escalator or moving walk is stopped automatically after a sufficient time (at least the anticipated user transfer time plus 10 s) after the user has actuated a control element described in clause 5-12-2-1-2.

5-12-2-2-3 Stop switch for emergency situations, manually operated

5-12-2-2-3-1 Stop switch for emergency situations shall be provided to stop the escalator or moving walks in the event of an emergency. They shall be placed in conspicuous and easily reachable

positions at least at or near each landing of the escalator or moving walk (see clause 7-2-1-2-2 for optical design). The distances between stop switches for emergency situations shall not exceed:

- 30 m on escalators.
- 40 m on moving walks.

If necessary, additional stop switches shall be provided to maintain the distance.

For moving walks intended to transport shopping trolleys and baggage carts, see clause I-2.

5-12-2-2-3-2 Stop switch for emergency situations shall be electric safety devices according to clause 5-12-1-2.

Note: Devices according to EN ISO 13850 do not support the functional requirement for stop switches according to clause 5-12-2-2-3. For the specific purpose of safety for escalators and moving walks the stop switch for emergency situations is defined different to EN ISO 13850.

5-12-2-2-4 Stopping initiated by monitoring or electric safety devices (see clause 5-12-1-2-1-1)

5-12-2-2-4-1 In case of any event detected by a monitoring or electric safety device as listed in Table 6 the driving machine shall be prevented from starting or shall be stopped immediately before a restart procedure (see clause 5-12-2-4).

References to the relevant requirements for each monitoring and electric safety device are given in Table 6.

Table 6 – Requirements for monitoring and electric safety devices/functions

No.	Event to be detected	Requirement
a)	Overload (by means of automatic circuit breakers). Starting shall be prevented (see also clause 5-12-2-4-1)	5-11-3-2
b)	Overload (operated on basis of temperature increase)	5-11-3-3
c)	Excessive speed or unintentional reversal of the direction of travel (according to clause 5-4-2-3). Starting shall be prevented (see also clause 5-12-2-4-1)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 2)
d)	Closing of the auxiliary brake (according to clause 5-4-2-2-4)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
e)	Breakage or undue elongation of parts immediately driving the steps, pallets or the belt, e.g. chains or racks. Starting shall be prevented (see also clause 5-12-2-4-1)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
f)	(Unintended) extension or reduction of the distance between the driving and return devices	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
g)	Foreign bodies being trapped at the point where the steps, pallets or the belt enter the comb (according to clause 5-7-3-2-6)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
h)	Stopping of a succeeding escalator or moving walk where an intermediate exit does not exist (see A-2-6) or the exit of the escalator or moving walk by structural measures is blocked (e.g. shutters, fire protection gates). See Annex I for additional	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 2)

	stop switch for emergency situation	
i)	Foreign bodies being trapped in the handrail entry (see clause 5-6-4-3)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
j)	Sagging of step or pallet (see clause 5-7-2-5). Starting shall be prevented (see also clause 5-12-2-4-1). Paragraph j) does not apply to belt moving walks (see clause 5-7-2-5)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 2)
k)	Missing step/pallet (see clause 5-3-6). Starting shall be prevented (see also clause 5-12-2-4-1)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 2)
l)	Non-lifting of the braking system after starting the escalator or moving walk (see clause 5-4-2-1-1). Starting shall be prevented (see also clause 5-12-2-4-1)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
m)	Hand rail speed deviation of more than -15 % to the actual speed for more than 15 s (see clause 5-6-1)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
n)	Opened inspection cover in the area of the truss and/or removed or opened floor plate (see clause 5-2-4)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)
o)	Exceeding the maximum permitted stopping distances by more than 20 % (see clause 5-4-2-1-1). Starting shall be prevented	5-12-2-4-1
p)	Fault to earth of a circuit in which there is an electric safety device. Starting shall be prevented (see also clause 5-12-1-1-4)	5-12-2-4-1
q)	Installation of a removable hand winding device (see clause 5-4-1-4)	5-12-1-2-2 or 5-12-1-2-3 or 5-12-1-2-6 (SIL 1)

5-12-2-2-4-2 The implementation for switching-off operations of monitoring and electrical safety devices into a safety circuit shall fulfill the requirements of Annex B.

5-12-2-3 Reversal of direction of travel

An intended reversal of the direction of travel shall be possible only if the escalator or moving walk stands still and clauses 5-12-2-1, 5-12-2-1-2, 5-12-2-1-3 and 5-12-2-2-2 are complied with.

5-12-2-4 Restarting

5-12-2-4-1 Restarting by switch

After each stop (clause 5-12-2-2-1, clause 5-12-2-2-3, clause 5-12-2-2-4) except the one mentioned in clause 5-12-2-2-2, restarting shall be possible only by means of the switches mentioned in clause 5-12-2-1 or by means of the inspection control described in clause 5-12-2-5. It shall be observed that where stopping is effected in the cases as listed in a), c), e), j), k), l), o), p) and q) of Table 6, restarting shall be possible only after the failure lock has been manually reset.

Before manual reset the root cause for stopping has to be investigated, the stopping device has to be checked and corrective action has to be taken if necessary.

The failure lock shall remain active even following failure or reinstatement of the power supply.

5-12-2-4-2 Reactivation for automatic restart

Where stopping is effected by a stop switch for emergency situation according to clause 5-12-2-2-3, reactivation of the escalator or moving walk for automatic restart without the switches mentioned in clause 5-12-2-1 is permitted under the following conditions:

a) The steps, pallets or the belt shall be supervised between the comb intersection lines and additional 0,30 m beyond each comb so that reactivation for automatic restart is effected only when there is no person or object within this zone.

The device shall be able to detect an opaque upright standing cylinder with a diameter of 0,30 m and a height of 0,30 m at any place within this zone.

b) The escalator or moving walk shall start by the entering of a user according to clause 5-12-2-1-2. Starting shall be effected only if, for a period of at least 10 s, the control device has not detected any persons or objects within the defined zone.

c) The reactivation control initiated by the control device for automatic restart shall be an electric safety device according to clause 5-12-1-2. Self controlling transmitter elements are permitted in single-channel design.

5-12-2-5 Inspection control

5-12-2-5-1 Escalators or moving walks shall be equipped with inspection controls to permit operation during maintenance or repair or inspection by means of portable and manually operated control devices.

5-12-2-5-2 For this purpose, one inspection outlet for the connection of the flexible cable of the portable manually operated control device shall be provided at least at each landing, e.g. in the driving station and the return station in the truss. The length of the cable shall be at least 3,0 m. Inspection outlets shall be located in such a way that any point of the escalator or moving walk can be reached with the cable.

5-12-2-5-3 The operating elements of this control device shall be protected against accidental operation. The escalator or moving walk is permitted to run only as long as the operating elements are switched on by permanent application of manual pressure. The direction of travel shall be distinctly recognisable from the indication on the switch. Each control device shall have a stop switch.

The stop switch shall:

- a) be operated manually.
- b) have the switching positions marked clearly and permanently.
- c) be a safety switch satisfying clause 5-12-1-2-2.
- d) require manual reset.

When the inspection control device is plugged in, the operation of the stop switch shall cause the disconnection of the power supply from the driving machine and the operational brake shall be activated.

5-12-2-5-4 When the inspection control device is used, all other starting devices shall be rendered inoperative in accordance with clause 5-12-1-2.

All inspection outlets shall be arranged in such a way that when more than one control device is connected, they all become inoperative. The electric safety devices (according to clause 5-12-2-2-4) shall remain effective with the exception of the electric safety devices mentioned in h), j), k), l), m) and n) of Table 6.

6- Verification of the safety requirements and/or protective measures

6-1 General

Table 7 indicates the methods by which the safety requirements and measures described in clause 5 shall be verified by the manufacturer for each new model of escalator/moving walk, together with a reference to the corresponding sub-clauses in this Jordanian standard. Secondary sub-clauses, which are not listed in the table, are verified as part of the quoted sub-clause. All verification records shall be kept by the manufacturer.

Where mechanical testing is required in accordance with this Jordanian standard, setting tolerances are permitted.

Table 7 – Methods to be used to verify conformity to the requirements

Clause	Testing ^{a)}	Measurement ^{b)}	Calculation ^{c)}	Visual inspection ^d
5-2-1-1	-	-	-	X
5-2-1-2	-	-	X	-
5-2-1-3	-	-	-	X
5-2-1-4	-	-	-	X
5-2-1-5	-	-	-	X
5-2-2	-	X	-	-
5-2-3	-	-	-	X
5-2-4	-	-	X	X
5-2-5	-	-	X	-
5-3-1	-	X	-	-
5-3-2	-	X	-	-
5-3-3	X	-	X	-
5-3-4	-	X	-	-
5-3-5	-	X	-	-
5-4-1-1	-	-	-	X
5-4-1-2	-	X	-	-
5-4-1-3-1	-	-	-	X
5-4-1-3-2	-	-	X	-
5-4-1-4	-	-	-	X
5-4-1-5	X	-	-	-
5-4-2-1-1	X	-	-	-
5-4-2-1-2	X	-	-	-
5-4-2-1-3-1	-	-	X	-
5-4-2-1-3-2	-	X	-	-
5-4-2-1-3-3	-	-	X	-
5-4-2-1-3-4	-	X	-	-

Table 7 – (Continued)

Clause	Testing ^{a)}	Measurement ^{b)}	Calculation ^{c)}	Visual inspection ^d
5-4-2-2-1	-	-	-	X
5-4-2-2-2	-	-	X	-
5-4-2-2-3	-	-	-	X
5-4-2-2-4	X	-	-	-
5-4-2-2-5	X	-	-	-
5-4-2-3	X	-	-	-
5-4-3-1	-	-	-	X
5-4-3-2	-	-	X	-
5-4-3-3	X	-	-	X
5-4-4-1	-	-	X	-
5-4-4-2	-	-	-	X

5-5-1	-	-	-	X
5-5-2-1	-	X	-	-
5-5-2-2	-	X	-	X
5-5-2-3	-	-	X	-
5-5-2-4	-	X	-	X
5-5-2-5	-	X	-	-
5-5-2-6	-	X	-	-
5-5-3-1	-	X	-	-
5-5-3-2	-	-	-	X
5-5-3-3	X	-	-	-
5-5-3-4	X	X	-	X
5-5-4	-	X	-	-
5-5-5	-	X	-	X
5-6-1	X	X	-	-
5-6-2-1	-	X	-	X
5-6-2-2	-	X	-	-
5-6-2-3	-	X	-	-
5-6-3	-	X	-	-
5-6-4-1	-	X	-	-
5-6-4-2	-	X	-	-
5-6-4-3	-	-	-	X
5-6-5	-	-	-	X
5-7-1	X	X	-	-
5-7-2-1	-	X	-	-
5-7-2-2	-	X	-	-
5-7-2-3	-	X	-	-
5-7-2-4	-	X	-	-
5-7-2-5	-	-	-	X
5-7-3-1	-	-	-	X
5-7-3-2-1	-	X	-	X
5-7-3-2-2	-	X	-	X
5-7-3-2-3	-	X	-	X
5-7-3-2-4	-	-	-	X

Table 7 – (Continued)

Clause	Testing ^{a)}	Measurement ^{b)}	Calculation ^{c)}	Visual inspection ^d
5-7-3-2-5	-	-	-	X
5-7-3-2-6	X	-	-	-
5-7-3-3	-	X	-	-
5-8-1	-	-	-	X
5-8-2-1	-	X	-	-
5-8-2-2	-	X	-	X
5-8-3	-	X	-	X
5-8-4	-	-	-	X

5-9	-	-	-	-
5-10	-	-	-	x
5-11	x	x	-	x
5-12	x	-	-	x
7	-	-	-	x
Annex A	-	x	-	x
Annex B	x	-	-	x
Annex G	-	x	-	x
^{a)} The result of the test is to show that the escalator/moving walk works as intended, including the electric safety devices. ^{b)} The result of the measurement is to show that the stated measurable parameters have been met. ^{c)} Calculations will verify that the design characteristics of the provided components meet the requirements. ^{d)} The results of the visual inspections is only to show that something is present (e.g. a marking, a control panel, an instruction handbook) , that the marking required satisfies the requirement and that the content of the documents delivered to the owner is in accordance with the requirements.				

6-2 Specific data, test reports and certificates

The following documentation should be held by the manufacturer:

- stress analysis of the truss or equivalent certificate by a stress analyst.
- proof by calculation of sufficient breakage resistance of the parts directly driving the steps, pallets or the belt, e.g. step chains, racks.
- calculation of the stopping distances for loaded moving walks (see clause 5-4-2-1-3-4) together with adjustment data.
- proof testing of steps or pallets.
- proof of the breaking strength of the belt.
- proof of sliding coefficients for skirting.
- proof of anti-slip properties of tread surfaces (steps, pallets, floor and comb plates without combs).
- proof of stopping distances and deceleration values.
- proof of electromagnetic compatibility.

7- Information for use

7-1 General

All escalators and moving walks are required to be provided with documentation that shall include an instruction handbook relating to use, maintenance, inspection, periodic checks and rescue operations. All information for use shall be in accordance with EN ISO 12100-2:2003 and also contain additional provisions for the use of machines within the scope of the Jordanian standard.

Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use (setting, teaching/programming, operation, cleaning, fault finding and maintenance) of the escalator and moving walk, and, if necessary, de-commissioning, dismantling and disposal.

7-2 Signals and warning devices

7-2-1 Plates, inscriptions and notices for use

7-2-1-1 General

All signs, inscriptions and notices for use shall be of durable material, placed in a conspicuous position and written in clearly legible characters in the language of the country where the escalator or moving walk is in operation.

7-2-1-2 Safety signs near the entrances of escalators or moving walks

7-2-1-2-1 The following mandatory action signs and prohibition signs for the user shall be fixed in the vicinity of the entrances:

- a) "Small children shall be held firmly" (see Figure G-1).
- b) "Dogs shall be carried" (see Figure G-2).
- c) "Use the handrail" (see Figure G-3, Reg. Nr. ISO 7010-M012).
- d) "Push chairs not permitted" (see Figure G-4).

When required by local conditions, prohibition signs, e.g. "Transportation of bulky and heavy loads not permitted" and mandatory action signs like "Use permitted only with footwear", will possibly be necessary.

7-2-1-2-2 Stop devices referred to in clause 5-12-2-2-3 shall be coloured red and either on the device itself or in its immediate vicinity be marked with the inscription "STOP".

7-2-1-2-3 During maintenance, repair, inspection or similar work, the access to the escalator or moving walk shall be barred to unauthorised persons by devices:

- which shall bear the notice "No Access", or
- the "No Entry" indicator (prohibition sign C,1^a as described in the "Convention on Road Signs and Signals" (Vienna, 8.11.1968) ^[4]).

And be available in immediate area.

7-2-1-3 Instructions for hand winding devices

If a hand winding device is provided, operating instructions for use shall be available in the vicinity. The direction of travel of the escalator or moving walk shall be indicated clearly.

7-2-1-4 Notices on the access doors to machinery spaces outside the truss, driving and return stations

On access doors to machinery spaces outside the truss, driving and return stations, a notice shall be fixed with the inscription:

"Machinery space - danger, access prohibited to unauthorised persons".

7-2-2 Special indicators for escalators and moving walks starting automatically

In the case of escalators or moving walks starting automatically, a clearly visible signal system, e.g. road traffic signals, shall be provided indicating to the user whether the escalator or moving walk is available for use, and its direction of travel.

7-3 Inspection and test

7-3-1 General

Escalators and moving walks shall be inspected before their first use, after major modifications and at regular intervals.

Such inspections and tests should be made by a competent person.

7-3-2 Constructional inspection and acceptance inspection and test

7-3-2-1 The constructional inspection and acceptance inspection and test shall be carried out at the job-site on completion of the escalator or moving walk.

7-3-2-2 For the constructional inspection and acceptance inspection and test, the data specified in clause 6-2 should form part of a pre-completed test sheet. Furthermore, layout drawings, description of the equipment and wiring diagrams (current flow chart with legend or explanations, and a terminal connection chart) which permit a check of compliance with the safety requirements specified in this Jordanian standard, shall be provided.

7-3-2-3 The constructional inspection comprises the examination of the completed installation for conformity with the required data and with regard to proper workmanship as specified in this Jordanian standard.

7-3-2-4 The acceptance inspection and test comprises:

- a) overall visual inspection.
- b) functional test.
- c) test of electric safety devices with regard to their effective operation.
- d) test of the brake(s) of the escalator or moving walk under no load, for compliance with the prescribed stopping distances (see clause 5-4-2-1-3-2 and clause 5-4-2-1-3-4). An examination of the brake adjustment according to the calculation required in clause 6-2 c) is also necessary. Additionally, for escalators, a test of the stopping distances under brake load (see clause 5-4-2-1-3-2) is required unless the stopping distances can be verified by other methods.
- e) measurement of the insulation resistance of the different circuits between conductors and earth (see clause 5-11-1-4). For this measurement, the electronic components shall be disconnected.

7-3-2-5 This needs to include a test of the electric continuity of the connection between the earth terminal(s) in the driving station and the different parts of the escalator or moving walk liable to be live accidentally.

7-3-3 Inspection and test after major modifications

A major modification is a change of the location, a change of the speed, of the electric safety devices, of the braking system, of the drive, of the control, of the step band, of the truss and of the balustrades. Wherever applicable, the principles set forth for the constructional inspection and acceptance inspection and test (clause 7-3-2) should apply to the new environmental conditions, modified components and other components which are affected.

The replacement of parts by parts of same design is not considered to be a major modification.

7-4 Accompanying documents (in particular, instruction handbook)

7-4-1 Contents

The instruction handbook or other written instructions shall contain among others:

- a) information relating to transport, handling and storage of the escalator or moving walk, e.g.:
 - storage conditions.
 - dimensions, mass value(s), position of the centre(s) of gravity.
 - indications for handling (e.g. drawings indicating application points for lifting equipment).
- b) information relating to installation and commissioning of the escalator or moving walk, e.g.:
 - building interfaces (see Annex A).
 - fixing/anchoring and vibration dampening requirements.
 - assembly and mounting conditions.
 - space needed for use and maintenance.
 - permissible environmental conditions (e.g. temperature, moisture, vibration, electromagnetic radiation, earthquake and civil defence).
 - instructions for connecting to the power supply (particularly about protection against electric overloading).
 - advice about waste removal/disposal.
 - if necessary, recommendations about protective measures which have to be taken by the owner. e.g. additional safeguards (see EN ISO 12100-1:2003, Figure 1, Note 4), safety distances, safety signs and signals.
- c) information relating to the escalator or moving walk itself, e.g.:
 - detailed description of the escalator or moving walk, its fittings, its guards and/or protective devices.

- comprehensive range of applications for which the escalator or moving walk is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate.
 - diagrams (especially schematic representation of safety functions and layout details).
 - technical documentation about electric equipment (see EN 60204 series [5]).
 - documents attesting that the escalator or moving walk complies with the relevant directives.
 - documents specifying the grade of the slip resistance.
- d) information relating to the use of the escalator or moving walk, e.g. about:
- intended use.
 - description of manual controls (actuators).
 - setting and adjustment.
 - risks which could not be eliminated by the protective measures taken by the designer.
 - interdiction to place merchandise between adjacent balustrades or between a balustrade and adjacent building structures.
 - preventing arrangements in the vicinity of the escalator/moving walk which encourages misuse.
 - keeping free of unrestricted areas (see clause A-2-5).
 - particular risks which may be generated by certain applications (including the use of shopping trolleys and/or baggage carts on escalators and moving walks, see Annex I), and about specific safe measures which are necessary for such applications.
 - reasonably foreseeable misuse and prohibited usages.
 - recommendation to not use escalators as regular staircases or emergency exits.
 - recommendation that, for escalators and moving walks which otherwise would be exposed to weather conditions, the customer provides a roof or enclosure.
 - fault identification and location, repair, and restarting after an intervention.
 - investigations and necessary corrective actions in case of faults requiring manual reset, to be taken before reset and restart.
- e) information for maintenance, e.g.:
- necessity to follow the requirements of EN 13015:2001 for escalators or moving walks.
 - personal protective equipment which need to be used and training required.
 - nature and frequency of inspections.
 - instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence should be carried out exclusively by skilled persons (e.g. maintenance staff, specialists).
 - instructions relating to maintenance actions (e.g. replacement of parts) which do not require specific skills and hence may be carried out by the owner.
 - drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks).
 - instructions relating to cleaning and refurbishment.
 - necessity for the maintainer to observe a complete revolution of the step/pallet band before making the escalator/moving walk available to the public after maintenance.
 - instructions on the necessary use of inspection controls during maintenance and repair work.
- f) information about periodic inspection and tests to ascertain whether the escalator or moving walk is safe in operation, including:
- electric safety devices with regard to their effective operation.
 - brake(s) according to clause 7-3-2 d).
 - driving elements for visible signs of wear and tear and for insufficient tension of belts and chains.
 - steps, pallets or the belt for defects, true run and guidance.
 - dimensions and tolerances specified in this Jordanian standard.

- combs for proper condition and adjustment.
- interior panel and the skirting.
- handrails.
- test of the electric continuity of the connection between the earth terminal(s) in the driving station and the different parts of the escalator or moving walk liable to be live accidentally.
- g) information for emergency situations, e.g.:
 - the operating method to be followed in the event of accident or breakdown.
 - use of hand winding device, if any (see clause 5-4-1-4 and clause 7-2-1-3).
 - warning about possible emission or leakage of harmful substance(s), and if possible indication of means to fight their effects.
- h) a declaration that the emission sound pressure level measured under free field conditions at a distance of 1 metre from the surface of the machinery and at a height of 1,6 metres from the floor plate is expected not to exceed 70 dB(A).

7-4-2 Presentation of the instruction handbook

- a) Type and size of print shall ensure the best possible legibility. Warning signs and/or cautions should be emphasised by the use of colours, symbols and/or large print.
- b) Information for use shall be given in the language(s) of the country in which the escalator or moving walk will be used for the first time and in the original version. If more than one language is to be used, each language should be readily distinguished from the other(s), and efforts should be made to keep the translated text and the relevant illustration together.
- c) Whenever helpful to the understanding, text should be supported by illustrations. Illustrations should be supplemented with written details enabling, for instance, manual controls (actuators) to be located and identified. they should not be separated from the accompanying text and should follow sequential operations.
- d) Consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.
- e) The use of colours should be considered, particularly in relation to components requiring quick identification.
- f) When information for use is lengthy, a table of contents and/or an index should be given.
- g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.

7-4-3 Advice for drafting and editing information for use

- a) The information shall clearly relate to the specific model of escalator or moving walk.
- b) When information for use is being prepared, the communication process "see – think – use" should be followed in order to achieve the maximum effect and should follow sequential operations. The questions "how?" and "why?" should be anticipated and the answers provided.
- c) Information for use shall be as simple and as brief as possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms.
- d) Documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling). It may be useful to mark them "keep for future reference". Where information for use is kept in electronic form (e.g. CD, DVD, tape) information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.

7-5 Marking

At least at one landing, the:

- name and full address of the manufacturer and, where applicable, his authorised representative.
- designation of series or type of the machinery.

- serial number.
- year of construction (year in which the manufacturing process is completed) shall be indicated, visible from the outside.

Annex A (Normative) Building interfaces

A-1 General

The requirements in clause A-2 and clause A-3 are important for the safety of users and maintenance personal.

If it is not possible for the manufacturers of the escalator or moving walk to fulfill these requirements (or some of them) due to the fact that e.g. they are not installing the escalator or moving walk, those requirements that are not fulfilled have to be part of the instruction handbook as an obligation for the owner (see clause 7-4).

A-2 Free space for users

A-2-1 The clear height above the steps of the escalator or pallets or belt of the moving walk at all points shall be not less than 2,30 m (see h_4 in Figures 2 and A-1).

The clear height shall extend to the end of the newel.

Note: The clear height of 2,30 m should also be applied to the unrestricted area.

A-2-2 To prevent collision, a minimum free area around the escalator or moving walk is defined as per Figure A-1. The height h_{12} , measured from the steps of the escalator or the pallets or the belt of the moving walk shall be at least 2,10 m. The distance between the outer edge of the handrail and walls or other obstacles (see b_{10} in Figure A-1) shall under no circumstances be less than 80 mm horizontally and 25 mm vertically below the lower edge of the handrail (see b_{12} in Figure 3). The area is permitted to be smaller, if by appropriate measures, the risk of injury is minimised.

A-2-3 For escalators arranged adjacent to one another either parallel or criss-cross, the distance between the handrails shall be not less than 160 mm (see b_{11} in Figure A-1).

A-2-4 Where building obstacles can cause injuries, appropriate preventive measures shall be taken. In particular, at floor intersections and on criss-cross escalators or moving walks, a vertical deflector of not less than 0,30 m in height, not presenting any sharp cutting edges, shall be placed above the handrail level and extend at least 25 mm below the lower edge of the handrail, e.g. as an imperforate triangle (see h_5 in Figures 2 and 4).

It is not necessary to comply with these requirements when the distance b_9 between the outer edge of the handrail and any obstacle is equal to or greater than 400 mm (see Figure A-1).

A-2-5 At the exit(s) of each individual escalator or moving walk a sufficient unrestricted area shall be available to accommodate persons. The width of the unrestricted area shall at least correspond to the distance between the outer edges of the handrails plus 80 mm on each side. The depth shall be at least 2,50 m measured from the end of the balustrade. It shall be permissible to reduce it to 2,00 m if the width of the unrestricted area is increased to at least double the distance between the outer edges of the handrails plus 80 mm on each side.

For succeeding escalators and moving walks the depth of an unrestricted area shall be determined in each individual case depending on e.g. type of use (persons only or persons with transport devices, number of intermediate exits, relative orientation and theoretical capacity). Where the exit of the escalator or moving walk is blocked by structural measures (e.g. shutters, fire protection gates) an

additional stop switch for emergency situations at handrail level (taking into account clause A-2-2) shall be provided with a distance between 2,0 m and 3,0 m before the step/pallet/belt reaches the comb intersection line. This stop switch shall be reachable from inside the escalator/moving walk."

A-2-6 In the case of successive escalators and moving walks without intermediate exits, they shall have the same capacity (see also h) in Table 6).

A-2-7 Where it is possible for people to come into contact with the outer edge of a handrail at a landing and can be drawn into a hazardous situation, such as toppling over a balustrade, appropriate preventative measures shall be taken (for an example, see Figure A-2).

Some examples are:

- prevention of entry into the space by the placement of permanent barriers.
- increasing the height of the building structure of the fixed balustrade in the hazard area by at least 100 mm above the handrail level and positioned between 80 mm and 120 mm from the outer edge of the handrail.

A-2-8 The surrounds of the escalator or moving walk shall be illuminated, especially in the vicinity of the combs.

Note: Information should be exchanged between the manufacturer and the customer.

A-2-9 It is permissible to arrange the lighting in the surrounding space and/or at the installation itself. The intensity of illumination at the landings including the combs shall be related to the intensity of illumination of the general lighting in the area. The intensity of illumination shall be not less than 50 lx at the comb intersection line measured at floor level.

A-3 Machinery spaces outside the truss

A-3-1 A safe access for persons to machinery spaces shall be provided.

A-3-2 Machinery spaces shall be lockable and only accessible to authorised persons (see EN 13015:2001, clause 4-3-2-13).

A-3-3 Machinery spaces shall be provided with permanently installed electric lighting on the following basis:

- a) a minimum of 200 lx at floor level in working areas.
- b) a minimum of 50 lx at floor level in access routes leading to these working areas.

A-3-4 Emergency lighting shall be installed to allow the safe evacuation of all personnel working in any machinery space.

Note: Emergency lighting is not intended for continuation of maintenance or other activities.

A-3-5 The dimensions of machinery spaces shall be sufficient to permit easy and safe working on equipment, especially the electrical equipment.

In particular there shall be provided at least a clear height of 2,00 m at working areas, and:

a) a clear horizontal area in front of the control panels and the cabinets. This area is defined as follows:

- 1) depth, measured from the external surface of the enclosures: at least 0,70 m.
- 2) width, the greater of the following values: 0,50 m or the full width of the cabinet or panel.
- b) a clear horizontal area of at least 0,50 m × 0,60 m for maintenance and inspection of moving parts at points where this is necessary.

A-3-6 The clear height for movement shall not be less than 1,80 m.

The access ways to the clear spaces mentioned in clause A-3-6 shall have a width of at least 0,50 m.

This value may be reduced to 0,40 m where there are no moving parts.

This full height for movement is taken to the underside of the structural roof beams and measured from both:

- a) the floor of the access area.

b) the floor of the working area.

A-3-7 In machinery spaces the clear height shall under no circumstances be less than 2,0 m.

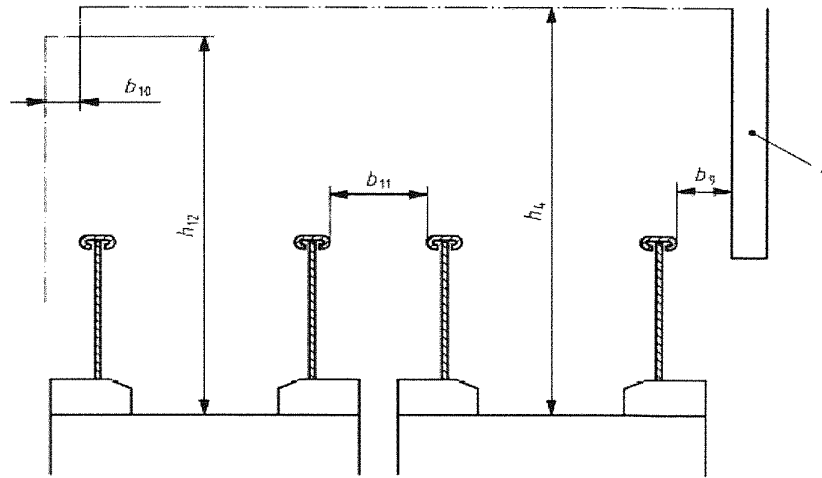
A-4 Electric power supply

Agreements shall be made between the owner and the manufacturer about electric supply and electric protection requirements (e.g. electric shock, short circuit, overload).

The installation shall comply with:

a) EN 60204-1:2006, or

b) with the requirements of the national rules of the country where it is installed.



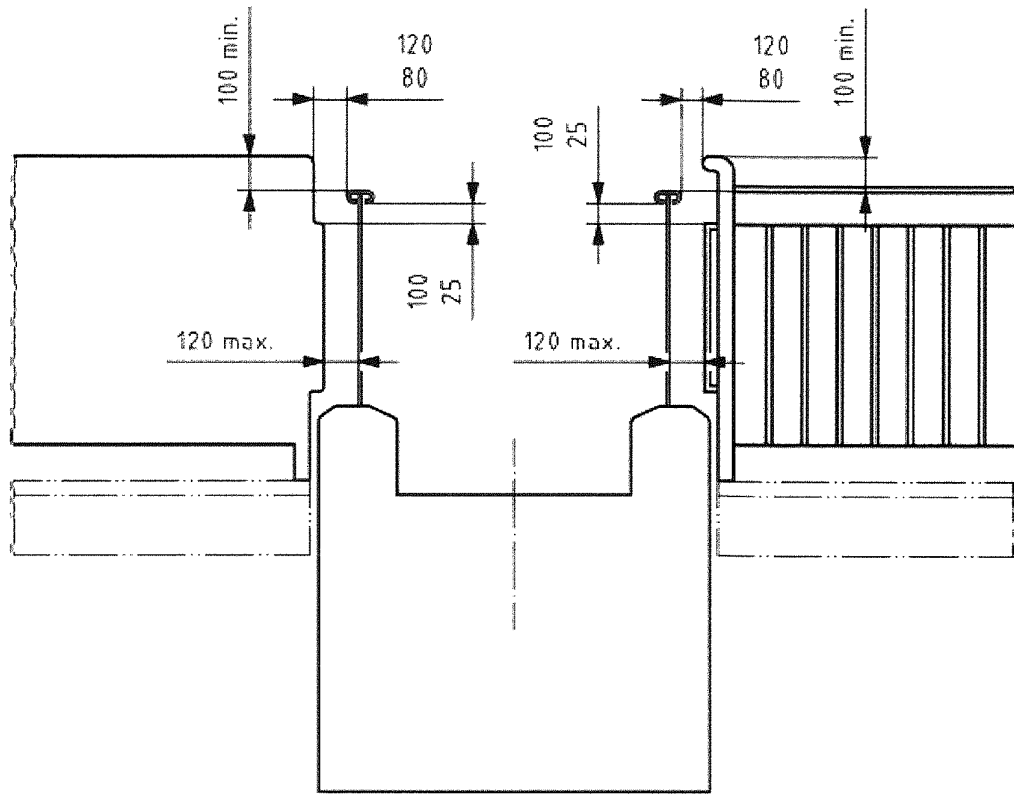
Key

1: obstacle (e.g. column)

Principal dimensions	Clause	Principal dimensions	Clause
$b_9 \geq 400 \text{ mm}$	A-2-4	$h_4 \geq 2\,300 \text{ mm}$	A-2-1
$b_{10} \geq 80 \text{ mm}$	A-2-2	$h_{12} \geq 2\,100 \text{ mm}$	A-2-2
$b_{11} \geq 160 \text{ mm}$	A-2-3	-	-

Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure A – 1 – Clearances between building structure and escalator/moving walk units



Note: This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure A – 2 – Example of barriers at landings

Annex B (Normative) Electronic components - Failure exclusion

B-1 Scope

Clause 5-12-1 envisages a number of faults of the electric equipment of the escalator and moving walk. During the failure analysis, some faults can be excluded under certain conditions. This annex describes these conditions and gives the requirements for fulfilling them.

B-2 Failure exclusions - conditions

Table B- 1 shows:

a) a list of the major and most usual components used in present electronic technology. the components have been grouped by "families":

- | | |
|-------------------------------|---|
| 1) passive components | 1 |
| 2) semiconductors | 2 |
| 3) miscellaneous | 3 |
| 4) assembled printed circuits | 4 |

b) a number of identified failures:

- | | |
|---------------------------------|-----|
| 1) interruption | I |
| 2) short-circuit | II |
| 3) change value to higher value | III |
| 4) change value to lower value | IV |
| 5) change of function | V |

c) the possibility and conditions of failure exclusion:

"The first condition for failure exclusion is that components must always be used within their own worst case limits, even in the worst case conditions specified by the standards, in the field of temperature, humidity, voltage and vibrations".

d) some remarks. In the table:

- the "NO" in the cell means: failure not excluded, i.e. shall be considered.
- the unmarked cell means: the identified fault type is not relevant.

Note: A design guide line for safety circuits is given in Annex E.

Table B – 1 – Exclusions of failures

Component	Possible failure exclusion					Conditions for the exclusion of faults Remarks
	I ^{a)}	II ^{b)}	III ^{c)}	IV ^{d)}	V ^{e)}	
1- Passive components						
1-1 Resistor fixed	No	(1)	No	(1)		(1) Only for film resistors with varnished or sealed resistance film and axial connection according to applicable IEC standards, and for wire wound resistors if they are made by a single layer winding protected by enamel or sealed.
1-2 Resistor variable	No	No	No	No		-
1-3 Resistor, non linear						-
1-3-1 NTC	No	No	No	No		-
1-3-2 PTC	No	No	No	No		-
1-3-3 VDR	No	No	No	No		-
1-3-4 IDR	No	No	No	No		-
1-4 Capacitor	No	No	-	No		-
1-5 Inductive components						
- coil	No	No	-	No		-
- choke						
2- Semiconductors						
2-1 Diode, LED	No	No	-	-	No	Change of function refers to change in reverse current value.
2-2 Zener Diode	No	No	-	No	No	Change to lower value refers to change in Zener voltage. Change of function refers to change in reverse current value.
2-3 Thyristor, Triac, GTO	No	No	-	-	No	Change of function refers to self triggering or latching of components.

Table B – 1 – (Continued)

Component	Possible failure exclusion					Conditions for the exclusion of faults Remarks														
	I ^{a)}	II ^{b)}	III ^{c)}	IV ^{d)}	V ^{e)}															
2-4 Optocoupler	No	(2)	-	-	No	<p>'I' means open circuit in one of the two basic components (LED and photo transistor). 'II' means short circuit between them.</p> <p>(2) Can be excluded under condition that the optocoupler is according to IEC 60747-5-5, and the isolation voltage is at least according to table below (taken from EN 60664-1:2007, Table F-1).</p> <table><tr><th>Voltage phase-to-earth derived from rated system voltage up to and including V_{rms} and d.c.</th><th>Preferred series of impulse withstand voltages in volts for installation (category III)</th></tr><tr><td>50</td><td>800</td></tr><tr><td>100</td><td>1 500</td></tr><tr><td>150</td><td>2 500</td></tr><tr><td>300</td><td>4 000</td></tr><tr><td>600</td><td>6 000</td></tr><tr><td>1 000</td><td>8 000</td></tr></table>	Voltage phase-to-earth derived from rated system voltage up to and including V _{rms} and d.c.	Preferred series of impulse withstand voltages in volts for installation (category III)	50	800	100	1 500	150	2 500	300	4 000	600	6 000	1 000	8 000
Voltage phase-to-earth derived from rated system voltage up to and including V _{rms} and d.c.	Preferred series of impulse withstand voltages in volts for installation (category III)																			
50	800																			
100	1 500																			
150	2 500																			
300	4 000																			
600	6 000																			
1 000	8 000																			
2-5 Hybrid circuits	No	No	No	No	No	-														
2-6 Integrated circuits	No	No	No	No	No	Change in function to oscillation. 'and' gates becoming 'or' gates, etc.														
3- Various																				

3-1 Connectors Terminals Plugs	No	(3)	-	-	-	<p>(3) If the protection of the connector is not better than IP 4X, the short circuits of connectors can be excluded if the minimum values are at least:</p> <ul style="list-style-type: none"> - 4 mm for creepage distances. - 3 mm for clearances. <p>These are absolute minimum values which can be found on the connected unit, not pitch dimension or theoretical values.</p> <p>If the protection of the connector is better than IP 4X (in accordance with EN 60529), the creepage distances can be reduced to the clearance values given by EN 60664-1:2007 with the conditions of</p> <ul style="list-style-type: none"> - pollution degree of 3. - material group III and - presence of an inhomogeneous field.
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Table B – 1 – (Continued)

Component	Possible failure exclusion					Conditions for the exclusion of faults Remarks
	I ^{a)}	II ^{b)}	III ^{c)}	IV ^{d)}	V ^{e)}	
3-2 Neon bulb	No	No	-	-	-	-
3-3 Transformer	No	(4)	(5)	(5)	-	<p>(4) Short-circuits include short-circuits of primary or secondary windings, or between primary and secondary coils.</p> <p>(5) Change in value refers to change of ratio by partial short-circuit in a winding.</p> <p>(4) and (5) Can be excluded under condition that isolation resistance and voltage are in line with EN 61558-1:2005, clause 18-2 and clause 18-3.</p>
3-4 Fuse	-	(6)	-	-	-	<p>'II' means short circuit of the blown fuse.</p> <p>(6) Can be excluded if the fuse is correctly rated, and constructed according to EN 60269-1.</p>

3-5 Relay	No	(7) (8)	-	-	-	(7) Short-circuits between contacts, and between contacts and coil can be excluded if the relay fulfils the requirements of clause 5-11-2-2-3 (clause 5-12-1-2-2-2). (8) Welding of contacts cannot be excluded. However, if the relay is constructed to have mechanically forced interlocked contacts, and made according to EN 60947-5-1, the assumptions of clause 5-11-2-1-3 apply.
3-6 Printed circuit board (PCB)	No	(9)	-	-	-	The general specifications of the PCB are in accordance with EN 62326-1. The base material shall be according to the specifications of the EN 61249 series of standards.

Table B – 1 – (Continued)

Component	Possible failure exclusion					Conditions for the exclusion of faults Remarks
	I a)	II b)	III c)	IV d)	V e)	

3-6 Printed circuit board (PCB)	No	(9)	-	-	-	<p>(9) If the PCB is constructed to the above requirements and the protection is not better than IP 4X, the short circuits can be excluded if the minimum values are at least:</p> <ul style="list-style-type: none"> - 4 mm for creepage distances. - 3 mm for clearances. <p>These are absolute minimum values which can be found on the connected unit, not pitch dimension or theoretical values.</p> <p>If the protection of the connector is better than IP 4X (in accordance with EN 60529), the creepage distances can be reduced to the clearance values given by EN 60664-1 with the conditions of:</p> <ul style="list-style-type: none"> - pollution degree of 3; - material group III; - and presence of an inhomogeneous field.
4- Assembly of components on printed circuit board	No	(10)	-	-	-	<p>(10) Short circuit can be excluded under circumstances where the component itself can be excluded and is mounted in a way that the creeping distances and clearances are not reduced below the minimum acceptable values as listed in clause 3-1 and clause 3-6 of this table, not by the mounting technique, nor by the PCB itself.</p>
<p>a) I: interruption b) II: short-circuit c) III: change value to higher value d) IV: change value to lower value e) V: change of function</p>						

Annex C (Normative)

58/70

هذه الوثيقة مشروع تصويت تم توزيعه لإبداء الرأي والملاحظات. لذلك فهو عرضة للتغيير والتبديل ولا يجوز الرجوع اليه كمواصفة قياسية أردنية الا بعد اعتماده من قبل مجلس الإدارة

Drafting and assessing fail safe circuits

To assess the failure of safe circuit see Figure c-1.

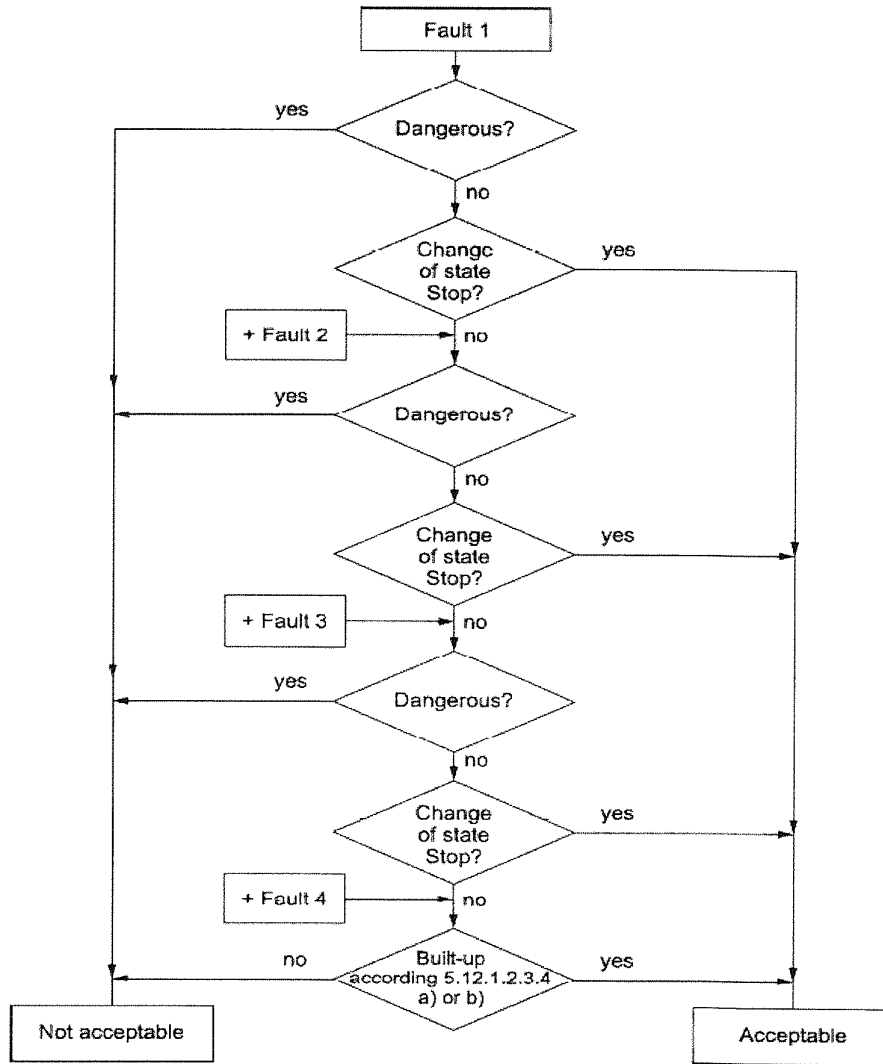


Figure C – 1 – Flow chart for drafting and assessing fail safe circuits

Annex D
(Normative)
Testing of fail safe circuits containing electronic components and/or
programmable electronic systems (PESSRAE)

D-1 General

For fail safe circuits containing electronic components, laboratory tests are necessary because practical checks on site, by inspectors, are impossible.

In the following, mention is made to printed circuit board. If a fail safe circuit is not assembled in such a manner, then the equivalent assembly shall be assumed.

D-2 General provisions

D-2-1 Failsafe circuits containing electronic components

The applicant shall indicate to the laboratory:

- a) the identification on the board.
- b) working conditions.
- c) listing of used components.
- d) layout of the printed circuit board.
- e) layout of the hybrids and marks of the tracks used in fail safe circuits.
- f) function description.
- g) electric data inclusive wiring diagram, if applicable, including input and output definitions of the board.

D-2-2 Safety circuits based on programmable electronic systems

In addition to clause D-2-1 the following documentation shall be provided:

- a) documents and descriptions relating to the common measures for the design and implementation process.
- b) general description of the software used (e.g. programming rules, language, compiler, modules).
- c) function description including software architecture and hardware/software interaction.
- d) description of blocks, modules, data, variables and interfaces.
- e) software listings.

D-3 Test samples

There shall be submitted to the laboratory:

- a) one printed circuit board:
- b) one printed circuit board bare (without components).

D-4 Mechanical tests

D-4-1 General

During the tests, the tested object (printed circuit) shall be kept under operation. During and after the tests, no unsafe operation and condition shall appear within the fail safe circuit.

D-4-2 Vibrations

Transmitter elements of fail safe circuits shall withstand the requirements of:

a) EN 60068-2-6:1995, clause A-6-1, Table C-2 (Endurance by sweeping):

20 sweep cycles in each axis:

- 1) at amplitude 0,35 mm or $5 g_n$. and
- 2) in the frequency range 10 Hz to 55 Hz.

and also of:

b) EN 60068-2-27:1993, clause 4-1, Table 1 (acceleration and duration of pulse) in the combination of:

- 1) 1 pulse in each axis with a peak acceleration 294 m/s^2 or $30 g_n$.
- 2) corresponding duration of pulse 11 ms. and
- 3) corresponding velocity change 2,1 m/s half sine.

Note: Where shock absorbers for transmitter elements are fitted, they are considered as part of the transmitter elements.

After tests, clearances and creeping distances shall not become smaller than the minimum accepted.

D-4-3 Bumping

D-4-3-1 General

Bumping tests are to simulate the cases when printed circuits fail, introducing the risk of rupture of components and unsafe situation. These tests shall be carried out according to EN 60068-2-29.

Tests are divided into the partial test shocking, and continuous shocking. During the tests, the operation of the circuit is not required.

D-4-3-2 Partial test shocking

The test object shall satisfy the following minimum requirements:

- a) Shocking shapes: 1 pulse in each axis (half-sinus).
- b) Amplitude of acceleration: 15 g.
- c) Duration of shock: 11 ms.

D-4-3-3 Continuous shocking

The test object shall satisfy the following minimum requirements:

- a) Amplitude of acceleration: 10 g.
- b) Duration of shock 16 ms.
- c)
- 1) Number of shocks: $1\,000 \pm 10$.
- 2) Shock frequency: 2/s.

D-5 Climatic stress testing

D-5-1 Temperature tests

Temperature tests shall be carried out according to EN 60068-2-14 as follows:

a) Operating ambient limits: 0 °C, + 65 °C (ambient temperature of the electric safety device in the control panel).

b) Test conditions:

- 1) The printed circuit board shall be in operational position.
- 2) The printed circuit board shall be supplied with normally rated voltage.
- 3) The electric safety device shall operate during and after the test. If the printed circuit board includes components other than fail safe circuits, they also shall operate during the test (their failure is not considered).
- 4) Tests will be carried out for minimum and maximum temperature (0 °C, + 65 °C). tests will last a minimum of 4 h.
- 5) If the printed circuit board is to be used to operate within wider temperature limits, it shall be tested for these values.

D-5-2 Humidity tests

Humidity tests are not necessary for fail safe circuits as the pollution degree for escalators/moving walks is supposed to be class 3 according to EN 60664-1:2007, and the relative creeping distances and clearances are specified in this Jordanian standard.

D-6 Functional and safety test of PESSRAE

Functional and safety tests for PESSRAE shall be performed according to EN 62061.

Annex E (informative) Design guide-line for safety circuits

E-1 This design guide-line gives recommendations to avoid dangerous situations in the case when information is collected from the safety circuit for control purposes, for remote control, alarm control, etc.

E-2 Some dangerous situations are recognised coming from the possibility of bridging one or several electric safety devices by short circuiting or by local interruption of common lead (earth) combined with one or several other failures. It is good practice to follow the recommendations given below:

- Design the board and circuits with distances in accordance with specifications in clause 3-1 and 3-6 of Table B-1.
- Organise common lead so that the common lead for the control of the escalator/moving walk comes behind the electronic components. Any rupture will cause a non-operation of the control (danger exists that changes in wiring occur during the life of the escalator/moving walk).
- Make always calculations about the "worst case" condition.
- Always use outside (out of element) resistors as protective devices of input elements. internal resistor of the device should not be considered as safe.
- Use only components according to listed specifications.
- Consider backwards voltage coming from electronics. Using galvanically separated circuits can solve the problems in some cases.
- Design electric installations in accordance with HD 60364-5-54 [6].
- The "worst case" calculation cannot be avoided, whatever the design. If modifications or add-ons **E-3** are made after the installation of the escalator/moving walk, the "worst case" calculation, involving new and existing equipment, must be carried out again.

E-4 Some failure exclusions can be accepted, according to Table B-1.

E-5 Failures outside the environment of the escalator/moving walk need not be taken into consideration.

E-6 "An interruption of the earth from the main supply of the building to the controller collection earth bar (rail) can be excluded, providing the installation is made in accordance with HD 60364-5-54."

Annex F

(Informative)

Examples of possible dynamic torsional tests for steps and pallets

F-1 General

The following examples illustrate practical methods for carrying out dynamic torsional tests as required by clause 5-3-3-3-1-2 and clause 5-3-2-3-2.

F-2 Torsional test 1

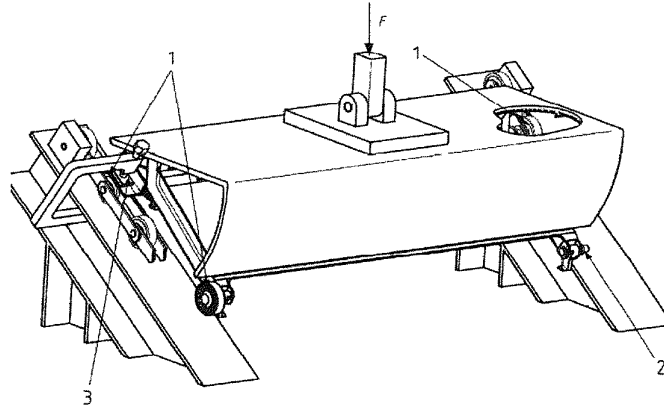
F-2-1 The step/pallet is tested at the maximum inclination (inclined support) for which it is to be applied, together with rollers (not rotating), axles or stub shafts (if existing). It is supported and fixed via the step/pallet chains.

F-2-2 In order to minimize the influence of the rollers on the deformation, all rollers supporting the step are replaced by steel rollers with the same main dimensions. Furthermore the supporting trailer roller is able to move with low friction on the supporting plane to allow also transverse movement.

F-2-3 To avoid the lift off of the step/pallet roller opposite to the unsupported free trailer roller mentioned below, it has a locking clamp parallel to the supporting area with a clearance less than 0,2 mm (see Figure F-1 for test equipment).

F-2-4 In order to enable the torsioning of the step/pallet, one trailer roller is not supported or is left out. In addition the centre of this trailer roller is able to move downward from 0 to - 4 mm, moving in an arc whose centre is the step/pallet chain roller centre. This 4 mm displacement is related to a trailer roller to step/pallet chain roller centre distance of 400 mm. This ratio is also maintained, when the 400 mm dimension is varied.

F-2-5 A dynamic load is applied perpendicular to the tread surface on a steel plate arranged as specified in clause 5-3-3-2-1 and clause 5-3-3-2-3 respectively, in the centre of the tread surface, which leads to the deflection at the unsupported or left out trailer roller.



Key

1: with steel rollers

2: without roller

3: locking clamp parallel to the supporting area

F: dynamic load

Note: The construction of the test equipment does not have to correspond to the drawing. It only serves to illustrate the requirements.

Figure F – 1 – Torsional test for step and pallet (1) – Test equipment

F-3 Torsional test 2

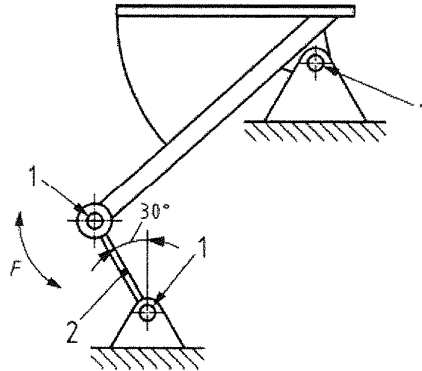
F-3-1 The step/pallet assembly is mounted by its chain axle and by one end of the trailer wheel axle, as shown in Figure F-2, below (no wheels are fitted for this test). The chain axle is supported at the position normally occupied by the step/pallet chain. The step/pallet is free to rotate about, but not to slide along, the chain axle. The 'fixed' end of the trailer wheel axle is held at the journal by a ball-jointed arm, to allow free movement in all directions. The lower end of the arm is ball-jointed to a fixed support.

F-3-2 The 'free' end of the trailer wheel axle is connected by a ball joint to the actuating device. The lower end of the actuating device is ball-jointed to a fixed support so that the 'free' end of the trailer wheel axle is able to move in any direction. The axis of the actuating device is perpendicular to the plane encompassing the axes of both trailer and chain wheel axles.

F-3-3 The restraining and actuating linkages make use of a ball bearing of identical design to the bearing fitted to the trailer wheels. The normal trailer wheel fixings are used, and the prescribed torque values applied, for the test assembly.

F-3-4 The actuating device is applied and released in each direction so as to cause a cyclic linear displacement. The peak displacement is 2 mm, above and below the nominal 'zero' position of the step/pallet (i.e. from the point with the axles chain and trailer wheel axles in the same plane).

This ± 2 mm displacement is related to a trailer roller to step/pallet chain roller centre distance of 400 mm. This ratio is also maintained, when the 400 mm dimension is varied.



Key

1: pivot

2: link (one side of step only)

F: dynamic load

Figure F – 2 – Torsional test for step and pallet (2) – Test principle

Annex G
(Normative)

Safety signs for the user of escalators and moving walks

The design of safety signs shall be in accordance with ISO 3864-1 and ISO 3864-3. The minimum diameter of the signs shall be 80 mm.

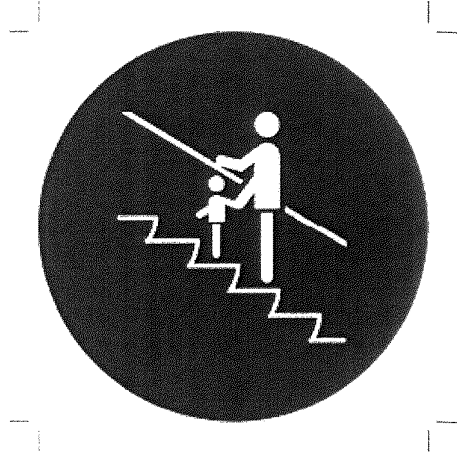


Figure G – 1 – Mandatory action sign "Small children shall be held firmly"



Figure G – 2 – Mandatory action sign "Dogs shall be carried"



Figure G – 3 – Mandatory action sign "Use the handrail"



Figure G – 4 – Prohibition sign "Push chairs not permitted"

Annex H (Informative) Guidelines for selection and planning of escalators and moving walks

H-1 Maximum capacity

For traffic flow planning, the maximum number of persons that can be carried by an escalator or moving walk in 1 h is given in Table H-1:

Table H – 1 – Maximum capacity

Step/pallet width z_1 m	Nominal Speed v m/s		
	0,50	0,65	0,75
0,60	3 600 persons/h	4 400 persons/h	4 900 persons/h
0,80	4 800 persons/h	5 900 persons/h	6 600 persons/h
1,00	6 000 persons/h	7 300 persons/h	8 200 persons/h
Note 1: Use of shopping trolleys and baggage carts (see Annex I) will reduce the capacity by approx. 80%.			
Note 2: For moving walks with a pallet width in excess of 1,00 m the capacity is not increased as users need to hold the handrail, the additional width is to principally enable the use of shopping trolleys and baggage carts.			

H-2 Escalators or moving walks for public transport

For escalators or moving walks which:

- are part of a public transport system including entrance and exit points, or
- are suitable for intensive use, regularly operating for approximately 140 h/week with a load reaching 100 % of the brake load (see clause 5-4-2-1-3-1 and clause 5-4-2-1-3-3) for a total duration of at least 0,5 h during any time interval of 3 h, it is recommended to install auxiliary brakes also for rises h_{13} less than 6 m.

The load conditions and additional safety features should be agreed between the manufacturer and the owner reflecting the traffic levels which exist.

Annex I (Normative)

Requirements on escalators and moving walks intended to transport shopping trolleys and baggage carts

I-1 Escalators

I-1-1 The use of both shopping trolleys and baggage carts on escalators is unsafe and shall not be permitted.

I-1-2 The principle reasons why the use of these products is considered to be unsafe are foreseeable misuse, overloading and width restriction.

I-1-3 Where shopping trolleys and/or baggage carts are available in the area around escalator installations, suitable barriers shall be provided to prevent access.

Note: If safe means of transportation, i.e. shopping trolleys or baggage carts, are available to be used on escalators, than special measures should be defined between the manufacturer of the escalator, the manufacturer of the means of transportation and the customer based on risk assessment in accordance with ISO 14798:2009 [1].

I-1-4 Outline guidance is given as follows:

I-1-5 Shopping trolleys or baggage carts which are chosen for use on an escalator must be specified between the shopping trolley or baggage cart manufacturer and the escalator manufacturer. If non-specified shopping trolleys or baggage carts are available in the escalator area, there is a serious risk of misuse. It is necessary to prevent access to the escalator entrance.

I-1-6 The width of the shopping trolley or baggage cart and its contents should be at least 400 mm less than the nominal step width. Passengers should be able to leave the escalator, even if shopping trolleys or baggage carts are on the escalator.

I-1-7 The escalators should be supplied with a horizontal step run of 1,6 m at both landing areas, minimum transition radii of 2,6 m at the upper landing and 2,0 m at the lower landing, and limiting the rated speed to 0,5 m/s and the inclination to 30°.

I-1-8 Combs should be designed with an angle β of max. 19° combined with a diameter of the shopping trolley or baggage cart roller of at least 120 mm diameter.

I-1-9 Additional stops for emergency situations at handrail level (taking into account clause A-2-2) with a distance between 2,0 m and 3,0 m before the step reaches the comb intersection line should be provided. The stop for emergency situations near the transition curve should be reachable from inside the escalator and the stops for emergency situations at exit(s) shall be reachable from outside of the escalator.

I-1-10 Shopping trolleys or baggage carts should conform to the escalator design:

- The shopping trolley or baggage cart design should ensure a safe and correct loading.
- The maximum weight for a shopping trolley or baggage cart should be 160 kg when loaded.
- Shopping trolley or baggage cart should automatically lock themselves on the inclined part of escalators.
- Shopping trolley or baggage cart should be fitted with a braking or blocking system.

- Shopping trolley or baggage cart should have deflectors (bumpers) to reduce the risk of clamping.
- For safe exit from the escalator, it is necessary that the rear rollers of the shopping trolley or baggage cart are able to push the front rollers over the comb. The front rollers and/or blocking system should easily release from the steps.
- Deflectors and guiding devices should be added to the surrounding area to ensure correct alignment of shopping trolley or baggage cart when entering the escalator.
- Safety signs about safe and correct use of the shopping trolley or baggage cart should be added.

I-2 Moving walks

I-2-1 The use of suitably designed shopping trolleys (according to EN 1929-2 and EN 1929-4) and baggage carts on moving walks is permitted.

I-2-2 Shopping trolleys or baggage carts which are chosen for use on a moving walk shall be specified between the baggage cart manufacturer and the moving walk manufacturer. If non-specified shopping trolleys or baggage carts are available in the moving walk area, there is a serious risk of misuse. It is necessary to prevent access to the moving walk entrance.

I-2-3 The width of the shopping trolley or baggage cart and its contents shall be at least 400 mm less than the nominal pallet/belt width. Passengers shall be able to leave the moving walk, even if shopping trolleys or baggage carts are on the moving walk.

I-2-4 For moving walks with an inclination greater than 6°, the rated speed shall be limited to 0,5 m/s.

I-2-5 Combs shall be designed with an angle β of max. 19° combined with a diameter of the shopping trolley or baggage cart roller of at least 120 mm diameter.

I-2-6 Additional stops for emergency situations at handrail level (taking into account clause A-2-2) with a distance between 2,0 m and 3,0 m before the pallet reaches the comb intersection line shall be provided. The stop for emergency situations near the transition curve shall be reachable from inside the moving walk and the stops for emergency situations at exit(s) shall be reachable from outside of the moving walk.

I-2-7 Shopping trolleys or baggage carts shall conform to the moving walk design:

- The shopping trolley or baggage cart design shall ensure a safe and correct loading.
- The maximum weight for a shopping trolley or baggage cart shall be 160 kg when loaded.
- Shopping trolley or baggage cart shall automatically lock themselves on the inclined part of moving walks.
- Shopping trolley or baggage cart shall be fitted with a braking or blocking system.
- Shopping trolley or baggage cart shall have deflectors (bumpers) to reduce the risk of clamping.
- For safe exit from the moving walk, it is necessary that the rear rollers of the shopping trolley or baggage cart are able to push the front rollers over the comb. The front rollers and/or blocking system shall easily release from the pallet.
- Deflectors and guiding devices shall be added to the surrounding area to ensure correct alignment of shopping trolley or baggage cart when entering the moving walk.
- Safety signs about safe and correct use of the shopping trolley or baggage cart should be added.

Annex J **(Informative)**

Determination of anti-slip properties of the tread surfaces of steps and pallets, of comb plates and cover plate

J-1 Introduction

J-1-1 The generally held requirement for anti-slip designs of tread surfaces for steps and pallets and of comb plates and cover plates formerly in EN 115:1995 needs to be made more precise for safe use in practice.

J-1-2 Procedures for determining and assessing the anti-slip properties of coverings have not been standardised before either internationally or on a European level.

J-1-3 However, in the Federal Republic of Germany, there have been tried and tested procedures for determining the anti-slip properties of floor coverings for many years - DIN 51130:2004 [7] or Employers' Liability Insurance Association rules for health and safety at work: BGR 181:Oct. 2003 [8].

J-1-4 The manufacturers of escalators and moving walks working together in the CEN/TC 10/WG 2 have checked this suitability procedure to see whether it can be applied to the corresponding components for escalators and moving walks. The results obtained show that the DIN 51130:2004 procedure for determining the anti-slip properties of step and pallet coverings and comb plates and cover plates is suitable.

J-1-5 The decision on the DIN 51130:2004 procedure does not exclude other, at least just as safe solutions, which could have been set out too in the technical rules of other member states of the European Union or other states contracted to the Agreement on the European Economic Area.

J-1-6 Test certificates from test centres that are registered in other member states of the European Union or in other states contracted to the Agreement on the European Economic Area are taken into consideration in the same way as DIN 51130:2004 test certificates if the tests, test procedures and construction requirements on which the test certificates of these centres are based are equivalent to the DIN 51130:2004 ones. These centres are mainly those that meet the requirements set out in EN ISO/IEC 17025 [9] or EN 45011 [10].

J-1-7 Test certificates issued under this Jordanian Standard contain the results of the DIN 51130:2004 test and the resulting assessment in accordance with clause J-2.

J-2 Testing and assessing anti-slip properties

J-2-1 The procedure for testing anti-slip properties is governed by DIN 51130:2004.

J-2-2 Your attention is drawn to the fact that the intermediary medium of oil in the DIN 51130:2004 test procedure is not used to give the test a particularly adverse operating condition. The use of a specific, defined oil is used as a constant test parameter with which, as has been proved, better differentiation of the test results is achieved.

Note: This procedure is based on the people carrying out the test treading on the covering to be tested on an inclined plane. It is used as an aid to deciding whether the respective covering is suitable for use on escalators and moving walks.

J-2-3 The average inclination angle determined from a range of measurements is critical for classifying the covering in one of five assessment groups. The assessment group is used as a benchmark for the level of anti-slip properties where coverings in assessment group R 9 meet the lowest anti-slip requirements and those in assessment group R 13 the highest. The allocation of assessment groups to the angle ranges is shown in Table J-1.

Table J –1 – Allocating the overall average values of the inclination angles to the anti-slip assessment groups

Overall average value	Assessment group
from 6° to 10°	R 9
over 10° to 19°	R 10
over 19° to 27°	R 11
over 27° to 35°	R 12
greater than 35°	R 13

J-2-4 The assessment of the anti-slip properties of coverings with surface profiles arranged in a specific direction, e.g. a step covering with lengthwise grooves or cover plates with transverse grooves, shall be based on average values that take into consideration the place the coverings are laid and the direction the users walk on them.

J-2-5 Coverings that meet at least assessment group R 9 are considered anti-slip for indoor installations and at least assessment group R 10 for outdoor installations.

Note: If, at the landings of escalators and moving walks and their allocated floors, there are different assessment groups, it should be taken care that neighbouring floors shall only differ by one in their assessment groups.

J-2-6 The part of the test related to the area below the surface of cleated profiles is not used to assess the anti-slip properties of coverings on escalators and moving walks.

Annex K (Informative) **Determination of sliding properties of footwear on balustrade skirting**

K-1 Introduction

K-1-1 On escalators there is the danger of being entrapped between the moving step band and the stationary balustrade skirting. To reduce the risk several requirements are defined in clause 5-5-3-4. One of these is that suitable measures must be taken to reduce the sliding friction of skirting panels. This general requirement must be made more specific for safe use in practice.

K-1-2 Procedures for determining and assessing the sliding properties of coverings have not been standardised before either internationally or on a European level.

K-1-3 But there is a draft German standard, DIN 51131:2006 [11], that is to be submitted to the CEN as the German proposal for a European Standard. This draft standard sets out parameters for measuring the kinetic friction coefficients μ on surfaces that are normally trodden on with footwear. Using this procedure the conditions to be taken into consideration on escalators can largely be reproduced.

K-1-4 The manufacturers of escalators and moving walks working together on the CEN/TC 10/WG 2 have checked this suitability procedure to see whether it can be applied. The results obtained show that the procedure as per DIN 51131:2006 for determining the sliding properties of balustrade skirting is suitable. In addition an upper limit for the kinetic friction coefficient μ of skirting panels was determined from the test results that, together with the other requirements in this Jordanian standard, sufficiently reduces the risk of being entrapped.

K-1-5 The decision on the DIN 51131:2006 procedure does not exclude other, at least just as safe solutions, which could also have been set out in technical rules of other member states of the European Union or other states contracted to the Agreement on the European Economic Area.

K-1-6 Test certificates from test centres that are registered in other member states of the European Union or in other states contracted to the Agreement on the European Economic Area are taken into consideration in the same way as DIN 51131:2006 test certificates if the tests, test procedures and construction requirements on which the test certificates of these centres are based are equivalent to the DIN 51131:2006 ones. These centres are mainly those that meet the requirements set out in EN ISO/IEC 17025 or EN 45011.

K-1-7 Test certificates issued under this Jordanian Standard contain the results of the DIN 51131:2006 test and the resulting assessment in accordance with clause K-2.

K-2 Testing and assessing sliding properties

K-2-1 The procedure for testing sliding properties is governed by DIN 51131:2006.

K-2-2 In order to reproduce conditions on escalators as realistic as possible, unlike with DIN 51131:2006, tests on all three slider materials (leather, PVC and rubber) shall be carried out under dry conditions and also under wet conditions for leather on the skirting panels to be tested. For each slider material and skirting panel used the average of the kinetic friction coefficient μ is calculated from the third to the fifth individual measurements.

K-2-3 The average of the kinetic friction coefficient μ shall be $< 0,45$ for all test combinations so that the requirement for a reduced sliding friction on the skirting panel is met.

Bibliography

- [1] ISO 14798:2009, Lifts (elevators), escalators and moving walks — Risk assessment and reduction methodology.
- [2] EN ISO 14121-1, Safety of machinery — Risk assessment — Part 1: Principles (ISO 14121-1:2007).
- [3] HD 516 S2/A1, Guide to use of low voltage harmonized cables. Amendment A1.
- [4] Convention on Road Signs and Signals (Vienna, 8.11.1968).
- [5] EN 60204 series of standards, Safety of machinery — Electrical equipment of machines (IEC 60204 series of standards).
- [6] HD 60364-5-54, Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective bonding conductors (IEC 60364-5-54:2002, modified).
- [7] DIN 51130:2004, Prüfung von Bodenbelägen - Bestimmung der rutschhemmenden Eigenschaft - Arbeitsräume und Arbeitsbereiche mit Rutschgefahr, Begehungsverfahren - Schiefe Ebene (EN: Testing of floor coverings - Determination of the anti-slip properties - Workrooms and fields of activities with slip danger, walking method - Ramp test. FR: Essais des revêtements de sol - Détermination de la résistance au glissement - Pièces et zones de travail exposées aux risques de glissement - Méthode de marche sur plan incliné)
- [8] BGR 181:2003, Fußböden in Arbeitsräumen und Arbeitsbereichen mit Rutschgefahr.
- [9] EN ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005).
- [10] EN 45011, General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996).
- [11] DIN 51131:2006, Prüfung von Bodenbelägen - Bestimmung der rutschhemmenden Eigenschaft - Verfahren zur Messung des Gleitreibungskoeffizienten (EN: Testing of floor coverings - Determination of the anti-slip property - Measurement of sliding friction coefficient. FR: Essais des revêtements de sol - Détermination de la résistance au glissement - Mesurage du coefficient de la friction de glissement)

Annex NA
(Informative)
National editorial modifications

Table NA-1 in this annex illustrates the editorial deviations from European Standard 115-1:2008+A1:2010 "Safety of escalators and moving walks, Part 1: Construction and installation".

Single vertical dotted bars (:) in the margins are used to indicate the applicable editorial modifications of the European Standard which have been changed.

Editorial deviations are cross-referenced to the clause of the European Standard together with reasons for these deviations.

Table NA . 1 . List of national editorial modifications

No.	Clause	Modification	Explanation
1	1	Replace "this international standard" by "this Jordanian Standard".	Applying the Jordanian Directive 21-1/2009, Regional or national adoption of International standards and other International deliverables, part1: adoption of international Standards
2	3-1-5, 3-1-13, 5-3-3-2-1, 5-3-3-2-3, 5-5-2-4, 5-8-4, 5-12-2-1-1 7-3-2, Annex E	Dividing the clause into subclauses	Applying the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian standards.

	F-2, F-3 J-1, J-2 K-1		
3	5-12-1-1-4	Deletion the footnote ¹⁾ , for containing languages other than English	Applying the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian standards.
4	Table B-1	Replacing the key at the end of the table with ^{a)} , ^{b)} , ^{c)} , ^{d)} and ^{e)}	Applying the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian standards.
5	Annex ZA, Annex L	Deletion these two Annexes	Applying the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian standards.
6		Add the word "clause" before any referenced clause number.	Applying the Jordanian Directive 1-2/2005, part 2: Rules for the structure and drafting of Jordanian standards.