

INTERNATIONAL STANDARD



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

(<https://standards.iteh.ai>)

Document Preview

[IEC 60204-32:2023](#)

<https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ce-bde8-4d74c4457dca/iec-60204-32-2023>



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.

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 It also gives information on projects, replaced and withdrawn publications.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.

International Standards
standards.iteh.ai)
Document Preview

[IEC 60204-32:2023](https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ce-bde8-4d74c4457dca/iec-60204-32-2023)

<https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ce-bde8-4d74c4457dca/iec-60204-32-2023>



IEC 60204-32

Edition 3.0 2023-07
COMMENTED VERSION

INTERNATIONAL STANDARD



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

iteh Standard
(<https://standards.iteh.ai>)
Document Preview

[IEC 60204-32:2023](https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ee-bde8-4d74c4457dca/iec-60204-32-2023)

<https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ee-bde8-4d74c4457dca/iec-60204-32-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.020, 53.020.01

ISBN 978-2-8322-7186-5

Warning! Make sure that you obtained this publication from an authorized distributor.

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	58
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	99
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	124
	17.3 Requirements applicable to all documentation	124
	17.4 Installation documents	124
	17.5 Overview diagrams and function diagrams.....	124
	17.6 Circuit diagrams	124
	17.7 Operating manual	124
	17.8 Maintenance manual.....	124
	17.9 Parts list.....	124
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.....	130
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.....	140
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.
- 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.

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

<https://standards.iteh.ai/catalog/standards/iec/108261e1-ded5-48ce-bde8-4d74c4457dca/iec-60204-32-2023>

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).