
**Lifts (elevators), escalators and
moving walks — Programmable
electronic systems in safety related
applications —**

Part 2:

Escalators and moving walks (PESSRAE)

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*Ascenseurs, escaliers mécaniques et trottoirs roulants — Systèmes
électroniques programmables dans les applications liées à la sécurité —*

Partie 2: Escaliers mécaniques et trottoirs roulants

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

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The committee responsible for this document is ISO/TC 178, *Lifts, escalators and moving walks*.

ISO 22201 consists of the following parts, under the general title *Lifts (elevators), escalators and moving walks — Programmable electronic systems in safety-related applications*:

- Part 2: *Escalators and moving walks (PESSRAE)*
- Part 3: *Life cycle guideline for Programmable Electronic Systems related to PESSRAL and PESSRAE* [Technical Report]

When revised, ISO 22201:2009, *Lifts (elevators) — Design and development of programmable electronic systems in safety-related applications for lifts (PESSRAL)*, will become Part 1.

Introduction

Systems comprised of electrical and/or electronic components have been used for many years to perform safety functions in most application sectors. Computer-based systems, generically referred to as programmable electronic systems (PES), are being used in many application sectors to perform non-safety functions and, increasingly, to perform safety functions. If computer system technology is to be effectively and safely exploited, it is essential that those responsible for making decisions have sufficient guidance on the safety aspects on which to make these decisions. In most situations, safety is achieved by a number of protective systems that rely on many technologies (for example mechanical, hydraulic, pneumatic, electrical, electronic, programmable electronic). Any safety strategy must therefore consider not only all the elements within an individual system (for example sensors, controlling devices and actuators) but also all the safety-related sub-systems making up the total combination of safety-related systems.

This International Standard is based upon the guidelines provided in the generic International Electro-technical Commission (IEC) Standard IEC 62061 and Comité Européen de Normalisation (CEN) Standard EN 115-1:2008.

The requirements given in this International Standard recognize the fact that the product family covers a total range of passenger and goods/passenger escalators and moving walks used in residential buildings, offices, hospitals, hotels, industrial plants, etc. This International Standard is the product family standard for escalators and moving walks and takes precedence over all aspects of the generic standard.

This International Standard sets out the product specific requirements for systems comprised of programmable electronic components and programmable electronic systems (PES) that are used to perform safety functions in escalators and moving walks. This International Standard has been developed in order that consistent technical and performance requirements and rational be specified for Programmable Electronic System in Safety-Related Application for Escalators and moving walks (PESSRAE).

Risk analysis, terminology, and technical solutions have been considered taking into account the methods of the IEC 61508 series of standards. The risk analysis of each safety function specified in [Table 1](#) resulted in the classification of electric safety functions applied to PESSRAE. [Tables 1](#) and [2](#) give the safety integrity level and functional requirements, respectively, for each electric safety function.

The safety integrity levels (SIL) specified in this International Standard may also be applied to other technologies used to satisfy the safety functions specified in this International Standard.

Harmonization with national escalator and moving walk norms:

Application of this International Standard:

The application of this International Standard is intended to be by reference within a national escalator and moving walk norm such as escalator and moving walk codes, standards, or laws. There are three reasons for this.

- To allow selective reference by national norms to specific escalator and moving walk safety functions described in this International Standard. Not all escalator and moving walk safety functions identified in this International Standard are called out in every national norm.
- To allow for future harmonization of national norms with escalator and moving walk safety functions identified in this International Standard. Because there exist some differences in the requirements for fulfilment of the safety objective of national escalator and moving walk norms and in national practice of escalator and moving walk use and maintenance, there are instances where the requirements for escalator and moving walk safety functions described in this International Standard are based on the consensus work and agreement by the ISO committee responsible for this International Standard. National bodies may choose to selectively harmonize with those escalator and moving walk safety functions that differ in the requirements called for by the existing national norm in future norm revisions.
- To allow for the application of this International Standard where escalator and moving walk safety functions are new or deviate from those specified in this International Standard. More and more,

national escalator and moving walk legislations are moving to performance based requirements. For this reason the development of new or different escalator and moving walk safety functions can be foreseen in product specific applications. For those who require escalator and moving walk safety functions that are new or different from those specified in this International Standard, this International Standard provides a verifiable method to establish the necessary level of safety integrity for those functions.

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Lifts (elevators), escalators and moving walks — Programmable electronic systems in safety related applications —

Part 2: Escalators and moving walks (PESSRAE)

1 Scope

1.1 This International Standard is applicable to the product family of escalators and moving walks used in residential buildings, offices, hospitals, hotels, industrial plants, etc. This International Standard covers those aspects that need to be addressed when programmable electronic systems are used to carry out electric safety functions for escalators and moving walks (PESSRAE). This International Standard is applicable for escalator and moving walk safety functions that are identified in escalator and moving walk codes, standards, or laws that reference this International Standard for PESSRAE application. The safety integrity levels (SILs) specified in this International Standard are understood to be valid for PESSRAE application in the context of the referenced escalator and moving walk codes, standards, and laws in [Annex B](#).

1.2 This International Standard is also applicable for the application of PESSRAE that are new or deviate from those described in this International Standard.

1.3 The requirements of this International Standard regarding electrical safety/protective devices are such that the possibility of a failure of an electric safety/protective device complying with all the requirements of the standard needs not to be taken into consideration.

In particular, this International Standard:

- a) uses safety integrity levels (SIL) for specifying the target failure rate for the safety functions to be implemented by the PESSRAE;
- b) specifies the requirements for achieving safety integrity for a function but does not specify who is responsible for implementing and maintaining the requirements (for example, designers, suppliers, owner/operating company, contractor); this responsibility is assigned to different parties according to safety planning and national regulations;
- c) applies to PES used in escalator and moving walk applications that meet the minimum requirements of a recognized escalator and moving walk standards such as EN 115, ASME A17.1/CSA B44, or escalator and moving walk laws such as The Japan Building Standard Law Enforcement Order For Elevator and Escalator;
- d) defines the relationship between this International Standard and IEC 61508 and defines the relationship between this International Standard and the EMC Standard for Escalators and moving walks on immunity, ISO 22200;
- e) outlines the relationship between escalator and moving walk safety functions and their safe-state conditions;
- f) applies to phases and activities that are specific to design of hardware and software but not those phases and activities which occur post design, for example sourcing and manufacturing;

- g) requires the manufacturer of the PESSRAE to provide instructions that specify what is necessary to maintain the integrity of the PESSRAE (instruction manual) for organization carrying out the assembly, connections, adjustment and maintenance of the escalators and moving walks;
- h) provides requirements relating to the hardware and software safety validation;
- i) establishes the safety integrity levels for specific escalator and moving walk safety functions;
- j) specifies techniques/measures required for achieving the specified safety integrity levels;
- k) defines a maximum level of performance (SIL 3) which can be achieved for a PESSRAE according to this International Standard and defines a minimum level of performance (SIL 1).

1.4 This International Standard does not cover:

- a) hazards arising from the PES equipment itself such as electric shock etc.;
- b) the concept of fail-safe that may be of value when the failure modes are well defined and the level of complexity is relatively low. The concept of fail-safe was considered inappropriate because of the full range of complexity of PESSRAE that are within the scope of this International Standard;
- c) other relevant requirements necessary for the complete application of a PESSRAE in a escalator and moving walk safety function such as system integration specifications, temperature and humidity, the mechanical construction, mounting and labelling of switches, actuators, or sensors that contain PESSRAE. These requirements are to be carried out in accordance with the national escalator and moving walk norm that references this International Standard.

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2 Conformance

To conform to this International Standard, it shall be shown that each of the requirements outlined in [Clause 6](#) has been satisfied to the defined criteria and therefore the clause objective(s) has(have) been met.

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3 Normative references

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

IEC 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General Requirements*

IEC 61508-2, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable/electronic safety-related systems*

IEC 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements*

IEC 61508-4, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 4: Definitions and abbreviations*

IEC 61508-5, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 5: Example of methods for the determination of Safety Integrity Levels*

ISO 22200, *Electromagnetic compatibility — Product family standard for lifts, escalators and moving walks — Immunity*

IEC 61249-2-1, *Materials for printed boards and other interconnecting structures - Part 2-1: Reinforced base materials, clad and unclad - Phenolic cellulose paper reinforced laminated sheets, economic grade, copper clad*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61508-4 apply, except that the definitions in this International Standard take precedence over those in the generic standard.

4.1

manually operated stopping device

stopping device which is intentionally, by human intervention, actuated and de-actuated

EXAMPLE toggle switch, mushroom type, hand operated switches

4.2

non-manually operated stopping device

stopping device which is automatically actuated or de-actuated due to human intervention or detection

4.3

non-SIL relevant safe-state requirement

required response to the actuation of a SIL rated safety function where the function performing this response is not required to be SIL rated

Note 1 to entry: See [Figure 4](#) and [Table 2](#).

4.4

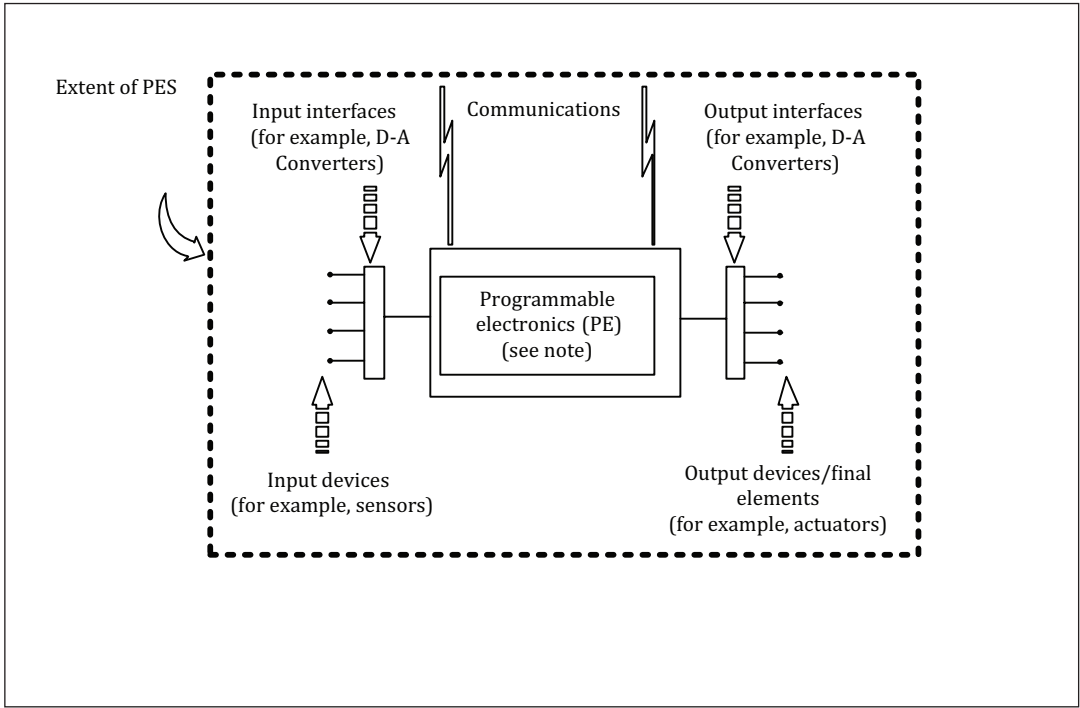
programmable electronic system

PES

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

Note 1 to entry: See [Figure 1](#).

Note 2 to entry: A PES may perform functions that fulfil requirements for SIL rated and non-SIL rated function(s). The SIL rating of a function is only required to consider that portion of PES that perform the SIL relevant functional requirements.



IEC 32 45/02

NOTE The programmable electronics are shown centrally located but could exist at several places in the PES.

Figure 1 — Basic PES structure

4.5 Programmable Electronic Systems in Safety-Related Applications for Escalators and moving walks PESSRAE

application of a software-based PES in a safety-related system for escalators and moving walks

4.6 proof test
periodic test performed to detect failures in a safety-related system

Note 1 to entry: For example, where separate channels are used; these tests are done for each channel separately.

4.7 safety circuit
total combination of safety devices that fulfil all or a group of escalator and moving walk safety functions

Note 1 to entry: See [Figure 2](#).

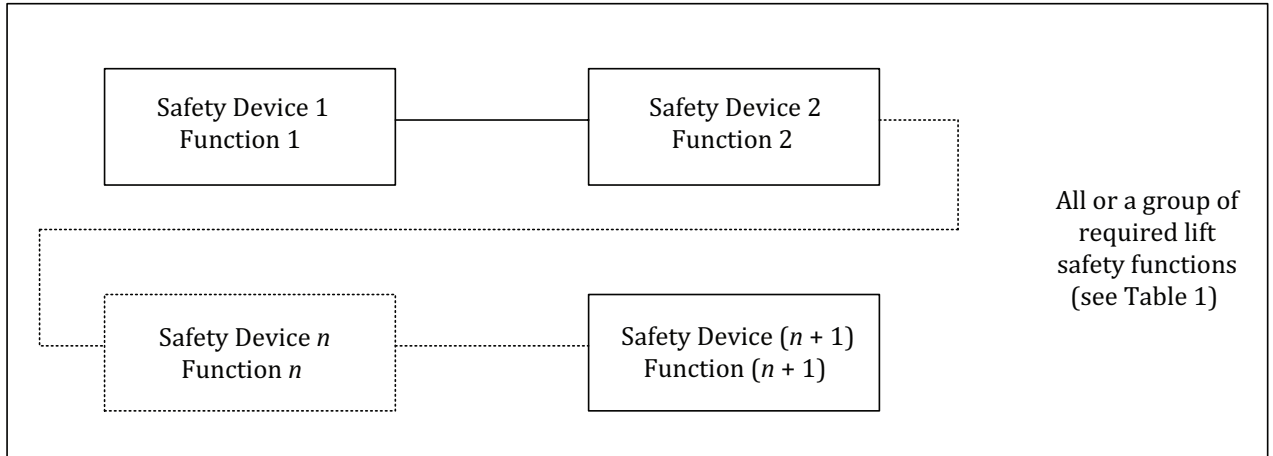


Figure 2 — Safety chain

4.8 safety device

part of the safety-related system, including necessary control circuits, that has been designated to achieve, in its own right, an escalator and moving walk safety function and may consist of PES elements and non-PES elements

Note 1 to entry: See [Figure 3](#) and [Table 1](#).



Figure 3 — Safety Device

4.9 safety function

function to be implemented by a safety-related system, which is intended to achieve or maintain a safe-state of the escalator and moving walk, with respect to a specific hazardous event

Note 1 to entry: See [Table 1](#).

Note 2 to entry: A safety function may include non-SIL relevant requirements, see [Table 2](#).

4.10 safety-related system

consists of one or more safety devices performing one or more safety functions that may be based on programmable electronic systems (PES), electrical, electronic and/or mechanical elements of the escalator and moving walk

Note 1 to entry: The term includes all the hardware, software and supporting services (for example, power supplies) necessary to carry out the specified safety function (sensors, other input devices, final elements (actuators) and other output devices are therefore included in the safety-related system).

4.11
safety integrity level
SIL

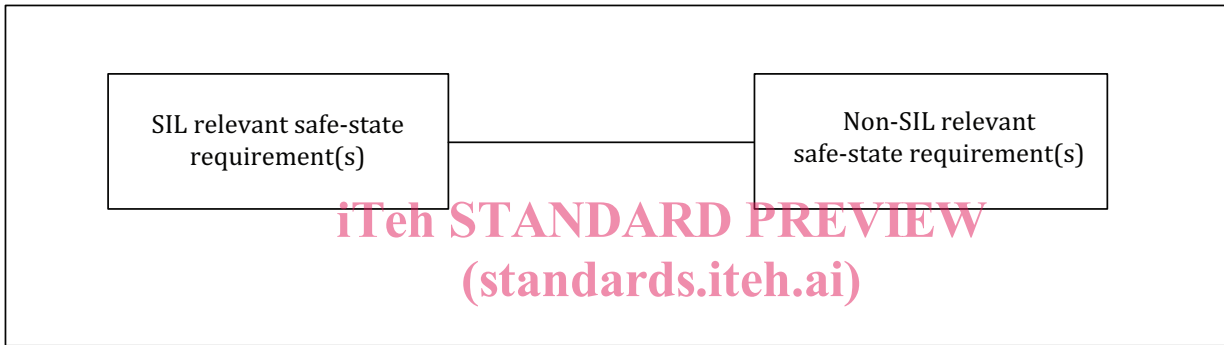
discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the programmable electronic safety-related system, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest. The SIL is indicative of a failure rate that includes all causes of failures (both random hardware failures and systematic failures), which lead to an unsafe state, for example hardware failures, software induced failures and failures due to electrical interference

Note 1 to entry: In the context of this International Standard, SIL 3 is the highest safety integrity level that is applied to escalators and moving walks.

4.12
SIL Relevant Safe-State Requirement

part of the safety-related system where the specified SIL of the function is required to be met

Note 1 to entry: See [Figure 4](#) and [Table 2](#).



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Figure 4 — Escalator and moving walk safety function

4.13
system reaction time

sum of the following two values:

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

5 Symbols and abbreviated terms

PCB Printed Circuit Board

6 Requirements

6.1 General

6.1.1 [Table 1](#) defines the safety function names, the associated escalator and moving walk functional description, applicable escalator and moving walk type and required SIL for the SIL relevant part of the safety function.

NOTE Safety functions refer to those escalator and moving walk functions that are identified in codes, standards and laws that reference this International Standard for PESSRAE application. (See B.1).