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INTERNATIONAL STANDARD

colour inside

Safety of machinery – Electrical equipment of machines – Part 32: Requirements for hoisting machines



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF MACHINERY – ELECTRICAL EQUIPMENT OF MACHINES –

Part 32: Requirements for hoisting machines

FOREWORD

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A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60204-32 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects. It is an International Standard.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment to the IEC 60204-1 sixth edition (2016) especially for:
   - requirements for earthing and bonding;
   - requirements for circuit protection;
   - consideration of use of Power Drive Systems;
   - protective bonding requirements and terminology;
   - requirements pertaining to safe torque off for PDS, emergency stop, and control circuit protection;
   - symbols for actuators of control devices;
b) reference for high voltage electrical equipment;
c) cableless control system requirements;
d) EMC requirements;
e) technical documentation requirements;
f) general updating to current special national conditions, normative standards, and bibliographical references.

The text of this International Standard is based on the following documents:

Draft	Report on voting
44/1000/FDIS	44/1005/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The following differing practices of a less permanent nature exist in the countries indicated below:

4.3.1: The voltage characteristics of electricity supplied by public distribution systems in Europe are given in EN 50160:2010.

5.1: Exception is not allowed (USA).

5.1: TN-C systems are not permitted in low-voltage installations in buildings (Norway).

5.2: Terminals for the connection of the protective earthing conductors may be identified by the colour green, the letters “G” or “GR” or “GRD” or “GND”, or the word “ground” or “grounding”, or with the graphical symbol IEC 60417-519:2002-10 or any combination (USA).

5.3.1: Isolation of the neutral conductor is mandatory in TN-systems (Norway).

6.3.3 b),

13.4.5 b),

18.2.1: TT power systems are not allowed (USA).

6.3.3,

18.2,

Annex A: TN systems are not used. TT systems are the national standard (Japan)

6.3.3 b) The use of residual current protective devices with a rated residual operating current not exceeding 1 A is mandatory in TT systems as a means for fault protection by automatic disconnection of supply (Italy).

7.2.3: Disconnection of the neutral conductor is mandatory in a TN-S system (France).

7.2.3: Third paragraph: distribution of a neutral conductor with an IT system is not allowed (USA and Norway).

7.10: For evaluation of short circuit ratings, the requirements of UL 508A Supplement SB may be used (USA).

8.2.2: See IEC 60364-5-54:2011, Annex E List of notes concerning certain countries. Maximum nominal AC control circuit voltage is 120 V (USA).

9.1.2: Only stranded wires are allowed on machines, except for 0,2 mm^2 solid conductors within enclosures (USA).

12.2: The smallest power circuit conductor allowed on machines is 0,82 mm^2 (AWG 18).

Table 5: Cross-sectional area is specified in NFPA 79 using American Wire Gauge (AWG) (USA). See Annex F.

13.2.2: For the protective conductor, the colour identification GREEN (with or without YELLOW stripes) is used as equivalent to the bicolour combination GREEN-AND YELLOW (USA and Canada).

13.2.3: The colour identification WHITE or GREY is used for earthed neutral conductors instead of the colour identification BLUE (USA and Canada).

15.2.2: First paragraph: Maximum value between conductors 150 V (USA).

15.2.2: Second paragraph, fifth bullet: The full load current rating of lighting circuits does not exceed 15 A (USA).

16.4: Nameplate marking requirements (USA).

A.2.2.2: The permissible maximum value of *RA* is regulated (e.g. when U_0 > 300 V, R_A shall be less than 10 Ω, when U_0 < 300 V, R_A shall be less than 100 Ω, U_0 is the nominal AC line to earth voltage in volts (V) (Japan).

A.2.2.2: The maximum permissible value of R_A is 83 Ω (Netherlands).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 60204 provides requirements and recommendations relating to the electrical equipment of hoisting machines so as to promote

– safety of persons and property;

– consistency of control response;

– ease of operation and maintenance.

It is important that high performance is not ~~to be~~ obtained at the expense of the essential factors mentioned above.

Figure 1 and Figure 2 have been provided as an aid to understanding the interrelationship of the various elements of a hoisting machine and its associated equipment. Figure 1 is an overall block diagram of a typical material handling system (a group of cranes working together in a coordinated manner) and Figure 2 is a block diagram of a typical crane and associated equipment showing the various elements of the electrical equipment addressed in this document.

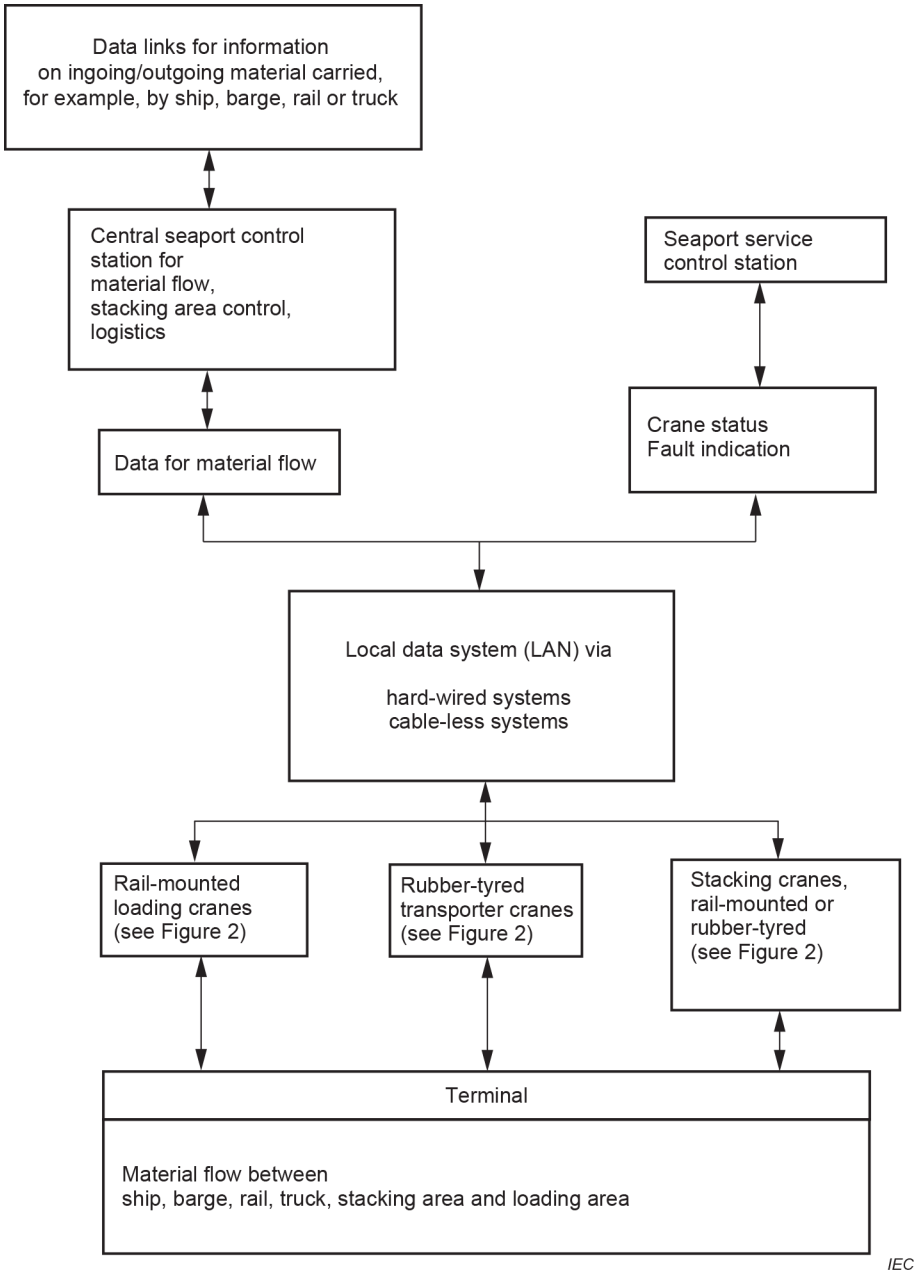


Figure 1 – Block diagram of combined working cranes in a typical material handling system in a seaport

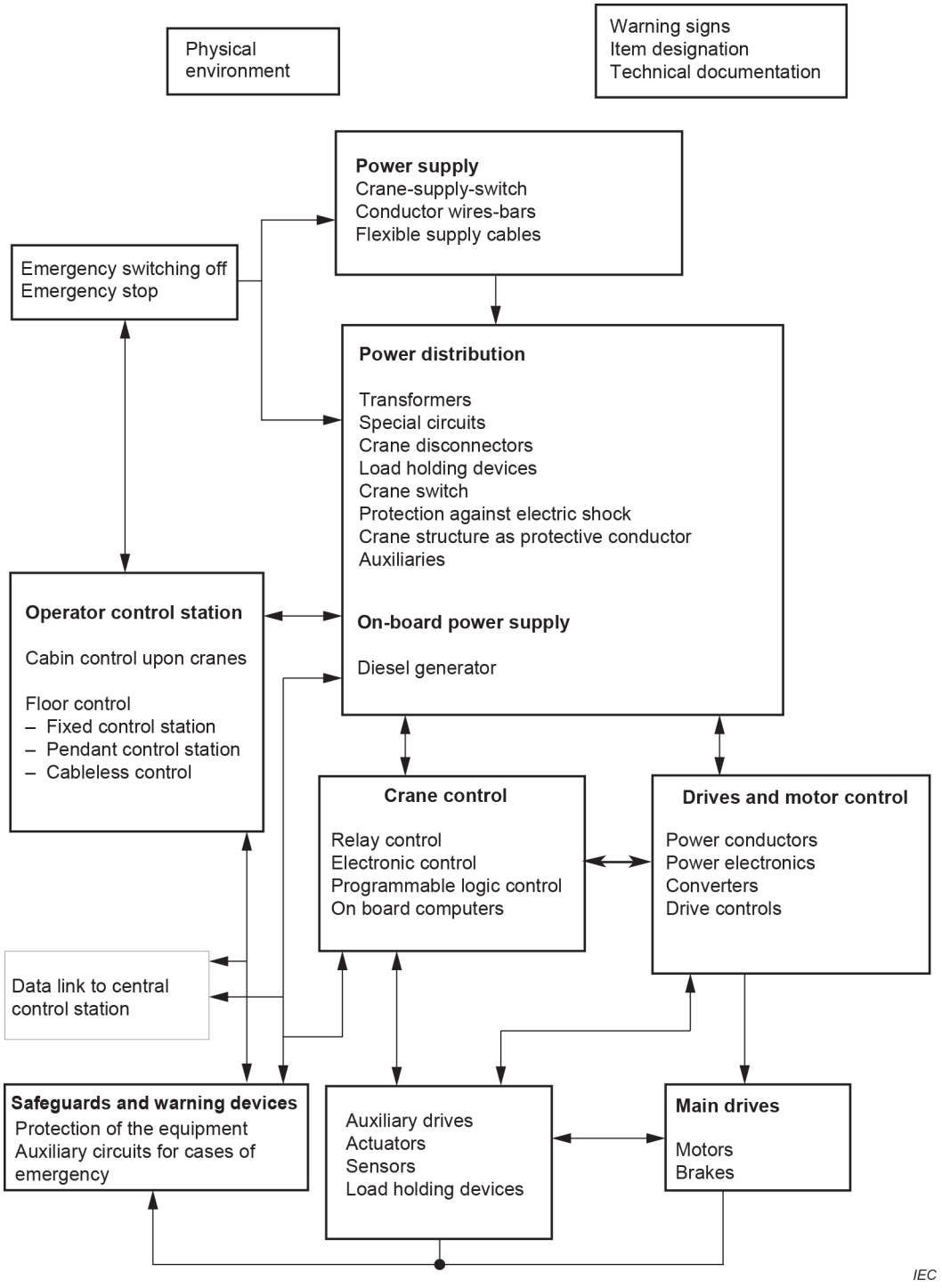


Figure 2 – Block diagram of a typical crane and its associated electrical equipment

SAFETY OF MACHINERY – ELECTRICAL EQUIPMENT OF MACHINES –

Part 32: Requirements for hoisting machines

1 Scope

This part of IEC 60204 applies to ~~the application of~~ electrical ~~and~~, electronic, programmable **1** electronic equipment and systems to hoisting machines and related equipment, including a group of hoisting machines working together in a co-ordinated manner **2**.

NOTE 1 In this document, the term “electrical” includes both electrical and electronic matters (i.e. “electrical equipment” means both the electrical, electronic and programmable electronic equipment).

NOTE 2 In the context of this document, the term “person” refers to any individual and includes those persons who are assigned and instructed by the user or user’s agent(s) in the use and care of the hoisting machine in question.

The equipment covered by this document commences at the point of connection of the supply to the electrical equipment of the hoisting machine (crane-supply-switch) and includes systems for power supply and control feeders situated outside of the hoisting machine, for example, flexible cables or conductor wires or conductor bars (see Figure 3).

NOTE 3 ~~For the requirements for the electrical supply installation in buildings, see IEC 60364.~~ The requirements for the electrical supply installation of electrical equipment of a hoisting machine are given in IEC 60364.

This document is applicable to equipment or parts of equipment not exceeding 1 000 V AC or 1 500 V DC between lines and with nominal frequencies not exceeding 200 Hz.

NOTE 4 ~~For higher voltages, see IEC 60204-11.~~ Special requirements for electrical equipment of hoisting machines intended to be operated at higher voltages can be found in IEC 60204-11. **3**

This document does not cover all the requirements (for example guarding, interlocking, or control) that are needed or required by other standards or regulations in order to protect persons from hazards other than electrical hazards. Each type of hoisting machine has unique requirements to be accommodated to provide adequate safety. This document does not cover noise risks.

Additional and special requirements can apply to the electrical equipment of hoisting machines including those that

~~– are intended for use in open air (i.e., outside buildings or other protective structures);~~

– handle or transport potentially explosive material (e.g. paint or sawdust);

– are intended for use in potentially explosive and/or flammable atmospheres;

– have special risks when transporting or moving certain materials;

– are intended for use in mines.

For the purposes of this document, hoisting machines include cranes of all types, winches of all types and storage and retrieval machines. The following product groups are included:

– overhead travelling cranes;

– mobile cranes;

– tower cranes;

– slewing luffing cranes;

– gantry cranes;

– offshore cranes;
– floating cranes;
– winches of all types;
– hoists and accessories;
– loader cranes;
– cable cranes;
– load holding devices;
– storage and retrieval machines;
– monorail hoists;
– straddle carriers;
– rubber tyred gantry cranes (RTGs).

NOTE 5 A definition of the different crane types can be found in ISO 4306-1.

This document does not cover individual items of electrical equipment other than their selection for use and their erection.

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 60034-1:2017, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-5, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

IEC 60034-11, *Rotating electrical machines – Part 11: Thermal protection*

IEC 60068-2-27:~~1987~~2008, ~~*Basic*~~ *Environmental testing* ~~*procedures*~~ *– Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31:2008, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

~~IEC 60068-2-32:1975, *Basic environmental testing procedures – Part 2-32: Tests – Test Ed: Free fall*~~
~~Amendment 2 (1990)~~

IEC 60072-1, *Rotating electrical machines – Dimensions and output series – Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080*

IEC 60072-2, *Dimensions and output series for rotating electrical machines – Part 2: Frame numbers 355 to 1000 and flange numbers 1180 to 2360*

IEC 60072-3, *Dimensions and output series for rotating electrical machines – Part 3: Small built-in motors – Flange numbers BF10 to BF50*

IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators*

IEC 60309-1, *Plugs, fixed or portable socket-outlets and ~~couplers~~ appliance inlets for industrial purposes – Part 1: General requirements*

~~IEC 60332 (all parts), *Tests on electric and optical fibre cables under fire conditions*~~

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*
IEC 60364-4-41:2005/AMD1:2017

~~IEC 60364-4-42:2001, *Electrical installations of buildings – Part 4-42: Protection for safety – Protection against thermal effects*~~

IEC 60364-4-43:~~2001~~2008, *Low-voltage electrical installations ~~of buildings~~ – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-52:~~2001~~2009, *Low-voltage electrical installations ~~of buildings~~ – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60364-5-53:~~2002~~2019, *Low-voltage electrical installations ~~of buildings~~ – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 60364-5-54:~~2002~~2011, *Low-voltage electrical installations ~~of buildings~~ –Part 5-54: Selection and erection of electrical equipment – Earthing arrangements~~, protective conductors~~ and protective ~~bonding~~ conductors*

IEC 60364-6:~~2006~~2016, *Low-voltage electrical installations – Part 6: Verification*

IEC 60417, *Graphical symbols for use on equipment* (available at https://www.graphical-symbols.info/equipment)

~~IEC 60439-1:1999, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*[1].~~
~~Amendment 1 (2004)~~

IEC 60445:2021, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

~~IEC 60446:1999, *Basic and safety principles for man-machine interface, marking and identification – Identification of conductors by colours or alphanumerics*~~

IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and identification – Actuating principles*

IEC 60529~~:2001~~, *Degrees of protection provided by enclosures (IP Code)*

~~IEC 60617, *Graphical symbols for diagrams*~~

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~~[1] There exists a consolidated edition 4.1 (2004) that includes edition 4 and its amendment.~~

IEC 60664-1~~:2007~~, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60755:2017, *General safety requirements for residual current operated protective devices*

~~IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*~~

IEC 60947-1~~:2007~~, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-2:~~2006~~2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors, and fuse-combination units*

IEC 60947-4-1:~~2000~~2018, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*
~~Amendment 1 (2002)[1]~~

IEC 60947-5-1:~~2003~~2016, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 60947-5-5, *Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function*

IEC 60947-6-2, *Low-voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*

~~IEC 61082-1:2006, *Preparation of documents used in electrotechnology – Part 1: Rules*~~

IEC 61140, *Protection against electric shock – Common aspects for installations and equipment*

~~IEC 61180-2:1994, *High-voltage techniques for low-voltage equipment – Part 2: Test equipment*~~

IEC 61204-7, *Low-voltage switch mode power supplies – Part 7: Safety requirements*

IEC 61310 (all parts), *Safety of machinery – Indication, marking and actuation*

~~IEC 61346 (all parts), *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations*~~

IEC 61439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61557-3, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 3: Loop impedance*

IEC 61557-9:2014, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 9: Equipment for insulation fault detection in IT systems*

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~~[1] There exists a consolidated edition 2.1 (2002) that includes edition 2 and its amendment.~~

IEC 61558-1, *Safety of ~~power transformers, power supplies, reactors and similar products~~ transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-2, *Safety of power transformers, power supplies, reactors and combinations thereof – Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers*

IEC 61558-2-6, *Safety of ~~power transformers, power supply units and similar~~ transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general ~~use~~ applications*

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

IEC 61800-3, *Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods for PDS and machine tools*

IEC 61800-5-1, *Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy*

IEC 61800-5-2~~:2007~~, *Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*

IEC 61984, *Connectors – Safety requirements and tests*

IEC 62023, *Structuring of technical information and documentation*

~~IEC 62027, *Preparation of parts lists*~~

IEC 62061, *Safety of machinery – Functional safety of safety-related ~~electrical, electronic and programmable electronic~~ control systems*

~~IEC 62079, *Preparation of instructions – Structuring, content and presentation*~~

IEC 62745:2017, *Safety of machinery – Requirements for cableless control systems of machinery*

~~ISO 7000:2004, *Graphical symbols for use on equipment – Index and synopsis*~~

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*, available at https://www.iso.org/obp

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

~~ISO 12100-1:*Safety of machinery – Part 1: Basic terminology, methodology*~~

~~ISO 12100-2:2003, *Safety of machinery – Basic concepts, General principles for design – Part 2: Technical principles*~~

ISO 13849-1~~:2006~~, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 13849-2~~:2003~~, *Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

ISO 13850:~~2006~~2015, *Safety of machinery – Emergency stop function – Principles for design*

~~ISO 13851:2002, *Safety of machinery – Two-hand control devices – Functional aspects and design principles*~~

~~ISO 13852:1996, *Safety of machinery – Safety distances to prevent danger zones being reached by the upper limbs*~~

ISO 13857, *Safety of machinery –Safety distances to prevent hazard zones being reached by upper and lower limbs*

3 Terms, definitions and abbreviated terms 4

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
actuator
part of a device to which an external ~~manual~~ action is to be applied

Note 1 to entry: The actuator may take the form of a handle, knob, push-button, roller, plunger, etc.

Note 2 to entry: There are some actuating means that do not require an external actuating force but only an action, for example, touchscreens.

~~NOTE 3 Note the difference between actuator and machine actuator (3.44).~~

Note 3 to entry: See also 3.1.53.

3.1.2
ambient temperature
temperature of the air or other medium where the equipment is to be used

3.1.3
apparatus
finished device or combination thereof made commercially available as a single functional unit, intended for the end user and liable to generate electromagnetic disturbance, or the performance of which is liable to be affected by such disturbance

3.1.4
~~(electrically) protective~~ barrier
part providing protection against ~~direct~~ contact by a human being or livestock with hazardous-live parts from any usual direction of access

~~[IEV 826-12-23]~~

[SOURCE: IEC 60050-195:2021, 195-06-15, modified – The term "protective barrier" has been replaced with "barrier".]

3.1.5
basic drive module
BDM
electronic power converter and related control, connected between an electric supply and a motor

[SOURCE: IEC 61800-2:2021, 3.4]

3.1.6
basic protection
protection against electric shock under fault-free conditions

Note 1 to entry: Previously referred to as “protection against direct contact”

[SOURCE: IEC 60050-195:1998, 195-06-01, modified – The note to entry has been added.]

3.1.7
cabin-controlled hoisting machine
hoisting machine operated from a cabin permanently attached to the hoisting machine

3.1.8
cable tray
cable support consisting of a continuous base with raised edges ~~and~~ but no covering

Note 1 to entry: A cable tray ~~may~~ can be perforated or mesh.

[SOURCE: IEC 60050-826:2022, 826-15-08]

3.1.9
cable trunking system
system of closed enclosures comprising a base with a removable cover intended for the complete surrounding of insulated conductors, cables, cords and/or for the accommodation of other electrical equipment including information technology equipment

[SOURCE: IEC 60050-826:2022, 826-15-04]

3.1.10
concurrent
~~acting in conjunction; used to describe a situation wherein two or more control devices exist in an actuated condition at the same time (but not necessarily synchronously)~~

<two or more control devices> existing in an actuated condition at the same time, but not necessarily synchronously

3.1.11
conductor wire
conductor bar
conductor rail
wire, conductive bar or rail of a feeder system having a sliding current collector

3.1.12
conduit
part of a closed wiring system of generally circular cross-section for insulated conductors and/or cables in electrical or communication installations, allowing them to be drawn in and/or replaced

Note 1 to entry: Conduits should be sufficiently ~~closed~~ close-jointed so that the insulated conductors and/or cables can only be drawn in and not inserted laterally.

[SOURCE: IEC 60050-826:2022, 826-15-03]

3.1.13
control circuit
<of a hoisting machine> circuit used for the control, including monitoring, of a hoisting machine and the electrical equipment

3.1.14
control device
device connected into the control circuit and used for controlling the operation of the hoisting machine (e.g. position sensor, manual control switch, relay, magnetically operated valve, speed sensor)

3.1.15
controlgear
a general term covering switching devices and their combination with associated control, measuring, protective, and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures, and supporting structures, intended in principle for the control of electrical energy consuming equipment

[SOURCE: IEC 60050-441:1984, 441-11-03~~, modified~~]

3.1.16
control station
operator control station
assembly of one or more control actuators fixed on the same panel or located in the same enclosure

Note 1 to entry: A control station may also contain related equipment, for example, potentiometers, signal lamps, instruments, display devices, etc.

Note 2 to entry: A definition of "actuator" is given in 3.1.1.

3.1.17
controlled stop
stopping of a hoisting machine motion with electrical power to the machine actuators maintained during the stopping process

3.1.18
crane
machine for hoisting/lowering and horizontally relocating suspended loads

3.1.19
crane-disconnector
~~hand-operated~~ disconnecting device installed on a hoisting machine for disconnecting (isolating) a supply circuit (e.g. for repair or maintenance work)

3.1.20
crane-supply-switch
disconnecting (isolating) and switching device used to disconnect the hoisting machine from the incoming supply

3.1.21
crane-switch
switching device designed to break the electrical power supply to the connected drives (e.g. for use in cases of emergency stop)

3.1.22
~~(continuous)~~ current-carrying capacity
ampacity (US)
maximum value of electric current which can be carried continuously by a conductor, a device or an apparatus, under specified conditions without its steady-state temperature exceeding a specified value

[SOURCE: IEC 60050-826:2022, 826-11-13]

3.1.23
direct contact
electric contact of ~~persons~~ human beings or ~~animals~~ livestock with live parts

~~[IEV 826-12-03]~~

[SOURCE: IEC 60050-195:2021,195-06-03.]

3.1.24
direct opening action
<contact element> achievement of contact separation as the direct result of a specified movement of the switch actuator through non-resilient members (e.g. not dependent upon springs)

[SOURCE: IEC 60947-5-1:2016, K.2.2]

3.1.25
disconnecting device
device which provides, in the open position, an isolating distance in accordance with specified requirements

3.1.26
duct
enclosed channel designed expressly for holding and protecting electrical conductors, cables, and busbars

Note 1 to entry: Conduits (3.1.12), cable trunking systems (3.1.9) and underfloor channels are types of duct.

3.1.27
earth
local earth
ground (US)
local ground (US)
part of the Earth which is in electric contact with an earth electrode and that has an electric potential not necessarily equal to zero

[SOURCE: IEC 60050-195:2021, 195-01-03, modified – The terms "earth" and "ground" have been added.]

3.1.28
electrical operating area
room or location for electrical equipment to which access is intended to be restricted to skilled or instructed persons, by the opening of a door or the removal of a barrier without the use of a key or tool and which is clearly marked by appropriate warning signs

3.1.29
electronic equipment
part of the electrical equipment containing circuitry dependent for its operation on electronic devices and components

3.1.30
emergency stop device
manually actuated control device used to initiate an emergency stop function

[SOURCE: ISO 13850:2015, 3. 3]

~~NOTE See Annex E.~~

3.1.31
emergency switching-off device
manually actuated control device used to switch off or to initiate the switching off of the supply of electrical energy to all or a part of an installation where a risk of electric shock or another risk of electrical origin is involved

~~NOTE See Annex E.~~

3.1.32
enclosed electrical operating area
room or location for electrical equipment to which access is intended to be restricted to skilled or instructed persons by the ~~opening of~~ use of a key or tool to open a door or ~~the removal of~~ remove a barrier ~~by the use of a key or tool~~, and which is clearly marked by appropriate warning signs

3.1.33
enclosure
part providing protection of equipment against certain external influences and, in any direction, basic protection as protection against direct contact

Note 1 to entry: The definition taken from the existing IEV needs the following explanations within the scope of this document.

a) Enclosures provide protection of persons or livestock against access to hazardous parts.

b) Barriers, shaped openings, or any other means suitable to prevent or limit the penetration of the specified test probes, whether attached to the enclosure or formed by the enclosed equipment, are considered as part of the enclosure, except where they can be removed without the use of a key or tool.

c) An enclosure may be

   – a cabinet or box, either mounted on the hoisting machine or separate from the hoisting machine;

   – a compartment consisting of an enclosed space within the hoisting machine structure (e.g. box girder).

3.1.34
electrical equipment
~~material, fittings, devices, components, appliances, fixtures, apparatus, and the like used as part of, or in connection with, the electrical equipment of hoisting machines~~

items used in connection with the utilisation of electricity by machines or parts of machines, for example material, fittings, devices, components, appliances, fixtures, apparatus, and similar

3.1.35
equipotential bonding
~~provision of electric connections between conductive parts, intended to achieve equipotentiality~~

set of electric connections intended to achieve equipotentiality between conductive parts

[SOURCE: IEC 60050-195:2021, 195-01-10]

3.1.36
exposed conductive part
conductive part of ~~electrical~~ equipment that can be touched and that is not ~~normally~~ live under normal conditions, but that can become live ~~under fault conditions~~ when basic insulation fails

~~[IEV 826-12-10, modified]~~

[SOURCE: IEC 60050-195:2021, 195-06-10]

3.1.37
extraneous conductive part
conductive part not forming part of the electrical installation and ~~liable~~ that is likely to introduce an electric potential, generally the ~~earth~~ electric potential of a local earth

~~[IEV 826-12-11]~~

[SOURCE: IEC 60050-195:2021, 195-06-11]

3.1.38
failure
termination of the ability of an item to perform a required function

Note 1 to entry: After the failure, the item ~~has a~~ is in fault condition.

Note 2 to entry: A failure is an event, as distinguished from a fault, which is a state.

Note 3 to entry: This concept as defined does not apply to items consisting of software only.

Note 4 to entry: In practice the terms “fault” and “failure” are often used synonymously.

~~[IEV 191-04-01]~~

[SOURCE: IEC 60050-845:2020, 845-27-105, modified – A fourth note to entry has been added.]

3.1.39
fault
state of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

Note 1 to entry: A fault is often the result of a failure of the item itself, but may exist without prior failure.

~~NOTE 2 In English, the term “fault” and its definition are identical with those given in IEV 191-05-01. In the field of machinery, the French term “défaut” and the German term “Fehler” are used rather than the terms “panne” and “Fehlzustand” that appear with this definition.~~

3.1.40
fault protection
protection against electric shock under single-fault conditions

Note 1 to entry: Previously referred to as “protection against indirect contact”.

[SOURCE: IEC 60050-195:2021, 195-06-02, modified – A note to entry has been added.]

3.1.41
first environment
environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes

Note 1 to entry: Houses, apartments, commercial premises or offices in a residential building are examples of first environment locations.

3.1.42
fixed installation
particular combination of several types of apparatus and, where applicable, other devices, which are assembled, installed and intended to be used permanently at a predefined location

3.1.43
functional bonding
equipotential bonding necessary for proper functioning of electrical equipment

3.1.44
guard
part of a hoisting machine specifically used to provide protection by means of a physical barrier~~. Depending on its construction, a guard may be called casing, cover, screen, door, enclosing guard, etc.~~

~~[ISO 12100-1, 3.25, modified]~~

3.1.45
hand-held direct-control device
manually operated switching device, the enclosure of which is portable by hand during operation, acting direct on a power circuit without a control circuit

3.1.46
hazard
potential source of~~ physical injury or damage to health~~ harm

Note 1 to entry: The term “hazard” can be qualified in order to define its origin (e.g. mechanical hazard, electrical hazard) or the nature of the potential harm (e.g. electric shock hazard, cutting hazard, toxic hazard, fire hazard).

Note 2 to entry: The hazard envisaged by this definition either

– is permanently present during the intended use of the machine (e.g. motion of hazardous moving elements, electric arc during a welding phase, unhealthy posture, noise emission, high temperature), or
– can appear unexpectedly (e.g. explosion, crushing hazard as a consequence of an unintended/unexpected start-up, ejection as a consequence of a breakage, fall as a consequence of acceleration/deceleration).

[SOURCE ISO 12100:2010, 3.6, modified – Note 3 has been deleted.]

3.1.47
indirect contact
electric contact of~~ persons~~ human beings or~~ animals~~ livestock with exposed conductive parts that have become live under fault conditions

~~[IEV 826-12-04]~~

[SOURCE: IEC 60050-195:2021, 195-06-04]

3.1.48
inductive power supply system
system of inductive power transfer, consisting of a track converter and a track conductor, along which one or more pick-ups and associated pick-up converters can move, without any galvanic or mechanical contact, in order to transfer electrical power, for example, to a mobile hoisting machine

Note 1 to entry: The track conductor and the pick-up are analogous to the primary and secondary of a transformer, respectively.

3.1.49
instructed person
~~(~~electrically~~)~~ instructed person
person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards that electricity can create

~~[IEV 826-18-02]~~

[SOURCE: IEC 60050-195:2021, 195-04-02]

3.1.50
interlock ~~(for safeguarding)~~
~~arrangement that interconnects guard(s) or device(s) with the control system and/or all or part of the electrical supply to the hoisting machine~~

arrangement of devices operating together to

- prevent hazardous situations,
- prevent damage to equipment or material,
- prevent specified operations,
- ensure correct operations

3.1.51
limiting device
device which prevents a hoisting machine or a hoisting machine element from exceeding a designed limit (e.g. space limit, pressure limit, load limit, load moment limit)

~~[ISO 12100-1, 3.26.8]~~

[SOURCE: ISO 12100 3.28.8, modified – In the definition, "machine or hazardous machine condition(s)" has been replaced by "hoisting machine or a hoisting machine element" and "load limit" has been added.]

3.1.52
live part
~~conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention, not a PEN conductor or PEM conductor or PEL conductor~~

~~NOTE This concept does not necessarily imply a risk of electric shock.~~

~~[IEV 826-12-08]~~

conductive part intended to be energized under normal operating conditions, including the neutral conductor and mid-point conductor, but excluding the PEN conductor, PEM conductor and PEL conductor

[SOURCE: IEC 60050-195:2021, 195-02-19]

3.1.53
machine actuator
power mechanism used to effect motion of the hoisting machine (for example, motor, solenoid, pneumatic or hydraulic cylinder)

3.1.54
machinery
machine
assembly of linked parts or components, at least one of which moves, with the appropriate machine actuators, control and power circuits, joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material

Note 1 to entry: The term "machinery" also covers an assembly of machines which, in order to achieve the same ~~end~~ target, are arranged and controlled so that they function as an integral whole

Note 2 to entry: The term "component" is used here in a general sense and does not refer only to electrical components.

~~[ISO 12100-1, 3.1, modified]~~

3.1.55
manually controlled hoisting machine
hoisting machine with continuous ~~direct~~ manual control of the load and with the load continuously visible to the operator

3.1.56
marking
signs or inscriptions primarily for the purpose of identifying equipment, components and/or devices~~, which can include certain features thereof~~

3.1.57
neutral conductor
N
conductor electrically connected to the neutral point and capable of contributing to the distribution of electrical energy

~~[IEV 826-14-07]~~

[SOURCE: IEC 60050-195:2021, 195-02-06]

3.1.58
obstacle
part preventing unintentional direct contact by a human being or livestock with live parts, but not preventing ~~direct~~ such contact by deliberate action

[SOURCE: IEC 60050-195:2021, 195-06-16, modified – The term "protective obstacle, <electrically>" has been replaced with "obstacle".]

3.1.59
overcurrent
electric current ~~exceeding the rated electric current~~ the values of which exceeds a specific limiting value

~~[IEV 826-11-14]~~

[SOURCE: IEC 60050-151:2001, 151-15-28]

3.1.60
overload ~~(of a circuit)~~
time/current relationship in a circuit which is in excess of the rated full load of the circuit when the circuit is not under a fault condition

Note 1 to entry: "Overload" should not be used as a synonym for “overcurrent”.

Note 2 to entry: In hoisting machines the term "overload" is also used for mechanical overload, which may or may not cause an electrical overload.

3.1.61
plug/socket combination
component and suitable mating component, appropriate to terminate conductors, intended for connection or disconnection of two or more conductors

Note 1 to entry: Examples of plug/socket combination include

– connectors which ~~conform to~~ fulfil the requirements of IEC 61984;
– a plug and socket-outlet, a cable coupler, or an appliance coupler in accordance with IEC 60309-1;
– a plug and socket-outlet in accordance with IEC 60884-1 or an appliance coupler in accordance with IEC 60320-1.

3.1.62
power circuit
circuit that supplies power ~~from the supply network~~ to units of equipment used for productive operation and to transformers supplying control circuits

3.1.63
Power Drive System
PDS
system consisting of one or more complete drive module(s) (CDM) and a motor or motors

[SOURCE: IEC 61800-2:2021, 3.52]

3.1.64
PDS of category 1
PDS intended for use in the first environment

3.1.65
PDS of category 2
PDS, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional

Note 1 to entry: A professional is a person or an organization having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

3.1.66
PDS of category 3
PDS intended for use in the second environment and not intended for use in the first environment

3.1.67
PDS of category 4
PDS of rated voltage equal to or above 1 000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

3.1.68
protective bonding
equipotential bonding for protection against electric shock

Note 1 to entry: Measures for protection against electric shock can also reduce the risk of burns or fire.

Note 2 to entry: Protective bonding can be achieved with protective conductors and protective bonding conductors and by conductive joining of conductive parts of the machine and its electrical equipment.

3.1.69
protective bonding circuit
protective conductors and conductive parts connected together to provide protection against electric shock in the event of insulation failure

3.1.70
protective conductor
~~conductor required for protective bonding by some measures for protection against electric shock for electrically connecting any of the following parts:~~

~~– exposed conductive parts;~~

~~– extraneous conductive parts;~~

~~– main earthing terminal (PE)~~

~~[IEV 826-13-22, modified]~~

conductor providing a primary fault current path from the exposed conductive parts of the electrical equipment to a protective earthing (PE) terminal

3.1.71
redundancy
application of more than one device or system, or part of a device or system, with the objective of ensuring that in the event of one failing to perform its function, another is available to perform that function

3.1.72
reference designation
distinctive code which serves to identify an ~~item~~ object in the documentation and on the equipment

3.1.73
risk
combination of the probability of occurrence of harm ~~(i.e., physical injury or damage to health)~~ and the severity of that harm

Note 1 to entry: "Harm" refers to physical injury or damage to health.

~~[ISO 12100-1, 3.11, modified]~~

[SOURCE: ISO 12100:2010, 3.12, modified – Note 1 to entry has been added.]

3.1.74
safeguard
guard or protective device provided as a means to protect persons from a hazard

3.1.75
safeguarding
protective measure using safeguards to protect persons from the hazards which cannot reasonably be eliminated or from the risks which cannot be sufficiently reduced by inherently safe design measures

[SOURCE: ~~ISO 12100-1, 3.20~~ ISO 12100:2010, 3.21]

~~**3.1.76**~~
~~**safety-related control function (safety-related control circuit)**~~
~~control function (control circuit) of a hoisting machine that is intended to maintain the safe condition of the machine or prevent an immediate increase of the risk(s)~~

3.1.76
safety function
function of a machine whose failure can result in an immediate increase of the risk(s)

[SOURCE: ISO 12100:2010, 3.30]

3.1.77
second environment
environment that includes all establishments other than those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

Note 1 to entry: Industrial areas, technical areas of any building fed from a dedicated transformer are examples of second environment locations.

3.1.78
servicing level
level on which persons stand when operating or maintaining the electrical equipment

3.1.79
short-circuit current
overcurrent resulting from a short circuit due to a fault or an incorrect connection in an electric circuit

[SOURCE: IEC 60050-441:1984, 441-11-07]

3.1.80
short-circuit current rating
value of prospective short-circuit current that can be withstood by the electrical equipment for the total operating time (clearing time) of the short-circuit protective device (SCPD) under specified conditions

3.1.81
skilled person
~~(~~**electrically**~~)~~ **skilled person**
person with relevant training, education and experience to enable him or her to perceive risks and to avoid hazards that electricity can create

~~[IEV 826-18-01]~~

[SOURCE: IEC 60050-195:2021, 195-04-01, modified – Training is an additional and necessary condition.]

3.1.82
supplier
entity (e.g. manufacturer, contractor, installer, integrator) who provides equipment or services associated with the hoisting machine

Note 1 to entry: The user organization may also act in the capacity of a supplier to itself.

3.1.83
switching device
device designed to make and/or break the current in one or more electric circuits

~~NOTE A switching device may perform one or both of these actions.~~

[SOURCE: IEC 60050-441:1984, 441-14-01, modified – In the definition, "and/" has been added.]

3.1.84
terminal
part of an equipment or a component to which a conductor is attached, providing a re-usable connection

[SOURCE: IEC 60050-442:1998, 442-06-05, modified – In the definition, "or a component" has been added.]

3.1.85
uncontrolled stop
stopping of hoisting machine motion by removing electrical power to the machine actuators

Note 1 to entry: This definition does not imply any particular state of other (e.g. non-electrical) stopping devices, for example, mechanical or hydraulic brakes that are outside the scope of this document.

3.1.86
user
entity who utilizes the hoisting machine and its associated electrical equipment

3.2 Abbreviated terms 5

AWG American Wire Gauge
AC Alternating Current
BDM Basic Drive Module
CCS Cableless Control System
DC Direct Current
EMC Electro-Magnetic Compatibility
EMI Electro-Magnetic Interference
PDS Power Drive System
PELV Protective Extra-Low Voltage
RCD Residual Current protective Device
RMS Root Mean Square
SCPD Short-Circuit Protective Device
SELV Safe Extra-Low Voltage
STO Safe Torque Off

4 General requirements

4.1 General considerations

This document is intended to apply to electrical equipment used with a wide variety of hoisting machines and with a group of hoisting machines working together in a co-ordinated manner.

The risks associated with the hazards relevant to the electrical equipment shall be assessed as part of the overall requirements for risk assessment of the hoisting machine. This will ~~determine the acceptable level of risk, and the necessary protective measures~~

– identify the need for risk reduction, and
– determine adequate risk reductions, and
– determine the necessary protective measures

for persons who can be exposed to those hazards, while still maintaining an ~~acceptable~~ appropriate level of performance of the hoisting machine and its equipment.

Hazardous situations can result from, but are not limited to, the following causes:

– failures or faults in the electrical equipment resulting in the possibility of electric shock or fire of electrical origin;
– failures or faults in control circuits (or components and devices associated with those circuits) resulting in the malfunctioning of the hoisting machine;
– disturbances or disruptions in power sources as well as failures or faults in the power circuits resulting in the malfunctioning of the hoisting machine;
– loss of continuity of circuits that can result in a failure of a safety function, for example those that depend on sliding or rolling contacts~~, resulting in a failure of a safety function~~;
– electrical disturbances – for example, electromagnetic, electrostatic – either from outside the electrical equipment or internally generated, resulting in the malfunctioning of the hoisting machine;
– release of stored energy (either electrical or mechanical) resulting in, for example, electric shock, unexpected movement that can cause injury;
– acoustic noise and mechanical vibration at levels that cause health problems to persons;
– surface temperatures that can cause injury.