

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**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 60204-32

Edition 3.0 2023-07

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**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.020, 53.020.01

ISBN 978-2-8322-7075-2

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	11
INTRODUCTION.....	14
1 Scope.....	17
2 Normative references	18
3 Terms, definitions and abbreviated terms	21
3.1 Terms and definitions.....	21
3.2 Abbreviated terms.....	31
4 General requirements	32
4.1 General considerations	32
4.2 Selection of equipment	33
4.2.1 General	33
4.2.2 Selection of power contactors.....	33
4.2.3 Switchgear	33
4.2.4 Selection of PDS	33
4.3 Electrical supply.....	33
4.3.1 General requirements	33
4.3.2 AC supplies	34
4.3.3 DC supplies.....	34
4.3.4 Special supply systems.....	34
4.4 Physical environment and operating conditions.....	34
4.4.1 General	34
4.4.2 Electromagnetic compatibility (EMC)	35
4.4.3 Ambient air temperature	35
4.4.4 Humidity	35
4.4.5 Altitude	35
4.4.6 Contaminants	35
4.4.7 Ionizing and non-ionizing radiation.....	35
4.4.8 Vibration, shock, and bump	36
4.5 Transportation and storage	36
4.6 Provisions for handling.....	36
4.7 Installation	36
5 Incoming supply conductor terminations and devices for disconnecting and switching off	36
5.1 Incoming supply conductor terminations.....	36
5.2 Terminal for connection of the external protective conductor.....	37
5.3 Supply disconnecting and switching devices	37
5.3.1 General	37
5.3.2 Type	37
5.3.3 Requirements	39
5.3.4 Operating means of the supply disconnecting device	39
5.3.5 Crane-supply-switch	40
5.3.6 Crane-disconnector	41
5.3.7 Crane-switch	42
5.3.8 Excepted circuits	43
5.4 Devices for removal of power for prevention of unexpected start-up.....	43
5.5 Devices for isolating electrical equipment	44
5.6 Protection against unauthorized, inadvertent and/or mistaken connection.....	45

6	Protection against electric shock	45
6.1	General.....	45
6.2	Basic protection	45
6.2.1	General	45
6.2.2	Protection by enclosures	45
6.2.3	Protection by insulation of live parts	46
6.2.4	Protection against residual voltages	47
6.2.5	Protection by barriers	47
6.2.6	Protection by placing out of reach or protection by obstacles	47
6.3	Fault protection.....	47
6.3.1	General	47
6.3.2	Prevention of the occurrence of a touch voltage	48
6.3.3	Protection by automatic disconnection of supply	48
6.4	Protection by the use of PELV	49
6.4.1	General requirements	49
6.4.2	Sources for PELV	50
7	Protection of equipment.....	50
7.1	General.....	50
7.2	Overcurrent protection	51
7.2.1	General	51
7.2.2	Supply conductors	51
7.2.3	Power circuits	51
7.2.4	Control circuits	51
7.2.5	Socket outlets and their associated conductors	52
7.2.6	Lighting circuits	52
7.2.7	Transformers	52
7.2.8	Location of overcurrent protective devices	52
7.2.9	Overcurrent protective devices	52
7.2.10	Rating and setting of overcurrent protective devices	53
7.3	Protection of motors against overheating	53
7.3.1	General	53
7.3.2	Overload protection	53
7.3.3	Over-temperature protection	54
7.4	Protection against abnormal temperature.....	54
7.5	Protection against the effects of supply interruption or voltage reduction and subsequent restoration	54
7.6	Motor overspeed protection.....	54
7.7	Additional earth fault/residual current protection	55
7.8	Phase sequence protection	55
7.9	Protection against overvoltages due to lightning and to switching surges	55
7.10	Short-circuit current rating	56
8	Equipotential bonding	56
8.1	General.....	56
8.2	Protective bonding circuit.....	58
8.2.1	General	58
8.2.2	Protective conductors	58
8.2.3	Continuity of the protective bonding circuit	59
8.2.4	Exclusion of switching devices from the protective bonding circuit	60
8.2.5	Parts that need not be connected to the protective bonding circuit.....	60

8.2.6	Protective conductor connecting points.....	60
8.2.7	Mobile hoisting machines.....	60
8.2.8	Additional requirements for electrical equipment having earth leakage currents higher than 10 mA AC or DC.....	61
8.3	Functional bonding.....	61
8.4	Measures to restrict the effects of high leakage current	62
9	Control circuits and control functions	62
9.1	Control circuits.....	62
9.1.1	General	62
9.1.2	Control circuit supply	62
9.1.3	Control circuit voltages	62
9.1.4	Protection.....	62
9.2	Control functions.....	63
9.2.1	General	63
9.2.2	Categories of stop functions	63
9.2.3	Operating modes	63
9.2.4	Suspension of safeguarding.....	63
9.2.5	Operation	64
9.2.6	Other control functions	66
9.2.7	Cableless control system (CCS)	67
9.3	Protective interlocks.....	68
9.3.1	General	68
9.3.2	Reclosing or resetting of an interlocking safeguard.....	68
9.3.3	Exceeding operating limits.....	68
9.3.4	Operation of auxiliary functions.....	68
9.3.5	Interlocks between different operations and for contrary motions.....	68
9.3.6	Reverse current braking	69
9.4	Control functions in the event of failure	69
9.4.1	General requirements	69
9.4.2	Measures to minimize risk in the event of failure.....	70
9.4.3	Protection against malfunction of control circuits	71
9.4.4	Protection against maloperation of a motion control system.....	77
10	Operator interface and hoisting machine mounted control devices	77
10.1	General.....	77
10.1.1	General requirements	77
10.1.2	Location and mounting.....	77
10.1.3	Protection.....	78
10.1.4	Position sensors	78
10.1.5	Portable and pendant control stations.....	78
10.2	Actuators	78
10.2.1	Colours.....	78
10.2.2	Markings.....	79
10.3	Indicator lights, displays and audible devices.....	80
10.3.1	General	80
10.3.2	Colours.....	80
10.3.3	Flashing lights and displays.....	80
10.4	Illuminated push-buttons	81
10.5	Rotary control devices	81
10.6	Start devices.....	81

10.7	Emergency stop devices	81
10.7.1	Location of emergency stop devices	81
10.7.2	Types of emergency stop device	82
10.7.3	Colour of actuators	82
10.7.4	Local operation of the crane-supply-switch and the crane-disconnector to effect emergency stop	82
10.8	Emergency switching-off devices	82
10.8.1	Location of emergency switching-off devices	82
10.8.2	Types of emergency switching-off device	82
10.8.3	Colour of actuators	82
10.8.4	Local operation of the crane-supply-switch and the crane-disconnector to effect emergency switching-off.....	83
10.9	Enabling control device	83
11	Controlgear: location, mounting and enclosures.....	83
11.1	General requirements	83
11.2	Location and mounting	83
11.2.1	Accessibility and maintenance	83
11.2.2	Physical separation or grouping	84
11.2.3	Heating effects	84
11.3	Degrees of protection.....	85
11.4	Enclosures, doors and openings	85
11.5	Access to switchgear and to controlgear	86
11.5.1	General	86
11.5.2	Access to gangways	86
11.5.3	Gangways in front of switchgear and controlgear	87
12	Conductors and cables	87
12.1	General requirements	87
12.2	Conductors	87
12.3	Insulation	88
12.4	Current-carrying capacity in normal service	89
12.5	Conductor and cable voltage drop.....	90
12.6	Flexible cables	91
12.6.1	General	91
12.6.2	Mechanical rating	91
12.6.3	Current-carrying capacity of cables wound on drums	91
12.7	Conductor wires, conductor bars and slip-ring assemblies	92
12.7.1	Basic protection	92
12.7.2	Protective conductor circuit.....	94
12.7.3	Protective conductor current collectors	94
12.7.4	Removable current collectors with a disconnecter function	95
12.7.5	Clearances in air	95
12.7.6	Creepage distances	95
12.7.7	Conductor system sectioning	95
12.7.8	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies	95
13	Wiring practices.....	96
13.1	Connections and routing	96
13.1.1	General requirements	96
13.1.2	Conductor and cable runs.....	96

13.1.3	Conductors of different circuits	97
13.1.4	AC circuits – Electromagnetic effects (prevention of eddy currents)	97
13.1.5	Connection between pick-up and pick-up converter of an inductive power supply system	97
13.2	Identification of conductors	97
13.2.1	General requirements	97
13.2.2	Identification of the protective conductor / protective bonding conductor	98
13.2.3	Identification of the neutral conductor	98
13.2.4	Identification by colour	99
13.3	Wiring inside enclosures	99
13.4	Wiring outside enclosures	100
13.4.1	General requirements	100
13.4.2	External ducts	100
13.4.3	Connection to the hoisting machine and to moving elements on the hoisting machine	100
13.4.4	Interconnection of devices on the hoisting machine	101
13.4.5	Plug/socket combinations	101
13.4.6	Dismantling for shipment	102
13.4.7	Additional conductors	102
13.5	Ducts, connection boxes and other boxes	103
13.5.1	General requirements	103
13.5.2	Percentage fill of ducts	103
13.5.3	Rigid metal conduits and fittings	103
13.5.4	Flexible metal conduits and fittings	103
13.5.5	Flexible non-metallic conduits and fittings	103
13.5.6	Cable trunking systems	104
13.5.7	Hoisting machine compartments and cable trunking systems	104
13.5.8	Connection boxes and other boxes	104
13.5.9	Motor connection boxes	104
14	Electric motors and associated equipment	104
14.1	General requirements	104
14.2	Motor enclosures	105
14.3	Motor dimensions	105
14.4	Motor mounting and compartments	105
14.5	Criteria for motor selection	105
14.6	Protective devices for mechanical brakes	106
14.7	Electrically operated mechanical brakes	106
15	Socket-outlets and lighting	106
15.1	Socket-outlets for accessories	106
15.2	Local lighting of the hoisting machine and of the equipment	106
15.2.1	General	106
15.2.2	Supply	106
15.2.3	Protection	107
15.2.4	Fittings	107
16	Marking, warning signs and reference designations	107
16.1	General	107
16.2	Warning signs	107
16.2.1	Electric shock hazard	107
16.2.2	Hot surfaces hazard	108

16.2.3	Hazard from energy storage system	108
16.3	Functional identification	109
16.4	Marking of enclosures of electrical equipment.....	109
16.5	Reference designations	109
17	Technical documentation	109
17.1	General.....	109
17.2	Information related to the electrical equipment.....	110
18	Verification	111
18.1	General.....	111
18.2	Verification of conditions for protection by automatic disconnection of supply	111
18.2.1	General	111
18.2.2	Test 1 – Verification of the continuity of the protective bonding circuit	112
18.2.3	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device	112
18.2.4	Application of the test methods for TN-systems	112
18.3	Insulation resistance tests.....	114
18.4	Voltage tests.....	115
18.5	Protection against residual voltages.....	115
18.6	Functional tests	115
18.7	Retesting	115
Annex A (normative)	Fault protection by automatic disconnection of supply	116
A.1	Fault protection for machines supplied from TN-systems.....	116
A.1.1	General	116
A.1.2	Conditions for protection by automatic disconnection of the supply by overcurrent protective devices	116
A.1.3	Condition for protection by reducing the touch voltage below 50 V.....	117
A.1.4	Verification of conditions for protection by automatic disconnection of the supply.....	118
A.2	Fault protection for machines supplied from TT-systems	120
A.2.1	Connection to earth	120
A.2.2	Fault protection for TT systems	120
A.2.3	Verification of protection by automatic disconnection of supply using a residual current protective device (RCD).....	121
A.2.4	Measurement of the fault loop impedance (Z_S).....	122
Annex B (informative)	Enquiry form for the electrical equipment of hoisting machines.....	124
Annex C (informative)	Current-carrying capacity and overcurrent protection of conductors and cables in the electrical equipment of machines.....	128
C.1	General.....	128
C.2	General operating conditions	128
C.2.1	Ambient air temperature	128
C.2.2	Methods of installation.....	128
C.2.3	Grouping	129
C.2.4	Classification of conductors	131
C.3	Co-ordination between conductors and protective devices providing overload protection.....	131
C.4	Overcurrent protection of conductors	132
Annex D (informative)	Conductor selection for intermittent duty	134
D.1	General.....	134
D.2	Intermittent duty with 10-min cycle	134

D.3 Intermittent duty with any cycle time 135

D.4 Calculation of thermal equivalent current 136

Annex E (informative) Explanation of emergency operation functions..... 138

E.1 Emergency operations 138

E.2 Emergency stop 138

E.3 Emergency start..... 138

E.4 Emergency switching-off 138

E.5 Emergency switching-on 138

Annex F (informative) Comparison of typical conductor cross-sectional areas..... 139

Annex G (informative) Measures to reduce the effects of electromagnetic influences 141

G.1 General..... 141

G.2 Mitigation of electromagnetic interference (EMI) 141

G.2.1 General 141

G.2.2 Measures to reduce EMI 142

G.3 Separation and segregation of cables 142

G.4 Power supply of a machine by parallel sources 146

G.5 Supply impedance where a Power Drive System (PDS) is used 146

G.6 Emission levels for electrical equipment for PDS..... 146

G.7 Conducted disturbances..... 147

G.8 Immunity requirements – Performance criteria 148

Annex H (informative) Documentation and information 149

Bibliography..... 151

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 38

Figure 4 – Disconnecter isolator 40

Figure 5 – Disconnecting circuit breaker 40

Figure 6 – Example of equipotential bonding for electrical equipment of a hoisting machine 57

Figure 7 – Symbol IEC 60417-5019: Protective earth 60

Figure 8 – Symbol IEC 60417-5020: Frame or chassis 61

Figure 9 – Method a) Earthed control circuit fed by a transformer 71

Figure 10 – Method b1) Non-earthed control circuit fed by transformer 72

Figure 11 – Method b2) Non-earthed control circuit fed by transformer 72

Figure 12 – Method b3) Non-earthed control circuit fed by transformer 73

Figure 13 – Method c) Control circuits fed by transformer with an earthed centre-tap winding 74

Figure 14 – Method d1a) Control circuit without transformer connected between a phase and the neutral of an earthed supply system..... 75

Figure 15 – Method d1b) control circuit without transformer connected between two phases of an earthed supply system 75

Figure 16 – Method d2a) Control circuit without transformer connected between phase and neutral of a non-earthed supply system..... 76

Figure 17 – Method d2b) control circuit without transformer connected between two phases of a non-earthed supply system 76

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	93
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	93
Figure 20 – Limit of arm’s reach in cases of using additional obstacles	94
Figure 21– Symbol IEC 60417-5019.....	98
Figure 22 – Symbol IEC 60417-5021.....	98
Figure 23 – Symbol ISO 7010-W012	108
Figure 24 – Symbol ISO 7010-W017	108
Figure 25 – Warning sign: energy storage system.....	108
Figure A.1 – Typical arrangement for fault loop impedance (Z_S) measurement in TN systems	119
Figure A.2 – Typical arrangement for fault loop impedance (Z_S) measurement for power drive system circuits in TN systems.....	119
Figure A.3 – Typical arrangement for fault loop impedance (Z_S) measurement in TT systems	122
Figure A.4 – Typical arrangement for fault loop impedance (Z_S) measurement for Power Drive System circuits in TT systems.....	123
Figure C.1 – Methods of conductor and cable installation independent of number of conductors/cables.....	129
Figure C.2 – Parameters of conductors and protective devices	131
Figure D.1 – An example of current and time of the segments of the operating cycle of a variable speed AC hoist drive	136
Figure G.1 – By-pass conductor for screen reinforcement.....	142
Figure G.2 – Examples of vertical separation and segregation	144
Figure G.3 – Examples of horizontal separation and segregation	144
Figure G.4 – Cable arrangements in metal cable trays	145
Figure G.5 – Connections between metal cable trays or cable trunking systems	145
Figure G.6 – Interruption of metal cable trays at fire barriers	146
Table 1 – Minimum cross-sectional area of protective copper conductors	37
Table 2 – Symbols for actuators (power).....	79
Table 3 – Symbols for actuators (machine operation).....	79
Table 4 – Colours for indicator lights and their meanings with respect to the condition of the hoisting machine	80
Table 5 – Minimum cross-sectional areas of copper conductors	88
Table 6 – Classification of conductors.....	88
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	90
Table 8 – Derating factors for cables wound on drums	92
Table 9 – Minimum permitted bending radii for the forced guiding of flexible cables	101
Table 10 – Application of the test methods for TN-systems	113
Table 11 – Examples of maximum cable length from each protective device to their loads for TN-systems	114
Table A.1 – Maximum disconnecting times for TN systems	116

Table A.2 – Maximum disconnecting time for TT-systems	121
Table C.1 – Correction factors	128
Table C.2 – Derating factors for I_Z for grouping	130
Table C.3 – Derating factors for I_Z for multi-core cables up to 10 mm ²	130
Table C.4 – Classification of conductors	131
Table C.5 – Maximum allowable conductor temperatures under normal and short-circuit conditions	132
Table D.1 – Correction factor for 10 min cycle	135
Table D.2 – Thermal time constant of conductors.....	135
Table F.1 – Comparison of conductor sizes	139
Table G.1 – Minimum separation distances using metallic containment as illustrated in Figure G.2	143
Table G.2 – Limits for the interference voltage for the environments / categories	146
Table G.3 – Limits for propagated electromagnetic disturbance	147
Table G.4 – Limits for conducted disturbances.....	147
Table G.5 – Immunity requirements – performance criteria	148
Table H.1 – Documentation and information that can be applicable.....	149

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 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.