

# Maskinsikkerhed – Elektrisk materiel på maskiner – Del 32: Krav til løftemaskiner

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



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## EUROPÄISCHE NORM

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Safety of machinery - Electrical equipment of machines -  
Part 32: Requirements for hoisting machines  
(IEC 60204-32:2023)

Sécurité des machines - Équipement électrique des  
machines - Partie 32: Exigences pour les  
appareils de levage  
(IEC 60204-32:2023)

Sicherheit von Maschinen - Elektrische Ausrüstung von  
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(IEC 60204-32:2023)

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## European foreword

The text of document 44/1000/FDIS, future edition 3 of IEC 60204-32, prepared by TC 44 "Safety of machinery - Electrotechnical aspects" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60204-32:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2026-05-31
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2028-05-31

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In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60034 (series)	NOTE	Approved as EN IEC 60034 (series)
IEC 60038	NOTE	Approved as EN 60038
IEC 60085	NOTE	Approved as EN 60085
IEC 60204-11	NOTE	Approved as EN IEC 60204-11
IEC 60216 (series)	NOTE	Approved as EN 60216 (series)
IEC 60228	NOTE	Approved as EN IEC 60228
IEC 60269-1	NOTE	Approved as EN 60269-1
IEC 60320-1	NOTE	Approved as EN IEC 60320-1
IEC 60332 (series)	NOTE	Approved as EN IEC 60332 (series)
IEC 60364-4-44	NOTE	Approved as HD 60364-4-442
IEC 60364-7-729	NOTE	Approved as HD 60364-7-729
IEC 60447	NOTE	Approved as EN 60447
IEC 60757	NOTE	Approved as EN IEC 60757
IEC 60898 (series)	NOTE	Approved as EN IEC 60898 (series)

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IEC 60947-5-8	NOTE	Approved as EN IEC 60947-5-8
IEC 61000-6-1	NOTE	Approved as EN IEC 61000-6-1
IEC 61000-6-2	NOTE	Approved as EN IEC 61000-6-2
IEC 61000-6-3	NOTE	Approved as EN IEC 61000-6-3
IEC 61000-6-4	NOTE	Approved as EN IEC 61000-6-4
IEC 61000-6-8	NOTE	Approved as EN IEC 61000-6-8
IEC 61084 (series)	NOTE	Approved as EN IEC 61084 (series)
IEC 61180	NOTE	Approved as EN 61180
IEC 61557-8	NOTE	Approved as EN 61557-8
IEC 61557-9	NOTE	Approved as EN 61557-9
IEC 61557-14	NOTE	Approved as EN IEC 61557-14
IEC 61643-12	NOTE	Approved as CLC/TS 61643-12
IEC 61666	NOTE	Approved as EN 61666
IEC 61800 (series)	NOTE	Approved as EN 61800 (series)
IEC 62020-1	NOTE	Approved as EN IEC 62020-1
IEC 62305 (series)	NOTE	Approved as EN IEC 62305 (series)
IEC 62491	NOTE	Approved as EN 62491
ISO 13732-1	NOTE	Approved as EN ISO 13732-1
ISO 13851	NOTE	Approved as EN ISO 13851
ISO 14118	NOTE	Approved as EN ISO 14118

(normative)

## Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cencenelec.eu](http://www.cencenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	EN IEC 60034-5	-
IEC 60034-11	-	Rotating electrical machines - Part 11: Thermal protection	EN IEC 60034-11	-
IEC 60068-2-27	2008	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-31	2008	Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	2008
IEC 60072-1	-	Rotating electrical machines - Dimensions and output series - Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080	EN IEC 60072-1	-
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	EN 60073	2002
IEC 60309-1	-	Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes - Part 1: General requirements	EN IEC 60309-1	-
IEC 60364-1 (mod)	2005	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions	HD 60364-1	2008
-	-		+ A11	2017

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IEC 60364-4-41 (mod)	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	2017
+ A1	2017		-	-
-	-		+ A11	2017
-	-		+ A12	2019
IEC 60364-4-43 (mod)	2008	Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent	HD 60364-4-43	2010
IEC 60364-5-52 (mod)	2009	Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems	HD 60364-5-52	2011
-	-		+ A11	2017
-	-		+ A12	2022
IEC 60364-5-53	2019	Low-voltage electrical installations -- Part 5- 53: Selection and erection of electrical equipment - Protection, isolation, switching, control and monitoring	-	-
IEC 60364-5-54	2011	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors	HD 60364-5-54	2011
-	-		+ A11	2017
IEC 60364-6	2016	Low voltage electrical installations - Part 6: Verification	HD 60364-6	2016
-	-		+ A11	2017
-	-		+ A12	2017
IEC 60417	-	Graphical symbols for use on equipment. Index, survey and compilation of the single sheets.	-	-
IEC 60445	2021	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors	EN IEC 60445	2021
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 60664-1	-	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	-
IEC 60947-1	-	Low-voltage switchgear and controlgear - Part 1: General rules	EN IEC 60947-1	-
IEC 60947-2	2016	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN 60947-2	2017
IEC 60947-3	-	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch- disconnectors and fuse-combination units	EN IEC 60947-3	-

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IEC 60947-4-1	2018	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN IEC 60947-4-1	2019
IEC 60947-5-1	2016	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices	EN 60947-5-1	2017
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	EN 60947-5-5	-
IEC 60947-6-2	-	Low-voltage switchgear and controlgear - Part 6-2: Multiple function equipment - Control and protective switching devices (or equipment) (CPS)	EN IEC 60947-6-2	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61204-7	-	Low-voltage switch mode power supplies - Part 7: Safety requirements	EN IEC 61204-7	-
IEC 61310	series	Safety of machinery - Indication, marking and actuation	EN 61310	series
IEC 61439-1	-	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN IEC 61439-1	-
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	EN IEC 61557-3	-
IEC 61558-1	-	Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests	EN IEC 61558-1	-
IEC 61558-2-2	-	Safety of transformers, reactors, power supply units and combinations thereof - Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers	EN IEC 61558-2-2	-
IEC 61558-2-6	-	Safety of 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 applications	EN IEC 61558-2-6	-
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	EN IEC 61558-2-16	-

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IEC 61800-3	-	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods for PDS and machine tools	EN IEC 61800-3	-
IEC 61800-5-1	-	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy	EN IEC 61800-5-1	-
IEC 61800-5-2	-	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional	EN 61800-5-2	-
IEC 61984	-	Connectors - Safety requirements and tests	EN 61984	-
IEC 62023	-	Structuring of technical information and documentation	EN 62023	-
IEC 62061	-	Safety of machinery - Functional safety of safety-related control systems	EN IEC 62061	-
IEC 62745	2017	Safety of machinery - Requirements for cableless control systems of machinery	EN 62745	2017
-	-		+ A11	2020
ISO 7010	-	Graphical symbols_- Safety colours and safety signs_- Registered safety signs	-	-
ISO 12100	2010	Safety of machinery - General principles for design - Risk assessment and risk reduction	EN ISO 12100	2010
ISO 13849-1	-	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design	EN ISO 13849-1	-
ISO 13849-2	-	Safety of machinery - Safety-related parts of control systems - Part 2: Validation	EN ISO 13849-2	-
ISO 13850	2015	Safety of machinery - Emergency stop function - Principles for design	EN ISO 13850	2015
ISO 13857	-	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs	EN ISO 13857	-

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# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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

**Sécurité des machines – Équipement électrique des machines –  
Partie 32: Exigences pour les appareils de levage**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **SAFETY OF MACHINERY – ELECTRICAL EQUIPMENT OF MACHINES –**

#### **Part 32: Requirements for hoisting machines**

#### FOREWORD

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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.

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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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://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)

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- 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<sup>2</sup> solid conductors within enclosures (USA).
- 12.2: The smallest power circuit conductor allowed on machines is 0,82 mm<sup>2</sup> (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  $R_A$  is regulated (e.g. when  $U_0 > 300$  V,  $R_A$  shall be less than 10  $\Omega$ , when  $U_0 < 300$  V,  $R_A$  shall be less than 100  $\Omega$ ,  $U_0$  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  $\Omega$  (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](http://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.

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## INTRODUCTION

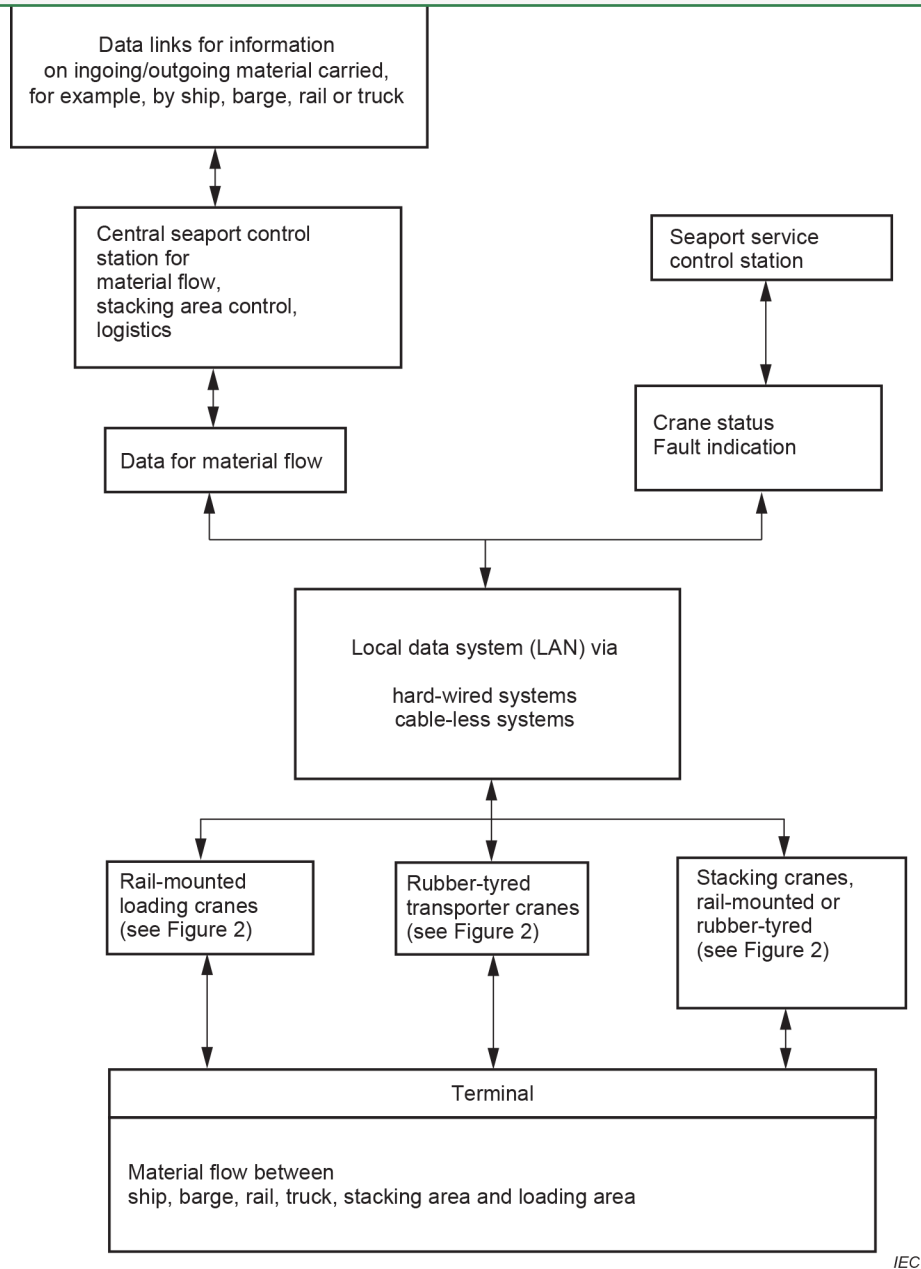
This part of IEC 60204 provides requirements and recommendations relating to the electrical equipment of hoisting machines so as to promote

- safety of persons and property;
- consistency of control response;
- ease of operation and maintenance.

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

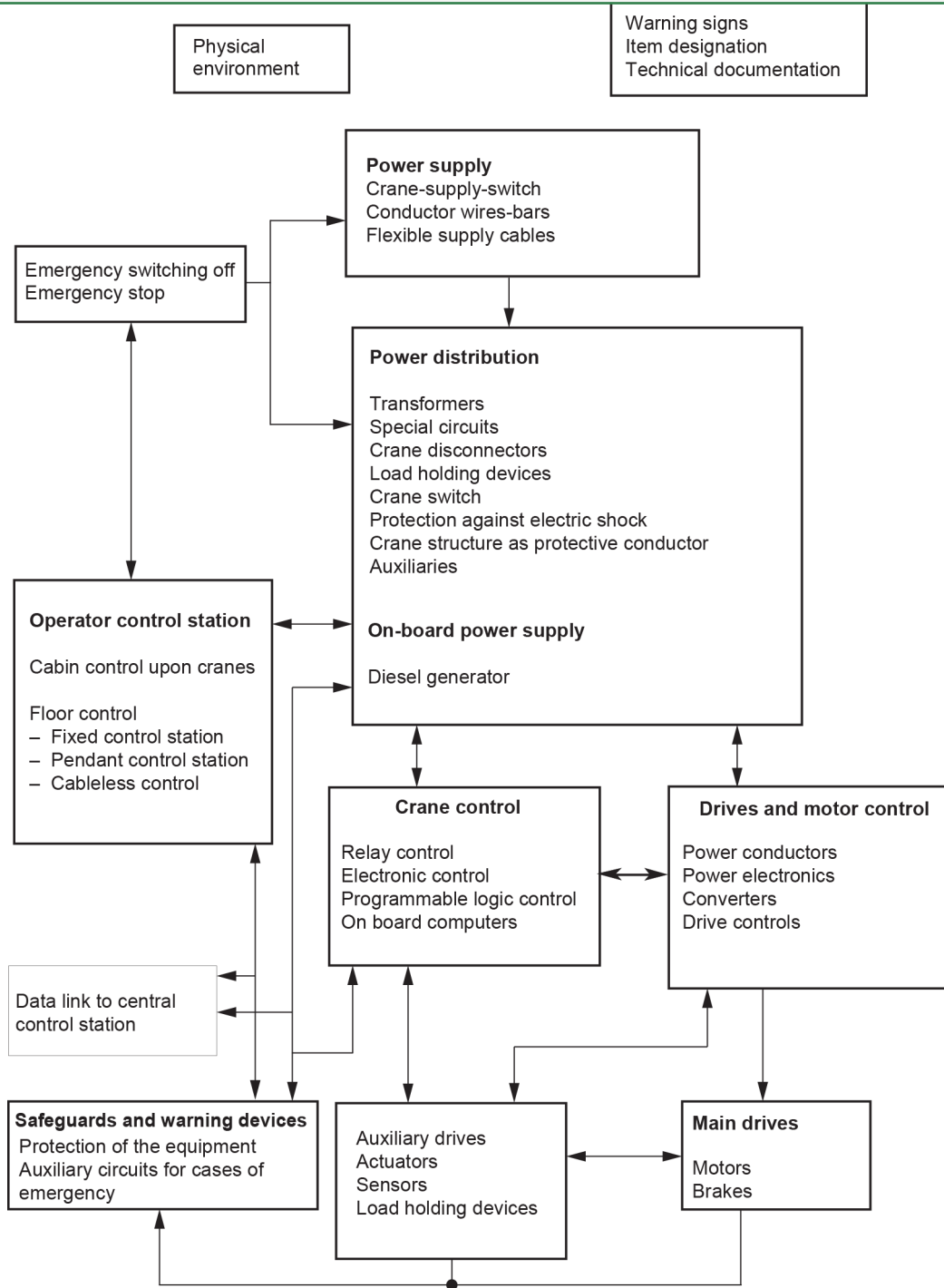
Figure 1 and Figure 2 have been provided as an aid to understanding the interrelationship of the various elements of a hoisting machine and its associated equipment. Figure 1 is an overall block diagram of a typical material handling system (a group of cranes working together in a coordinated manner)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

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

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

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## SAFETY OF MACHINERY – ELECTRICAL EQUIPMENT OF MACHINES –

### Part 32: Requirements for hoisting machines

#### 1 Scope

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

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 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 Special requirements for electrical equipment of hoisting machines intended to be operated at higher voltages can be found in IEC 60204-11.

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

- 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;

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- 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 60068-2-27:2008, *Environmental testing – 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 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 appliance inlets for industrial purposes – Part 1: General requirements*

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

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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 60364-4-43:2008, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

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

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

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

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

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

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

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

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

IEC 60664-1, *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 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-2:2016, *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 60947-4-1:2018, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-5-1:2016, *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 61140, *Protection against electric shock – Common aspects for installations and equipment*

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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 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*

IEC 61558-1, *Safety of 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 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 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, *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 62061, *Safety of machinery – Functional safety of safety-related control systems*

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

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

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

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

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