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Electrical requirements for lifts, escalators and moving walks —

Part 2: Electromagnetic compatibility with regard to immunity

Exigences électriques pour ascenseurs, escaliers mécaniques et trottoirs roulants —

Partie 2: Compatibilité électromagnétique en ce qui concerne l'immunité

Reference number
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 (see 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 (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 178, *Lifts, escalators and moving walks*.

This document cancels and replaces ISO 22200:2009.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

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

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

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

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

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

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

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

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

— consumers (in case of machinery intended for use by consumers).

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

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

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

This document is based on European Standard EN 12016:2013.

The requirements of this document have been specified so as to ensure a level of electromagnetic immunity which will allow minimal disturbance to the product family.

Two levels of immunity are given which have been selected such that the immunity levels for safety circuit apparatus are higher than the immunity levels for general function apparatus. The higher levels cover the possibility for example of disturbances emanating from hand-held transmitters in close proximity to safety circuit apparatus.

However, neither level covers cases where an extremely low probability of occurrence exists.

Test levels and immunity performance criteria are defined for:

— apparatus which are safety components or are used in conjunction with safety components, (safety circuits);

— apparatus used in general function circuits.

The immunity levels given are on the basis that equipment of the product family range is installed both indoor and outdoor in all types of building and, generally, is connected to a low voltage system.

Due to the size of an installed lift, it becomes impracticable to test the total assembly either in a test laboratory or in situ where the uncontrolled environment can also influence the test procedures and results. This applies also to measurements within the car. Similar considerations regarding dimensions apply equally to the testing of escalators and moving walks.

The following explains the rationale to the revisions of this document.

— New performance criterion C has been specified for voltage dip and voltage interruption.

— Because of extension of operating frequencies in the digital mobile telephone services and wireless communication systems, new requirements have been added on radio frequency electromagnetic field to cover up to 2 655 MHz.

— For the evaluation of test results regarding the radio equipment as defined by national regulations used in apparatus/assembly of apparatus, the exclusion band defined by the standards applies for that specific radio equipment.

— In addition, the uncontrolled operation of radio transmitter used in combined apparatus/assembly of apparatus is not allowed.

The related EMC product family standard for emission is ISO 8102-1.

Electrical requirements for lifts, escalators and moving walks —

Part 2:
Electromagnetic compatibility with regard to immunity

1 Scope

This document specifies the immunity performance criteria and test levels for apparatus used in lifts, escalators and moving walks which are intended to be permanently installed in buildings including the basic safety requirements in regard to their electromagnetic environment. These levels represent essential EMC requirements.

This document refers to EM conditions as existing in residential, office and industrial buildings.

This document addresses commonly known EMC related hazards and hazardous situations relevant to lifts, escalators and moving walks when they are used as intended and under the conditions foreseen by the lift installer or escalator and/or moving walk manufacturer.

It is assumed that no ports connected to safety circuit only are rated at currents greater than 100 amps.

It is assumed that mobile telephones and radio transmitters used at frequencies and power of that stated in Table 1 are not placed within 200 mm distance from safety circuit(s).

However:

— performance criteria and test levels for apparatus/assembly of apparatus used in general function circuits do not cover situations with an extremely low probability of occurrence;

— this document does not apply to other apparatus already proven to be in conformity to the EMC national regulation, and not related to the safety of the lift, escalator or moving walk, such as lighting apparatus, communication apparatus, etc.

This document does not apply to electromagnetic environments such as:

— radio transmitter stations;

— railways and metros;

— heavy industrial plant;

— electricity power stations;

which need additional investigations.

This document is not applicable to apparatus which were manufactured before the date of its publication.

2 Normative references

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

IEC 60050-161:1990+A1:2019, *International Electrotechnical Vocabulary (IEV) — Part 161: Electromagnetic compatibility*

IEC 61000-4-2:2008, *Electromagnetic Compatibility (EMC) — Part 4-2: Testing and measurement techniques; Electrostatic discharge immunity test*

IEC 61000-4-3:2020, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014+A1:2017, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) — Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-6-1:2016, *Electromagnetic compatibility — Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

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

CISPR 32:2015+A1:2019, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement*

CISPR 35:2016, *Electromagnetic compatibility of multimedia equipment - Immunity requirements*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 61000-6-1:2016, IEC 61000-6-2:2016 and the following apply.

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

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

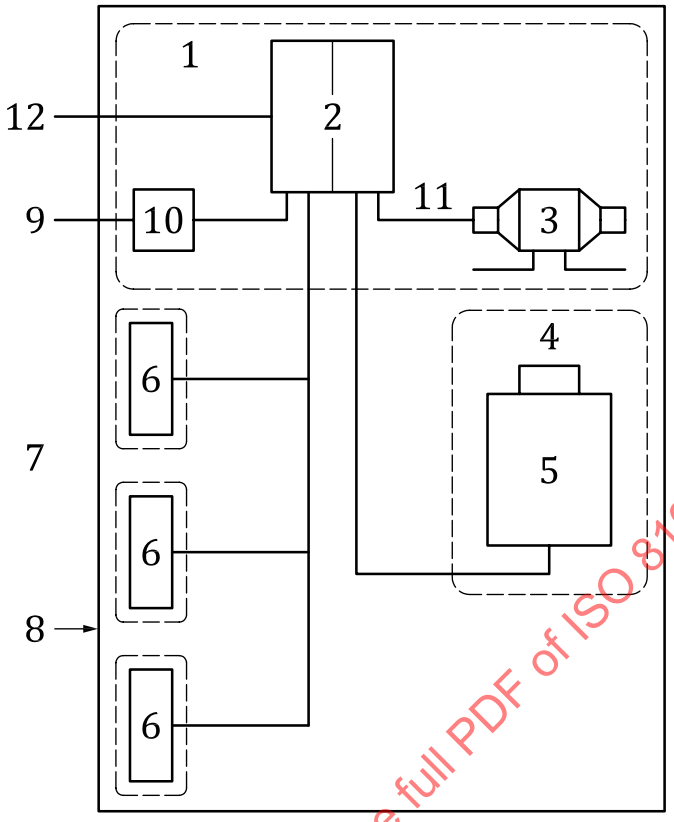
— IEC Electropedia: available at http://www.electropedia.org/

3.1
assembly of apparatus
arrangement of interconnected apparatus, which can be tested together

Note 1 to entry: See Figure 1 and Figure 2 as examples.

3.2
apparatus
assembly of components with an intrinsic function as defined by its manufacturer

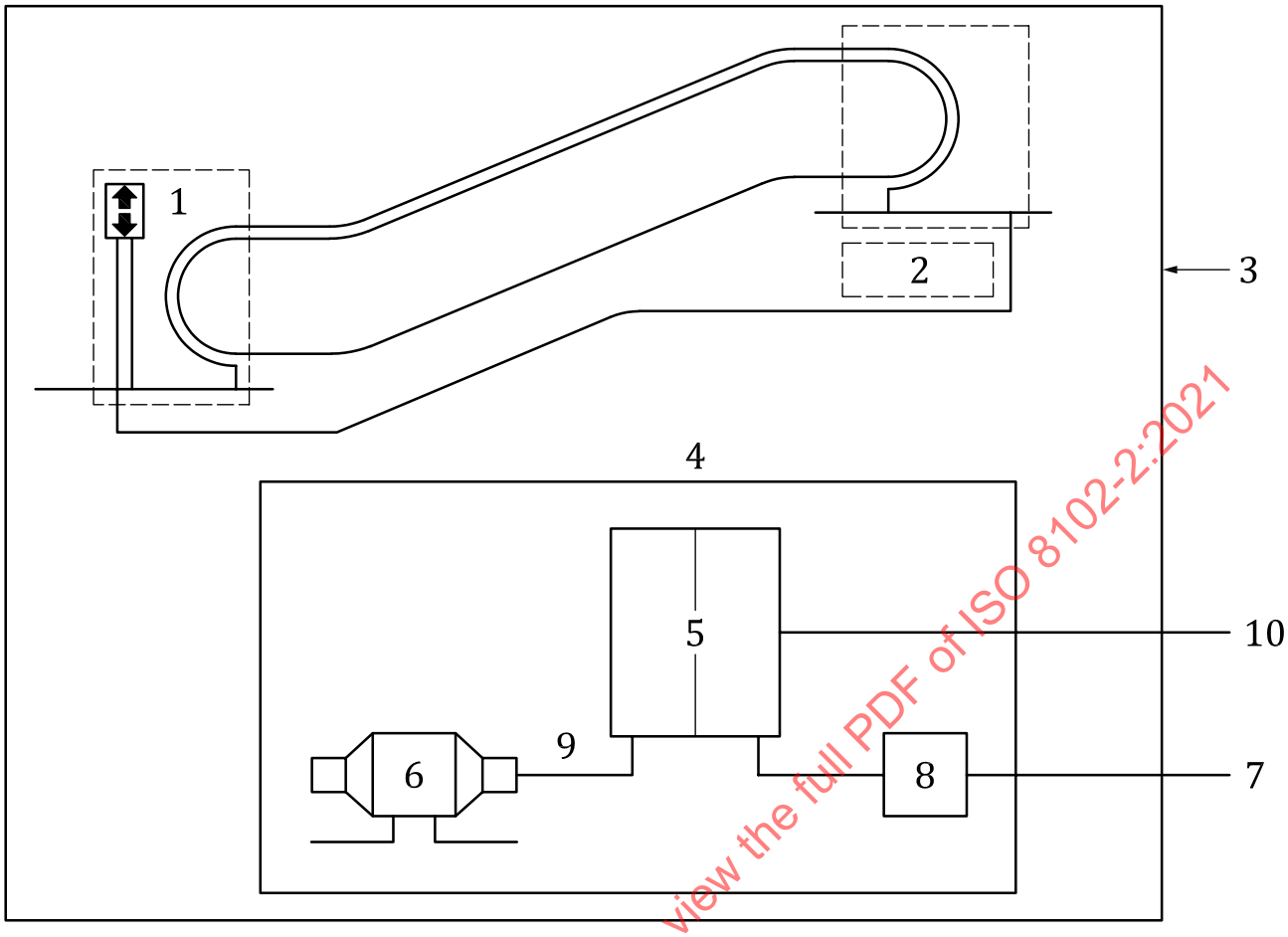
Note 1 to entry: See Figure 1 and Figure 2 as examples.



Key

	assembly of apparatus		
1	machinery space	7	landings
2	main control/ control cabinet	8	system boundary
3	machine	9	AC – and/or DC power ports
4	door control	10	main switch
5	lift car	11	output power port
6	apparatus installed at the landing (e.g. push buttons, indicators)	12	ports for monitoring and remote alarm systems

Figure 1 — EMC example (immunity) for lift systems



Key

⬚	assembly of apparatus		
1	control panels	6	machine
2	machinery space (see 4 to 10)	7	AC – and/or DC power ports
3	system boundary	8	main switch
4	machinery space	9	output power port
5	main control/control cabinet	10	ports for monitoring

NOTE the machinery space can also be an external room.

Figure 2 — EMC example (immunity) for escalator and moving walk systems

3.3
enclosure port
physical boundary of apparatus/assembly of apparatus through which electromagnetic fields can radiate or impinge

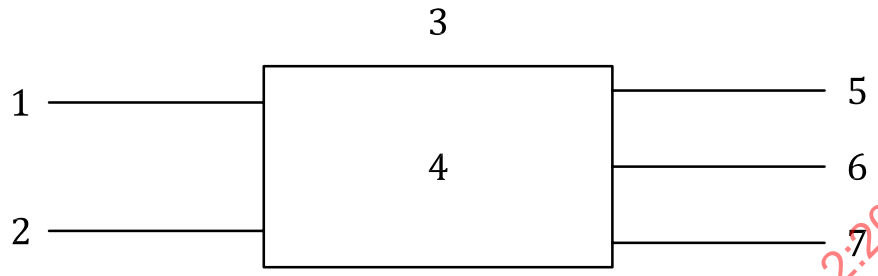
Note 1 to entry: See Figure 3 as example.

3.4
general function circuit
circuitry used in apparatus which does not incorporate safety circuits

Note 1 to entry: See Figure 1 to Figure 3.

3.5
port
particular interface of specified apparatus/assembly of apparatus with the external electromagnetic environment

Note 1 to entry: See Figure 3 as an example.



Key
1 AC power port
2 DC power port
3 enclosure port
4 apparatus/assembly of apparatus
5 ground port
6 signal/control port
7 machine/motor port

Figure 3 — Examples of ports

3.6
system
lift, escalator or moving walk comprising assembly of apparatus with electrical and electronic equipment and interconnections

Note 1 to entry: See Figure 1 and Figure 2 as examples.

4 Test procedure

4.1 The tests shall be carried out as stated in IEC 61000-4-2:2008, IEC 61000-4-3:2020+A2:2010, IEC 61000-4-4:2012, IEC 61000-4-5:2014+A1:2017, IEC 61000-4-6:2013, IEC 61000-4-11:2020, as appropriate (see Table 1 to Table 7).

An attempt shall be made to maximize susceptibility by varying the position of the test sample in the test facility.

4.2 Travelling cables or any other cables likely to be more than 5 m long shall be represented by a sample of at least 5 m long connected to the relevant port for the purpose of testing for susceptibility.

4.3 It is not always possible to measure the immunity levels for every function of the apparatus/assembly of apparatus. In such cases, the most critical period of operation shall be selected.

4.4 The test shall be carried out under a single set of environmental conditions within the specified operating range of temperature, humidity, air pressure and supply voltage, unless otherwise indicated in the standards referred to in 4.1.

4.5 All tests shall be carried out in well-defined and reproducible conditions.

4.6 To facilitate testing, assemblies of apparatus may be tested together. However, where apparatus contain safety circuits, the tests shall prove that the safety circuits comply with the immunity requirements for all circuits and specific requirements for safety circuits.

This does not imply that those parts of the whole assembly, which are general function circuits, need to comply with the safety circuit requirements.

4.7 Tests shall be carried out at the following ports of the apparatus or assembly of apparatus where they exist:

— enclosure port (see Table 1);

— ports for signal and control lines not crossing system boundaries (see Table 2);

— ports for monitoring and remote alarm systems crossing the system boundaries (see Table 3);

— input and output D.C. power ports with current rating ≤100 A (see Table 4);

— input and output D.C. power ports with current rating >100 A (see Table 5);

— input and output A.C. power ports with current rating at ≤100 A per phase (see Table 6);

— input and output A.C. power ports with current rating >100 A per phase (see Table 7).

NOTE Current rating is the current for which the apparatus/assembly of apparatus has been designed for final application.

4.8 The configuration and mode of operation during measurement shall be recorded.

4.9 Test values shall be applied as specified in Table 1 to Table 7, and the performance criteria shall be met as appropriate. The tests shall be carried out individually as single tests and in sequence. CISPR 35:2016 shall be applied to telecommunication ports as defined in CISPR 32:2015+A1:2019.

5 Applicability of tests

5.1 The application of tests for evaluation of immunity depends on the type of apparatus/assembly of apparatus, its configuration, ports, technology and operating conditions.

5.2 It can be determined from consideration of the electrical characteristics and usage of a particular apparatus/assembly of apparatus that some of the tests are inappropriate and therefore unnecessary. In such a case, the decision and justification not to test shall be recorded.

5.3 Where deviations from the test methods specified in 4.1 are applied, such deviations shall be justified and recorded.

6 Evaluation of tests results

6.1 General

The special requirements of the product family make it necessary to define precise criteria for the evaluation of the immunity test results.

The basic safety requirements of the system (lift, escalator or moving walk) are generally specified in local standards. For this reason, a performance criterion derived from the immunity levels of IEC 61000-6-1:2016 is deemed sufficient for most functions. However, for safety circuits, where any malfunction that can produce an unsafe operating mode cannot be tolerated, higher immunity levels derived from IEC 61000-6-2:2016 are stipulated.

If radio equipment is used in combined apparatus/assembly of apparatus, uncontrolled operation of a transmitter during testing is not allowed.

6.2 Performance criteria

A functional description of the apparatus or assembly of apparatus and a definition of performance criteria during, or as a consequence of, testing shall be recorded.

The definition of performance criteria shall be based on:

Performance criterion A: The apparatus/assembly of apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by its manufacturer, when the apparatus or assembly of apparatus is used as intended. In some cases, the performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user can reasonably expect from the apparatus or assembly of apparatus if used as intended

Performance criterion B: The apparatus/assembly of apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by its manufacturer, when the apparatus or assembly of apparatus is used as intended. In some cases, the performance level may be replaced by a permissible loss of performance. However, during the test, degradation of performance is allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user can reasonably expect from the apparatus or assembly of apparatus if used as intended.

Performance criterion C: Temporary loss of function is permitted, provided the function is self-recoverable or can be restored by the operation of the controls.

Performance criterion D: The apparatus/assembly of apparatus and the associated safety component(s) shall continue to operate as intended. No degradation of performance or loss of function is allowed other than a failure into a safe mode.

6.3 Enclosure ports of safety circuits

Where a risk assessment demonstrates that the location of a safety circuit can allow a mobile telephone or emergency services radio transmitter to be placed directly beside or on the device, then the enclosure port of the device shall be implemented so that performance criterion D is satisfied in these conditions.

7 Information for use

The manufacturer of apparatus/assembly of apparatus shall provide documentary information and instructions for installation and use to maintain compliance with this document.

This shall include where applicable:

— instructions for assembly and physical arrangement with other apparatus;

— instructions and precautions for interconnection to other apparatus;

— specifications of interconnection cables and devices;

— instructions for commissioning and testing;

— guidance on avoiding incorrect actions and assembly of apparatus which are known to cause non-compliance with this document.

Table 1 — Immunity - Enclosure port

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Electrostatic discharge[e]	IEC 61000-4-2:2008	kV (charge voltage)	4 Contact 8 Air discharge	6 Contact 15 Air discharge	B	D
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz V/m (rms, unmodulated) % AM (1 kHz)	80 to 166 10 80	80 to 166 10[d] 80	A	D
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz V/m (rms, unmodulated) % AM (1 kHz)	166 to 1 000 10 80	166 to 1 000 30[d] 80	A	D
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz V/m (rms, unmodulated) % AM (1 kHz)	1 429 to 1 516 10 80	1 429 to 1 516 30[d] 80	A	D
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz V/m (rms, unmodulated) % AM (1 kHz)	1 710 to 1 785 10 80	1 710 to 1 785 30[d] 80	A	D
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz V/m (rms, unmodulated) % AM (1 kHz)	1 840 to 2 170 3 80	1 840 to 2 170 10[d] 80	A	D

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] For the relationship between test levels, protection distances and radiated powers of mobile telephones, IEC 61000-4-3:2020.

[d] Field strength may be limited by distance on site, e.g. 200 mm for mobile phones. Therefore, if no RF shielding barrier is used, then a physical barrier shall maintain a distance of 200 mm between the safety circuit and potential sources of perturbation.

[e] If safety circuits are not in a grounded metal box, at least 8 mm of distance between box and circuitry shall be applied to avoid on site damage or other type of insulation shall be used.

[f] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

Table 1 *(continued)*

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Radio frequency electromagnetic field[c, f]	IEC 61000-4-3:2020	MHz	2 300 to 2 655	2 300 to 2 655	A	D
		V/m (rms, unmodulated)	3	10[d]		
		% AM (1 kHz)	80	80		

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] For the relationship between test levels, protection distances and radiated powers of mobile telephones, IEC 61000-4-3:2020.

[d] Field strength may be limited by distance on site, e.g. 200 mm for mobile phones. Therefore, if no RF shielding barrier is used, then a physical barrier shall maintain a distance of 200 mm between the safety circuit and potential sources of perturbation.

[e] If safety circuits are not in a grounded metal box, at least 8 mm of distance between box and circuitry shall be applied to avoid on site damage or other type of insulation shall be used.

[f] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

Table 2 — Immunity - Ports for signal and control lines not crossing installation boundary

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Fast transients common mode	IEC 61000-4-4:2012	kV (peak) T_r/T_h (ns) Rep. frequency (kHz)	±0,5 ±5/50 ±5	±2,0 ±5/50 ±5	B	D
Surge — Line to ground — Line to line	IEC 61000-4-5:2014 +A1:2017	T_r/T_h (µs) kV (peak) kV (peak)	Not relevant [f]	±1,2/50 ±2,0 ±1,0	Not relevant [f]	D
Radio frequency common mode [e]	IEC 61000-4-6:2013	MHz V (rms, unmodulated) % AM (1 kHz)	±0,15 to ±80 ±3 ±80[c, d]	±0,15 to ±80 ±10 ±80[d]	A	D

NOTE T_r is the rise time of the pulse, T_h is the time duration of the pulse, shape of the pulse is defined in the relevant test setup standard.

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] Applicable only to ports interfacing with cables whose total length, according to the manufacturer's functional specification, may exceed 3 m.

[d] The test level can also be defined as the equivalent current into a 150 Ω load.

[e] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

[f] Not required by IEC 61000-6-1:2016 for signal ports

Table 3 — Immunity - Ports for monitoring and remote alarm systems crossing the system boundaries; not applicable to input ports intended for connection to dedicated non-rechargeable power supplies

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Fast transients common mode	IEC 61000-4-4:2012	kV (peak)	±1,0	±2,0	B	D
		T_r/T_h (ns)	±5/50	±5/50		
		Rep. frequency (kHz)	±5[c]	±5		
Surge	IEC 61000-4-5:2014 +A1:2017	T_r/T_h (µs)	±1,2/50	±1,2/50	B	D
— Line to ground		kV (peak)	±1,0	±2,0		
— Line to line		kV (peak)	±0,5	±1,0		
Radio frequency common mode[e]	IEC 61000-4-6:2013	MHz	±0,15 to ±80	±0,15 to ±80	A	D
		V (rms, unmodulated)	±3	±10		
		% AM (1 kHz)	±80[c, d]	±80[d]		

NOTE T_r is the rise time of the pulse, T_h is the time duration of the pulse, shape of the pulse is defined in the relevant test setup standard.

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.

[d] The test level can also be defined as the equivalent current into a 150 Ω load.

[e] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

Table 4 — Immunity - Input and output D.C. power ports with current rating ≤ 100 A; not applicable to input ports intended for connection to dedicated non-rechargeable power supplies

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Fast transients common mode	IEC 61000-4-4:2012	kV (peak)	±0,5	±4,0	B	D
		T_r/T_h (ns)	±5/50	±5/50		
		Rep. frequency (kHz)	±5[d]	±2,5		
Surge	IEC 61000-4-5:2014 +A1:2017	T_r/T_h (µs)	±1,2/50	±1,2/50	B	D
— Line to ground		kV (peak)	±0,5	±2,5		
— Line to line		kV (peak)	±0,5[d]	±1,0		
Radio frequency common mode[e]	IEC 61000-4-6:2013	MHz	±0,15 to ±80	±0,15 to ±80	A	D
		V (rms, unmodulated)	±3	±10		
		% AM (1 kHz)	±80[c]	±80[c]		

NOTE T_r is the rise time of the pulse, T_h is the time duration of the pulse, shape of the pulse is defined in the relevant test setup standard.

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] The test level can also be defined as the equivalent current into a 150 Ω load.

[d] Applicable only to input ports crossing the system boundary.

[e] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

Table 5 — Immunity - Input and output D.C. power ports with current rating >100 A; not applicable to input ports intended for connection to dedicated non-rechargeable power supplies

Environmental phenomena	Test set-up	Units	Test values		Performance criteria	
			All circuits[a]	Safety circuits[b]	All circuits[a]	Safety circuits[b]
Fast transients common mode	IEC 61000-4-4:2012	kV (peak) T_r/T_h (ns) Rep. frequency (kHz)	±1,0 ±5/50 ±5[d]	Not relevant [f]	B	Not relevant [f]
Surge — Line to ground — Line to line	IEC 61000-4-5:2014 +A1:2017	T_r/T_h (µs) kV (peak) kV (peak)	±1,2/50 ±1,0 ±0,5[d]	Not relevant [f]	B	Not relevant [f]
Radio frequency common mode[e]	IEC 61000-4-6:2013	MHz V (rms, unmodulated) % AM (1 kHz)	±0,15 to ±80 ±3 ±80[c]	Not relevant [f]	A	Not relevant [f]

NOTE T_r is the rise time of the pulse, T_h is the time duration of the pulse, shape of the pulse is defined in the relevant test setup standard.

[a] Test values for ports containing general function and/or safety circuits.

[b] Test values for ports containing safety circuits.

[c] The test level can also be defined as the equivalent current into a 150 Ω load.

[d] Applicable only to input ports crossing the system boundary.

[e] If radio equipment is used in apparatus/assembly of apparatus, the exclusion band defined by the relevant standards applies for that specific radio equipment.

[f] The requirement is considered not relevant because safety circuits current rating is less than 100 A.