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INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD	11
INTRODUCTION	14
1 Scope	17
2 Normative references	18
3 Terms, definitions and abbreviated terms	22
3.1 Terms and definitions	22
3.2 Abbreviated terms	34
4 General requirements	34
4.1 General considerations	34
4.2 Selection of equipment	35
4.2.1 General	35
4.2.2 Selection of power contactors	35
4.2.3 Electrical equipment in compliance with the IEC 60439 series	36
4.2.3 Switchgear	36
4.2.4 Selection of PDS	36
4.3 Electrical supply	36
4.3.1 General requirements	36
4.3.2 AC supplies	36
4.3.3 DC supplies	36
4.3.4 On-board power supply Special supply systems	37
4.4 Physical environment and operating conditions	37
4.4.1 General	37
4.4.2 Electromagnetic compatibility (EMC)	37
4.4.3 Ambient air temperature	38
4.4.4 Humidity	38
4.4.5 Altitude	38
4.4.6 Contaminants	39
4.4.7 Ionizing and non-ionizing radiation	39
4.4.8 Vibration, shock, and bump	39
4.5 Transportation and storage	39
4.6 Provisions for handling	39
4.7 Installation	39
5 Incoming supply conductor terminations and devices for disconnecting and switching off	39
5.1 Incoming supply conductor terminations	39
5.2 Terminal for connection to of the external protective earthing system conductor	40
5.3 Supply disconnecting and switching devices	41
5.3.1 General	41
5.3.2 Type	41
5.3.3 Requirements	42
5.3.4 Operating means of the supply disconnecting device	43
5.3.5 Crane-supply-switch	44
5.3.6 Crane-disconnector	45
5.3.7 Crane-switch	46
5.3.8 Special Excepted circuits	46

5.4	Devices for switching off removal of power for prevention of unexpected start-up	47
5.5	Devices for disconnecting isolating electrical equipment	48
5.6	Protection against unauthorized, inadvertent and/or mistaken connection	48
6	Protection against electric shock	49
6.1	General	49
6.2	Basic protection against direct contact	49
6.2.1	General	49
6.2.2	Protection by enclosures	49
6.2.3	Protection by insulation of live parts	50
6.2.4	Protection against residual voltages	51
6.2.5	Protection by barriers	51
6.2.6	Protection by placing out of reach or protection by obstacles	51
6.3	Fault protection against indirect contact	51
6.3.1	General	51
6.3.2	Prevention of the occurrence of a touch voltage	52
6.3.3	Protection by automatic disconnection of supply	52
6.4	Protection by the use of PELV	53
6.4.1	General requirements	53
6.4.2	Sources for PELV	54
7	Protection of equipment	54
7.1	General	54
7.2	Overcurrent protection	55
7.2.1	General	55
7.2.2	Supply conductors	55
7.2.3	Power circuits	55
7.2.4	Control circuits	55
7.2.5	Socket outlets and their associated conductors	56
7.2.6	Lighting circuits	56
7.2.7	Transformers	56
7.2.8	Location of overcurrent protective devices	56
7.2.9	Overcurrent protective devices	56
7.2.10	Rating and setting of overcurrent protective devices	57
7.3	Protection of motors against overheating	57
7.3.1	General	57
7.3.2	Overload protection	57
7.3.3	Over-temperature protection	58
	7.3.4 Current limiting protection	
7.4	Protection against abnormal temperature protection	58
7.5	Protection against the effects of supply interruption or voltage reduction and subsequent restoration	58
7.6	Motor overspeed protection	59
7.7	Additional earth fault/residual current protection	59
7.8	Phase sequence protection	59
7.9	Protection against overvoltages due to lightning and to switching surges and lightning	59
7.10	Short-circuit current rating	60
8	Equipotential bonding	60
8.1	General	60

8.2	Protective bonding circuit.....	63
8.2.1	General.....	63
8.2.2	Protective conductors	63
8.2.3	Continuity of the protective bonding circuit	64
8.2.4	Exclusion of switching devices from the protective bonding circuit.....	65
8.2.5	Parts that need not be connected to the protective bonding circuit	65
8.2.6	Protective conductor connecting points	66
8.2.7	Mobile hoisting machines.....	66
8.2.8	Additional protective bonding requirements for electrical equipment having earth leakage currents higher than 10 mA AC or DC	66
8.3	Functional bonding	67
8.4	Measures to restrict the effects of high leakage current.....	67
9	Control circuits and control functions	68
9.1	Control circuits	68
9.1.1	General.....	68
9.1.2	Control circuit supply	68
9.1.3	Control circuit voltages	68
9.1.4	Protection	69
9.2	Control functions	69
9.2.1	General.....	69
9.2.1	Start functions	69
9.2.2	Categories of Stop functions	69
9.2.3	Operating modes.....	69
9.2.4	Suspension of safeguarding.....	70
9.2.5	Operation.....	70
9.2.6	Other control functions	73
9.2.7	Cableless controls system (CCS).....	73
9.3	Protective interlocks	76
9.3.1	General.....	76
9.3.2	Reclosing or resetting of an interlocking safeguard.....	77
9.3.3	Exceeding operating limits.....	77
9.3.4	Operation of auxiliary functions.....	77
9.3.5	Interlocks between different operations and for contrary motions.....	77
9.3.6	Reverse current braking.....	77
9.4	Control functions in the event of failure	78
9.4.1	General requirements	78
9.4.2	Measures to minimize risk in the event of failure.....	78
9.4.3	Protection against mal-operation due to earth faults, voltage interruptions, and loss of circuit continuity.....	81
9.4.3	Protection against malfunction of control circuits	81
9.4.4	Protection against maloperation of a motion control system	87
10	Operator interface and hoisting machine mounted control devices	88
10.1	General.....	88
10.1.1	General device requirements	88
10.1.2	Location and mounting.....	88
10.1.3	Protection	88
10.1.4	Position sensors.....	89
10.1.5	Portable and pendant control stations	89
10.2	Push-buttons Actuators.....	89

10.2.1	Colours	89
10.2.2	Markings	90
10.3	Indicator lights, displays and audible devices	91
10.3.1	General.....	91
10.3.2	Colours	92
10.3.3	Flashing lights and displays	92
10.4	Illuminated push-buttons	92
10.5	Rotary control devices	92
10.6	Start devices	93
10.7	Emergency stop devices	93
10.7.1	Location of emergency stop devices.....	93
10.7.2	Types of emergency stop device	93
10.7.3	Colour of actuators	94
10.7.4	Local operation of the crane-supply-switch and the crane-disconnector to effect emergency stop.....	94
10.8	Emergency switching-off devices.....	94
10.8.1	Location of emergency switching-off devices	94
10.8.2	Types of emergency switching-off device	94
10.8.3	Colour of actuators	94
10.8.4	Local operation of the crane-supply-switch and the crane-disconnector to effect emergency switching-off.....	95
10.9	Enabling control device.....	95
11	Controlgear: location, mounting and enclosures	95
11.1	General requirements	95
11.2	Location and mounting.....	95
11.2.1	Accessibility and maintenance	95
11.2.2	Physical separation or grouping	96
11.2.3	Heating effects	96
11.3	Degrees of protection	97
11.4	Enclosures, doors and openings.....	97
11.5	Access to switchgear and to controlgear.....	99
11.5.1	General.....	99
11.5.2	Access to gangways	99
11.5.3	Gangway in front of switchgear and controlgear	99
	11.5.4 Gangway and door restrictions	
12	Conductors and cables.....	100
12.1	General requirements	100
12.2	Conductors.....	100
12.3	Insulation	101
12.4	Current-carrying capacity in normal service	102
12.5	Conductor and cable voltage drop	103
12.6	Flexible cables	104
12.6.1	General.....	104
12.6.2	Mechanical rating	104
12.6.3	Current-carrying capacity of cables wound on drums	104
12.7	Conductor wires, conductor bars and slip-ring assemblies.....	105
12.7.1	Protection against direct contact Basic protection	105
12.7.2	Protective conductor circuit.....	108
12.7.3	Protective conductor current collectors.....	108

12.7.4	Removable current collectors with a disconnecter function.....	109
12.7.5	Clearances in air	109
12.7.6	Creepage distances.....	109
12.7.7	Conductor system sectioning	109
12.7.8	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies	109
13	Wiring practices	110
13.1	Connections and routing	110
13.1.1	General requirements	110
13.1.2	Conductor and cable runs	110
13.1.3	Conductors of different circuits.....	111
13.1.4	AC circuits – Electromagnetic effects (prevention of eddy currents).....	111
13.1.5	Connection between pick-up and pick-up converter of an inductive power supply system	111
13.2	Identification of conductors	111
13.2.1	General requirements	111
13.2.2	Identification of the protective conductor / protective bonding conductor.....	112
13.2.3	Identification of the neutral conductor.....	112
13.2.4	Identification by colour.....	113
13.3	Wiring inside enclosures	113
13.4	Wiring outside enclosures	114
13.4.1	General requirements	114
13.4.2	External ducts	114
13.4.3	Connection to the hoisting machine and to moving elements on the hoisting machine	114
13.4.4	Interconnection of devices on the hoisting machine	116
13.4.5	Plug/socket combinations	116
13.4.6	Dismantling for shipment	117
13.4.7	Additional conductors	117
13.5	Ducts, connection boxes and other boxes.....	117
13.5.1	General requirements	117
13.5.2	Percentage fill of ducts	117
13.5.3	Rigid metal conduits and fittings.....	117
13.5.4	Flexible metal conduits and fittings.....	118
13.5.5	Flexible non-metallic conduits and fittings	118
13.5.6	Cable trunking systems.....	118
13.5.7	Hoisting machine compartments and cable trunking systems	118
13.5.8	Connection boxes and other boxes	118
13.5.9	Motor connection boxes.....	119
14	Electric motors and associated equipment	119
14.1	General requirements	119
14.2	Motor enclosures	119
14.3	Motor dimensions	119
14.4	Motor mounting and compartments.....	119
14.5	Criteria for motor selection.....	120
14.6	Protective devices for mechanical brakes	120
14.7	Electrically operated mechanical brakes	120
15	Accessories Socket-outlets and lighting	120
15.1	Socket-outlets for accessories	120

15.2	Local lighting on of the hoisting machine and for of the equipment	121
15.2.1	General.....	121
15.2.2	Supply	121
15.2.3	Protection	122
15.2.4	Fittings.....	122
16	Marking, warning signs and reference designations.....	122
16.1	General.....	122
16.2	Warning signs	122
16.2.1	Electric shock hazard	122
16.2.2	Hot surfaces hazard	123
16.2.3	Hazard from energy storage system.....	123
16.3	Functional identification	123
16.4	Marking of enclosures of electrical equipment.....	123
16.5	Reference designations	124
17	Technical documentation.....	124
	17.2 Information to be provided	
	17.3 Requirements applicable to all documentation	
	17.4 Installation documents	
	17.5 Overview diagrams and function diagrams.....	
	17.6 Circuit diagrams	
	17.7 Operating manual	
	17.8 Maintenance manual.....	
	17.9 Parts list.....	
17.1	General.....	124
17.2	Information related to the electrical equipment.....	128
18	Verification	129
18.1	General.....	129
18.2	Verification of conditions for protection by automatic disconnection of supply	130
18.2.1	General.....	130
	18.2.2 Test methods in TN-systems.....	
18.2.2	Test 1 – Verification of the continuity of the protective bonding circuit.....	130
18.2.3	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device	130
18.2.4	Application of the test methods for TN-systems	131
18.3	Insulation resistance tests.....	134
18.4	Voltage tests	135
18.5	Protection against residual voltages	135
18.6	Functional tests	135
18.7	Retesting.....	135
	Annex A (normative) Protection against indirect contact in TN-systems.....	
Annex A	(normative) Fault protection by automatic disconnection of supply	140
A.1	Fault protection for machines supplied from TN-systems.....	140
A.1.1	General.....	140
A.1.2	Conditions for protection by automatic disconnection of the supply by overcurrent protective devices	140
A.1.3	Condition for protection by reducing the touch voltage below 50 V	141
A.1.4	Verification of conditions for protection by automatic disconnection of the supply	142

A.2	Fault protection for machines supplied from TT-systems	144
A.2.1	Connection to earth	144
A.2.2	Fault protection for TT systems	144
A.2.3	Verification of protection by automatic disconnection of supply using a residual current protective device (RCD)	145
A.2.4	Measurement of the fault loop impedance (Z_S)	146
Annex B (informative)	Enquiry form for the electrical equipment of hoisting machines	148
Annex C (informative)	Current-carrying capacity and overcurrent protection of conductors and cables in the electrical equipment of machines	152
C.1	General	152
C.2	General operating conditions	152
C.2.1	Ambient air temperature	152
C.2.2	Methods of installation	152
C.2.3	Grouping	153
C.2.4	Classification of conductors	155
C.3	Co-ordination between conductors and protective devices providing overload protection	155
C.4	Overcurrent protection of conductors	156
Annex D (informative)	Conductor selection for intermittent duty	158
D.1	General	158
D.2	Intermittent duty with 10-min cycle	158
D.3	Intermittent duty with any cycle time	159
D.4	Calculation of thermal equivalent current	160
Annex E (informative)	Explanation of emergency operation functions	162
E.1	Emergency operations	162
E.2	Emergency stop	162
E.3	Emergency start	162
E.4	Emergency switching-off	162
E.5	Emergency switching-on	162
Annex F (informative)	Comparison of typical conductor cross-sectional areas	163
Annex G (informative)	Measures to reduce the effects of electromagnetic influences	165
G.1	General	165
G.2	Mitigation of electromagnetic interference (EMI)	165
G.2.1	General	165
G.2.2	Measures to reduce EMI	166
G.3	Separation and segregation of cables	166
G.4	Power supply of a machine by parallel sources	170
G.5	Supply impedance where a Power Drive System (PDS) is used	170
G.6	Emission levels for electrical equipment for PDS	170
G.7	Conducted disturbances	171
G.8	Immunity requirements – Performance criteria	172
Annex H (informative)	Documentation and information	173
Bibliography	175
Index	
List of comments	182

Figure 1 – Block diagram of combined working cranes in a typical material handling system in a seaport..... 15

Figure 2 – Block diagram of a typical crane and its associated electrical equipment	16
Figure 3 – Examples of electrical supply systems.....	42
Figure 4 – Disconnecter isolator	44
Figure 5 – Disconnecting circuit breaker	44
Figure 6 – Example of equipotential bonding for electrical equipment of a hoisting machine.....	62
Figure 7 – Symbol IEC 60417-5019: Protective earth.....	66
Figure 8 – Symbol IEC 60417-5020: Frame or chassis	67
Figure 9 – Method a) Earthed control circuit fed by a transformer	82
Figure 10 – Method b1) Non-earthed control circuit fed by transformer.....	83
Figure 11 – Method b2) Non-earthed control circuit fed by transformer.....	83
Figure 12 – Method b3) Non-earthed control circuit fed by transformer.....	84
Figure 13 – Method c) Control circuits fed by transformer with an earthed centre-tap winding.....	84
Figure 14 – Method d1a) Control circuit without transformer connected between a phase and the neutral of an earthed supply system	85
Figure 15 – Method d1b) control circuit without transformer connected between two phases of an earthed supply system	86
Figure 16 – Method d2a) Control circuit without transformer connected between phase and neutral of a non-earthed supply system	86
Figure 17 – Method d2b) control circuit without transformer connected between two phases of a non-earthed supply system	87
Figure 18 – Limit of arm's reach in cases where the distance from the middle of the hoisting device-rail to the edge of the girder is less than 300 mm.....	107
Figure 19 – Limit of arm's reach in cases where the distance from the middle of the hoisting device-rail to the edge of the girder is at least 300 mm	107
Figure 20 – Limit of arm's reach in cases of using additional obstacles	108
Figure 21– Symbol IEC 60417-5019.....	112
Figure 22 – Symbol IEC 60417-5021.....	112
Figure 23 – Symbol ISO 7010-W012	122
Figure 24 – Symbol ISO 7010-W017	123
Figure 25 – Warning sign: energy storage system	123
Figure A.1 – Typical arrangement for fault loop impedance (Z_S) measurement in TN systems	143
Figure A.2 – Typical arrangement for fault loop impedance (Z_S) measurement for power drive system circuits in TN systems	143
Figure A.3 – Typical arrangement for fault loop impedance (Z_S) measurement in TT systems	146
Figure A.4 – Typical arrangement for fault loop impedance (Z_S) measurement for Power Drive System circuits in TT systems	147
Figure C.1 – Methods of conductor and cable installation independent of number of conductors/cables	153
Figure C.2 – Parameters of conductors and protective devices	155
Figure D.1 – An example of current and time of the segments of the operating cycle of a variable speed AC hoist drive	160
Figure G.1 – By-pass conductor for screen reinforcement.....	166
Figure G.2 – Examples of vertical separation and segregation.....	168

Figure G.3 – Examples of horizontal separation and segregation	168
Figure G.4 – Cable arrangements in metal cable trays.....	169
Figure G.5 – Connections between metal cable trays or cable trunking systems.....	169
Figure G.6 – Interruption of metal cable trays at fire barriers	170
Table 1 – Minimum cross-sectional area of the external protective copper conductors	40
Table 2 – Colour coding for push button actuators and their meanings
Table 3 – Symbols for push buttons
Table 2 – Symbols for actuators (power)	91
Table 3 – Symbols for actuators (machine operation)	91
Table 4 – Colours for indicator lights and their meanings with respect to the condition of the hoisting machine	92
Table 5 – Minimum cross-sectional areas of copper conductors	101
Table 6 – Classification of conductors.....	101
Table 7 – Examples of current-carrying capacity (I_Z) of PVC-insulated copper conductors or cables under steady-state conditions in an ambient air temperature of +40 °C for different methods of installation.....	103
Table 8 – Derating factors for cables wound on drums.....	105
Table 9 – Minimum permitted bending radii for the forced guiding of flexible cables.....	115
Table 10 – Application of the test methods for TN-systems.....	132
Table 11 – Examples of maximum cable length from each protective device to its their loads for TN-systems	133
Table A.1 – Maximum disconnecting times for TN systems
Table A.1 – Maximum disconnecting times for TN systems	140
Table A.2 – Maximum disconnecting time for TT-systems.....	145
Table C.1 – Correction factors	152
Table C.2 – Derating factors from for I_Z for grouping	154
Table C.3 – Derating factors from for I_Z for multi-core cables up to 10 mm ²	154
Table C.4 – Classification of conductors	155
Table C.5 – Maximum allowable conductor temperatures under normal and short-circuit conditions	156
Table D.1 – Correction factor for 10 min cycle.....	159
Table D.2 – Thermal time constant of conductors.....	159
Table F.1 – Comparison of conductor sizes.....	163
Table G.1 – Minimum separation distances using metallic containment as illustrated in Figure G.2	167
Table G.2 – Limits for the interference voltage for the environments / categories.....	170
Table G.3 – Limits for propagated electromagnetic disturbance	171
Table G.4 – Limits for conducted disturbances	171
Table G.5 – Immunity requirements – performance criteria	172
Table H.1 – Documentation and information that can be applicable.....	173

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF MACHINERY –
ELECTRICAL EQUIPMENT OF MACHINES –****Part 32: Requirements for hoisting machines****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This commented version (CMV) of the official standard IEC 60204-32:2023 edition 3.0 allows the user to identify the changes made to the previous IEC 60204-32:2008 edition 2.0. Furthermore, comments from IEC TC 44 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

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 mm² solid conductors within enclosures (USA).
 12.2: The smallest power circuit conductor allowed on machines is 0,82 mm² (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 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.

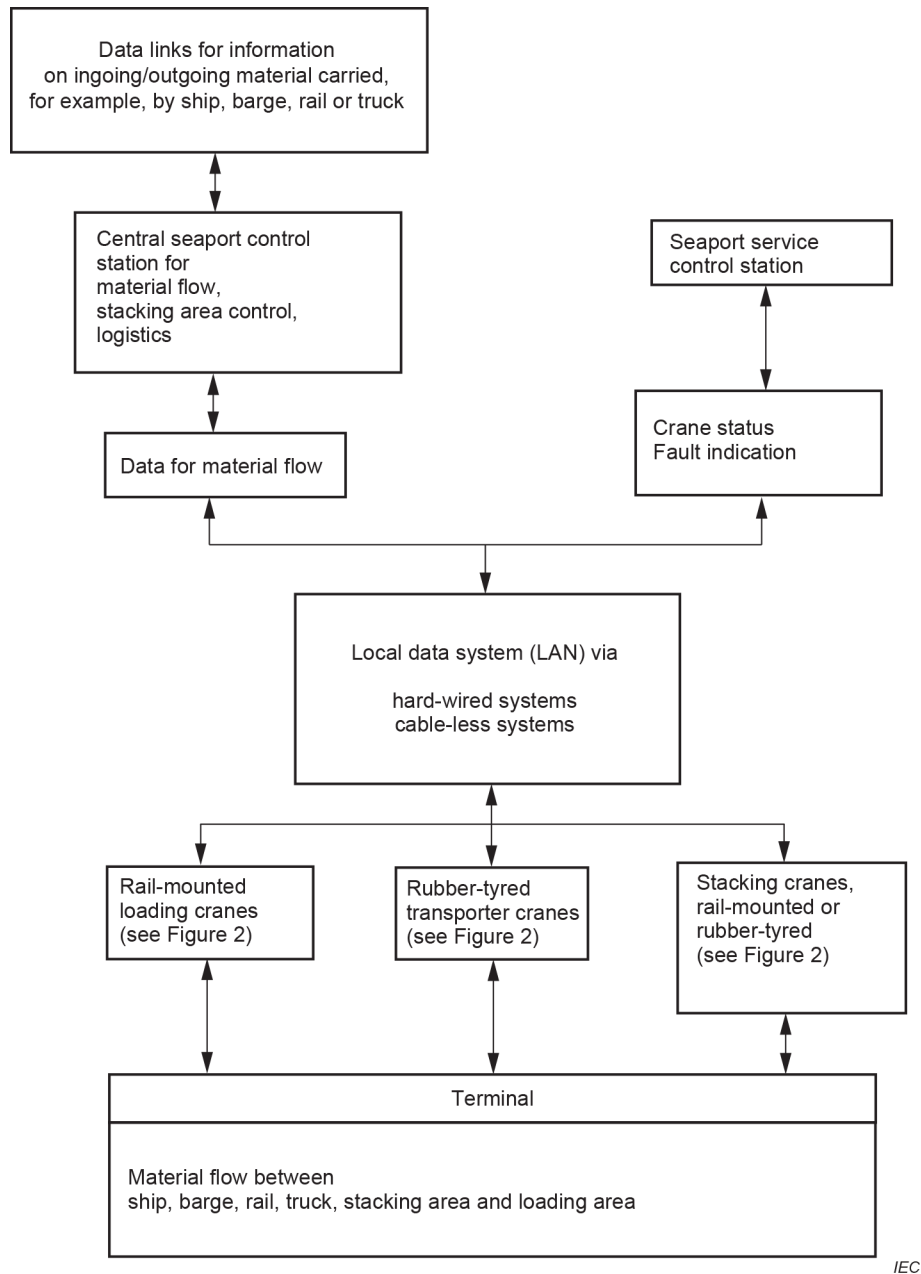
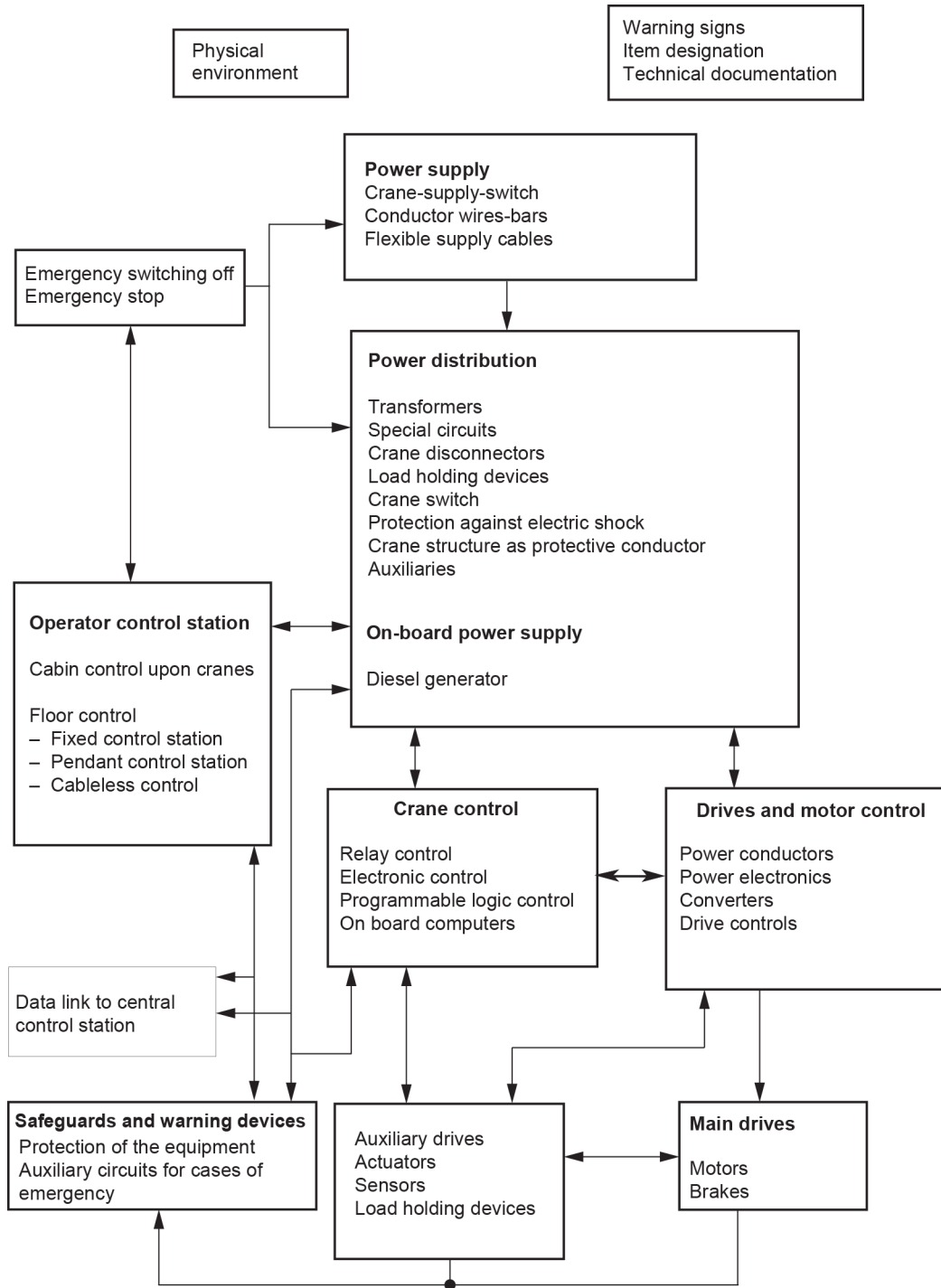


Figure 1 – Block diagram of combined working cranes in a typical material handling system in a seaport



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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 60364-4-43:20042008, *Low-voltage electrical installations ~~of buildings~~ – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-52:20042009, *Low-voltage electrical installations ~~of buildings~~ – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60364-5-53:20022019, *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 60364-5-54:20022011, *Low-voltage electrical installations ~~of buildings~~ – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, ~~protective conductors~~ and protective ~~bonding~~ conductors*

IEC 60364-6:20062016, *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 assemblies⁴. 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 60529:2004, *Degrees of protection provided by enclosures (IP Code)*

~~IEC 60617, Graphical symbols for diagrams~~

⁴ ~~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)⁴~~

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*

⁴ ~~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*