BSI Standards Publication

Adjustable speed electrical power drive systems

Part 5-1: Safety requirements — Electrical, thermal and energy

bsi.

National foreword

This British Standard is the UK implementation of EN IEC 61800-5-1:2023. It is identical to IEC 61800-5-1:2022, incorporating corrigendum September 2023. It supersedes BS EN 61800-5-1:2007+A11:2021, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Amendments/corrigenda issued since publication

Date	Text affected
30 November 2023	Implementation of IEC corrigendum September 2023

EUROPEAN STANDARD **EN IEC 61800-5-1**

EUROPÄISCHE NORM

October 2023

ICS 29.200; 29.130.99; 13.110

Supersedes EN 61800-5-1:2007; EN 61800-5-1:2007/A1:2017; EN 61800-5-1:2007/A11:2021

English Version

Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1:2022 + COR1:2023)

Entraînements électriques de puissance à vitesse variable - Partie 5-1: Exigences de sécurité - Électrique, thermique et énergétique (IEC 61800-5-1:2022 + COR1:2023)

Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Teil 5-1: Anforderungen an die Sicherheit - Elektrische, thermische und energetische Anforderungen (IEC 61800-5-1:2022 + COR1:2023)

This European Standard was approved by CENELEC on 2022-10-05. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 22G/455/FDIS, future edition 3 of IEC 61800-5-1 + COR1, prepared by SC 22G "Adjustable speed electric power drive systems (PDS)" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61800-5-1:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-04-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-10-20

This document supersedes EN 61800-5-1:2007 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

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Endorsement notice

The text of the International Standard IEC 61800-5-1:2022 + COR1:2023 was approved by CENELEC as a European Standard without any modification.

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

IEC 60034-9:2021	NOTE	Approved as EN IEC 60034-9:—[1] (not modified)
IEC 60060-1:2010	NOTE	Approved as EN 60060-1:2010 (not modified)
IEC 60068-1:2013	NOTE	Approved as EN 60068-1:2014 (not modified)
IEC 60068-2-14	NOTE	Approved as EN IEC 60068-2-14
IEC 60068-2-31:2008	NOTE	Approved as EN 60068-2-31:2008 (not modified)
IEC 60071-1:2019	NOTE	Approved as EN IEC 60071-1:2019 (not modified)
IEC 60073:2002	NOTE	Approved as EN 60073:2002 (not modified)
IEC 60085:2007	NOTE	Approved as EN 60085:2008 (not modified)
IEC 60112:2020	NOTE	Approved as EN IEC 60112:2020 (not modified)
IEC 60127-2:2014	NOTE	Approved as EN 60127-2:2014 (not modified)
IEC 60127-4:2005	NOTE	Approved as EN 60127-4:2005 (not modified)

[1] To be published. Stage at the time of publication: FprEN IEC 60034-9:2021.

IEC 60216 (series)	NOTE	Approved as EN 60216 (series)
IEC 60320-1	NOTE	Approved as EN IEC 60320-1
IEC 60335-1:2020	NOTE	Approved as EN IEC 60335-1:—[2] (not modified)
IEC 60364 (series)	NOTE	Approved as HD 60364 (series)
IEC 60364-1:2005	NOTE	Approved as HD 60364-1:2008 + A11:2017
IEC 60364-4-44:2007	NOTE	Approved as HD 60364-4-444:2010
IEC 60364-4-44:2007/A1:2015	NOTE	Approved as HD 60364-4-443:2016
IEC 60364-5-52:2009	NOTE	Approved as HD 60364-5-52:2011 + A11:2017
IEC 60445:2021	NOTE	Approved as EN IEC 60445:2021 (not modified)
IEC 60664 (series)	NOTE	Approved as EN 60664 (series)
IEC 60695-10-3:2016	NOTE	Approved as EN 60695-10-3:2016 (not modified)
IEC 60695-11-5:2016	NOTE	Approved as EN 60695-11-5:2017 (not modified)
IEC 60721 (series)	NOTE	Approved as EN 60721 (series)
IEC 60947-2:2016	NOTE	Approved as EN 60947-2:2017 (not modified)
IEC 60947-7-2:2009	NOTE	Approved as EN 60947-7-2:2009 (not modified)
IEC 61082-1:2014	NOTE	Approved as EN 61082-1:2015 (not modified)
IEC 61140:2016	NOTE	Approved as EN 61140:2016 (not modified)
IEC 61148:2011	NOTE	Approved as EN 61148:2012 (not modified)
IEC 61439-1:2020	NOTE	Approved as EN IEC 61439-1:2021 (not modified)
IEC 61508 (series)	NOTE	Approved as EN 61508 (series)
IEC 61643-11:2011	NOTE	Approved as EN 61643-11:2012 + A11:2018
IEC 61643-12	NOTE	Approved as CLC/TS 61643-12
IEC 61800-1:2021	NOTE	Approved as EN IEC 61800-1:2021 (not modified)
IEC 61800-2:2021	NOTE	Approved as EN IEC 61800-2:2021 (not modified)
IEC 61800-3:2017	NOTE	Approved as EN IEC 61800-3:2018 (not modified)
IEC 61800-5-1:2007	NOTE	Approved as EN 61800-5-1:2007 (not modified) + A11:2021
IEC 61800-5-1:2007/A1:2016	NOTE	Approved as EN 61800-5-1:2007/A1:2017 (not modified)
IEC 61800-5-2	NOTE	Approved as EN 61800-5-2
IEC 61800-5-3	NOTE	Approved as EN IEC 61800-5-3
IEC/TR 61800-6:2003	NOTE	Approved as CLC/TR 61800-6:2007 (not modified)
IEC 61800-7 (series)	NOTE	Approved as EN 61800-7 (series)

[2] To be published. Stage at the time of publication: FprEN IEC 60335-1:2023.

IEC 61936-1:2021	NOTE	Approved as EN IEC 61936-1:2021 (not modified)
IEC 62311:2019	NOTE	Approved as EN IEC 62311:2020 (not modified)
IEC/IEEE 82079-1:2019	NOTE	Approved as EN IEC/IEEE 82079-1:2020 (not modified)
IEC 60076-1:2011	NOTE	Approved as EN 60076-1:2011 (not modified)
IEC 60127 (series)	NOTE	Approved as EN IEC 60127 (series)
IEC 60309-1	NOTE	Approved as EN IEC 60309-1
IEC 60317 (series)	NOTE	Approved as EN IEC 60317 (series)
IEC 60384-14:2013	NOTE	Approved as EN 60384-14:2013 (not modified)
IEC 60691:2015	NOTE	Approved as EN 60691:2016 (not modified)
IEC 60730 (series)	NOTE	Approved as EN IEC 60730 (series)
IEC 60738-1:2006	NOTE	Approved as EN 60738-1:2006 (not modified)
IEC 60747-5-5:2020	NOTE	Approved as EN IEC 60747-5-5:2020 (not modified)
IEC 60825 (series)	NOTE	Approved as EN 60825 (series)
IEC 60940:2015	NOTE	Approved as EN 60940:2015 (not modified)
IEC 60947 (series)	NOTE	Approved as EN IEC 60947 (series)
IEC 60947-7-1:2009	NOTE	Approved as EN 60947-7-1:2009 (not modified)
IEC 61008 (series)	NOTE	Approved as EN 61008 (series)
IEC 61009 (series)	NOTE	Approved as EN 61009 (series)
IEC 61010-1:2010	NOTE	Approved as EN 61010-1:2010 (not modified)
IEC 61051-2:2021	NOTE	Approved as EN IEC 61051-2:2021 (not modified)
IEC 61058-1:2016	NOTE	Approved as EN IEC 61058-1:2018 (not modified)
IEC 61071:2017	NOTE	Approved as EN 61071:—[3] (not modified)
IEC 61204-7:2016	NOTE	Approved as EN IEC 61204-7:2018 (not modified)
IEC 61558-2-16:2021	NOTE	Approved as EN IEC 61558-2-16:—[4] (not modified)
IEC 61810-1:2015	NOTE	Approved as EN 61810-1:2015 (not modified)
IEC 61984:2008	NOTE	Approved as EN 61984:2009 (not modified)
IEC 62368-1:2018	NOTE	Approved as EN IEC 62368-1:2020 (not modified) + A11:2020
IEC 62423:2009	NOTE	Approved as EN 62423:2012 + A11:2021

[3] To be published. Stage at the time of publication: FprEN 61071:2017.

[4] To be published. Stage at the time of publication: FprEN IEC 61558-2-16:2021.

(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

Publication	Year	Title	EN/HD	Year
IEC 60034	series	Rotating electrical machines	-	series
IEC 60034-1	2022	Rotating electrical machines - Part 1: Rating and performance	-	-
IEC 60034-5	2020	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification	EN IEC 60034-5	2020
IEC 60050-112	-	International Electrotechnical Vocabulary - Part 112: Quantities and units	-	-
IEC 60050-113	-	International Electrotechnical Vocabulary - Part 113: Physics for electrotechnology	-	-
IEC 60050-114	-	International Electrotechnical Vocabulary - Part 114: Electrochemistry	-	-
IEC 60050-131	-	International Electrotechnical Vocabulary - Part 131: Circuit theory	-	-
IEC 60050-151	-	International Electrotechnical Vocabulary - Part 151: Electrical and magnetic devices	-	-
IEC 60050-161	-	International Electrotechnical Vocabulary. Chapter 161: Electromagnetic compatibility	-	-
IEC 60050-192	-	International electrotechnical vocabulary - Part 192: Dependability	-	-
IEC 60050-426	-	International Electrotechnical Vocabulary (IEV) - Part 426: Explosive atmospheres	-	-
IEC 60050-441	-	International Electrotechnical Vocabulary. Switchgear, controlgear and fuses	-	-
IEC 60050-442	-	International Electrotechnical Vocabulary - Part 442: Electrical accessories	-	-
IEC 60050-551	-	International Electrotechnical Vocabulary - Part 551: Power electronics	-	-

IEC 60050-601	-	International Electrotechnical Vocabulary. Chapter 601: Generation, transmission and distribution of electricity - General	-	-
IEC 60050-826	-	International Electrotechnical Vocabulary - Part 826: Electrical installations	-	-
IEC 60050-903	-	International electrotechnical vocabulary_- Part_903: Risk assessment	-	-
IEC 60068-2-1	2007	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	2007
IEC 60068-2-2	2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-6	2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-30	-	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	-
IEC 60068-2-30	2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-2-52	2017	Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)	EN IEC 60068-2-52	2018
IEC 60068-2-68	1994	Environmental testing - Part 2-68: Tests - Test L: Dust and sand	EN 60068-2-68	1996
IEC 60068-2-78	2012	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2013
IEC 60204-11	2018	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV	EN IEC 60204-11	2019
IEC 60320	-	Appliance couplers for household and similar general purposes	-	-
IEC 60364	series	Low-voltage electrical installations	HD 60364	series
+ A1	2017		-	-
IEC 60364-4-41 (mod)	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	2017
-	-		+ A11	2017
-	-		+ A12	2019
IEC 60364-5-54	2011	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors	HD 60364-5-54	2011
-	-		+ A11	2017
IEC 60417	-	Graphical symbols for use on equipment. Index, survey and compilation of the single sheets.	-	-

IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
-	-		+ corrigendum May	1993
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013
IEC 60617	-	Standard data element types with associated classification scheme for electric components - Part 4: IEC reference collection of standard data element types and component classes	-	-
IEC 60664-1	2020	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	2020
IEC 60664-3	2016	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	2017
IEC 60664-4	2005	Insulation coordination for equipment within low-voltage systems - Part 4: Consideration of high-frequency voltage stress	EN 60664-4	2006
-	-		+ corrigendum Oct.	2006
IEC 60695-2-10	2021	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN IEC 60695-2-10	2021
IEC 60695-2-11	2021	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end products (GWEPT)	EN IEC 60695-2-11	2021
IEC 60695-2-13	2021	Fire hazard testing - Part 2-13: Glowing/hot-wire based test methods - Glow-wire ignition temperature (GWIT) test method for materials	EN IEC 60695-2-13	2021
IEC 60695-10-2	2014	Fire hazard testing - Part 10-2: Abnormal heat - Ball pressure test method	EN 60695-10-2	2014
IEC 60695-11-10	2013	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	2013
IEC 60695-11-20	2015	Fire hazard testing - Part 11-20: Test flames - 500 W flame test method	EN 60695-11-20	2015
+ A1	1995		-	-
+ A2	1996		-	-
IEC 60721-3-3	1994	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weatherprotected locations	-	-

IEC 60721-3-4	2019	Classification of environmental conditions - Part 3-4: Classification of groups of environmental parameters and their severities - Stationary use at non-weatherprotected locations	EN IEC 60721-3-4	2019
IEC 60730-1 (mod)	2013	Automatic electrical controls - Part 1: General requirements	EN 60730-1	2016
+ A1	2015		+ A1	2019
+ A2	2020		+ A2	2022
IEC 60755	2017	General safety requirements for residual current operated protective devices	-	-
IEC 60799	2018	Electrical accessories - Cord sets and interconnection cord sets	EN IEC 60799	2021
IEC 60947-4-1	2018	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN IEC 60947-4-1	2019
IEC 60990	2016	Methods of measurement of touch current and protective conductor current	EN 60990	2016
IEC 61032	1997	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	1998
IEC 61084	series	Cable trunking systems and cable ducting systems for electrical installations	-	series
IEC 61180	2016	High-voltage test techniques for low-voltage equipment - Definitions, test and procedure requirements, test equipment	EN 61180	2016
IEC 61189-3	2007	Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 3: Test methods for interconnection structures (printed boards)	EN 61189-3	2008
IEC 61230	2008	Live working - Portable equipment for earthing or earthing and short-circuiting	EN 61230	2008
IEC 61386	series	Conduit systems for cable management	EN 61386	series
IEC 61558-1	2017	Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests	EN IEC 61558-1	2019
IEC 62109-1	2010	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	EN 62109-1	2010
IEC 62271-102	2018	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches	EN IEC 62271-102	2018
IEC 62477-1	2022	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN IEC 62477-1	2023
IEC 62477-2	2018	Safety requirements for power electronic converter systems and equipment - Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC	EN IEC 62477-2	2018

ISO 3746	-	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane	EN ISO 3746	-
ISO 3864-1	2011	Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings	-	-
ISO 7000	-	Graphical symbols for use on equipment - Registered symbols	-	-
ISO 7010	-	Graphical symbols - Safety colours and safety signs - Registered safety signs	-	-
ISO 9614-1	-	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points	EN ISO 9614-1	2009

Edition 3.0 2022-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Entraînements électriques de puissance à vitesse variable – Partie 5-1: Exigences de sécurité – Électrique, thermique et énergétique

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 5-1: Safety requirements – Electrical, thermal and energy

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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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 61800-5-1 has been prepared by subcommittee 22G: Adjustable speed electric power drive systems (PDS), of IEC technical committee 22: Power electronic systems and equipment. It is an International Standard.

This third edition cancels and replaces the second edition published in 2007 and Amendment 1:2016. This edition constitutes a technical revision.

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

a) harmonization with IEC 62477-1:2022;
b) harmonization with UL 61800-5-1 and CSA C22.2 No. 274, including an annex with a list of national deviation which was considered not possible to harmonize within a reasonable timeframe;
c) more detailed information about the evaluation of components according to this document and relevant safety component standards;
d) updated requirement for mechanical hazards including multiple IP ratings.

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

Draft	Report on voting
22G/455/FDIS	22G/457/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/publications.

In this document, terms in *italic* are defined in Clause 3.

The reader's attention is drawn to the fact that

- Annex S and Annex T list all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.
- Due to the rules of ISO/IEC Directives, Part 2, the term "must" instead of the term "shall" is used in Annex S and Annex T.

A list of all parts of the IEC 61800 series, published under the general title *Adjustable speed electrical power drive systems,* is available on the IEC website.

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 publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

The contents of the corrigendum 1 (2023-09) have been included in this copy.

INTRODUCTION

0.1 General

This document contains the revision of IEC 61800-5-1:2007 and IEC 61800-5-1:2007/AMD1:2016.

Several important issues have influenced the scope and the chosen approach of the maintenance of IEC 61800-5-1:2007 in the development of this document.

The most significant changes compared to IEC 61800-5-1:2007 are the following.

a) Structure and content is based on IEC 62477-1 considering modifications and new topics such as the following

- Clause 1: Scope updated to include radio emitting/transmitting *BDM/CDM/PDS*.
- 4.1, 5.1, 6.1: "Intended use" included.
- 4.2: Single fault/abnormal operation analysis (significantly reworked).
- 4.3: Short-circuit and overload protection included as new subclause.
- 4.4 and Annex A: Protection against electric shock updated according to IEC 61140:2016 and IEC 60364-4-41, including insulation coordination according to IEC 60664 (all parts) considering the following:
  - 4.4.2 – Decisive voltage classification (especially DVC As for dry, wet and salt-water wet); Table 2 and Table 3 reworked;
  - 4.4.3 – Basic protection (reworked);
  - 4.4.4 – Fault protection (reworked);
  - 4.4.5 – Enhanced protection (reworked);
  - 4.4.7 – Insulation (reworked):
    - 4.4.7.1.2 – Working voltage (new);
    - 4.4.7.1.8 – Component*s* bridging insulation (new);
    - 4.4.7.7 – *clearance* and *creepage distances* for functional insulation on PWB and component assemblies (reworked);
    - 4.4.7.8 – Solid insulation (new/reworked);
    - 4.4.7.9 – Connection of parts of solid insulation (cemented joints) (new);
  - 4.4.8/Annex H – Compatibility with RCD (reworked);
  - 4.4.10 – Access conditions for *high-voltage PDS* (new).
- 4.5: Protection against energy hazards (new).
- 4.6: Protection against fire and thermal hazards (new).
- 4.7: Protection against mechanical hazards (new).
- 4.8: *BDM/CDM/PDS* with multiple sources of supply (new).
- 4.9: Protection against environmental stresses (new) (in alignment with IEC 61800-2).
- 4.11: Wiring and connections updated (significantly reworked).
- 4.12: Enclosure updated (significantly reworked).
- 4.13 Bibliography: Evaluation of component*s* (new).
- 4.14 Annex P: Protection against electromagnetic fields (new).
- Clause 5: Updated with some additional/modified test requirement:
  - 5.2.2.2 – Non-accessibility test (significantly reworked);
  - 5.2.2.3 – Ingress protection test (IP rating) (significantly reworked);

- 5.2.2.4 – Enclosure integrity tests (new);
- 5.2.2.5 – Wall or ceiling mounted *BDM/CDM/PDS* test (new);
- 5.2.2.6 – Handles and manual control securement test (new);
- 5.2.2.7 – Strain relief test (new);
- 5.2.3.7 – Touch current measurement test (reworked);
- 5.2.3.9 – Limited power source (new);
- 5.2.3.11 – Protective equipotential bonding test (new);
- 5.2.3.12 – Input test (new);
- 5.2.3.13 – Thin sheet material test (new);
- 5.2.3.14 – Test procedure for determination of working voltage (new);
- 5.2.3.16 – Preconditoning of material (reworked);
- 5.2.4.4 – Protective equipotential bonding short-circuit test (new);
- 5.2.4.9 – Output overload test (new);
- 5.2.4.13.5 – Covering of openings for cooling air test (type test) (new);
- 5.2.5.6 – Cemented joints test (new);
- 5.2.7 – Hydrostatic pressure test (new);
- 5.2.8 – Electromagnetic fields (EMF) test (new).

- Clause 6: – Update with more specific marking.
  - Structure aligned with IEC 62477-1 as close as possible;
  - Table 48 simplified.
- Annex A – Additional information for protection against electric shock (reworked).
- Annex C – Symbols referred (reworked).
- Annex E – Altitude correction for *clearance*s (reworked).
- Annex F – *Clearance* and *creepage distance* determination for frequencies greater than 30 kHz (reworked).
- Annex H – Guidelines for RCD compatibility (reworked).
- Annex M – Test probes for determining access (new).
- Annex O – Guidance for determination of *clearance* and *creepage distance* (new).
- Annex P – Protection of persons against electromagnetic fields for frequencies from 0 Hz up to 300 GHz (new).
- Annex Q – Automatic disconnection of supply (new).
- Annex R – Guide 116 risk evaluation included (new).
- Bibliography – Relevant component safety standards (new).

b) Harmonization with UL 61800-5-1

Complete document is modified taken into consideration UL 61800-5-1 US National deviations. US National deviations from UL 61800-5-1 not possible to harmonize have been placed in Annex S.

c) Harmonization with CSA C22.2 No. 274

- Due to a short time frame, only some few topics have been harmonized.
- Canadian National deviations from CSA C22.2 No. 274 not possible to harmonize have been placed in Annex T.

d) Harmonization with UL 347A

- Some few relevant topics have been harmonized considering safety aspects related to *high-voltage BDM/CDM/PDS.*

Further harmonization is expected to be adopted in IEC 61800-5-1 considering the content of UL 61800-5-1, CSA C22.2 No 274 and UL 347A in future editions of IEC 61800-5-1.

0.2 Feedback from industry and national committees

The use of IEC 61800-5-1:2007 by manufacturers and test institutes since its release has identified several topics which are considered useful to implement, or topics which need further information for a better understanding of the intent of the specific requirement. These topics are also implemented in this document.

0.3 Requirement covered by other relevant parts of the IEC 61800 series

- general requirements for DC *power drive systems* are covered in IEC 61800-1;
- general requirements for AC *power drive systems* are covered in IEC 61800-2;
- EMC aspects are covered in IEC 61800-3;
- functional safety aspects are covered in IEC 61800-5-2;
- functional safety aspects for encoders are covered in IEC 61800-5-3;
- type of load duty aspects are covered in IEC TR 61800-6;
- communication profiles aspects are covered in IEC 61800-7 (all parts);
- *power interface* voltage aspects are covered in IEC TS 61800-8;
- ecodesign aspects are covered in IEC 61800-9 (all parts);

The following document is not part of the IEC 61800 series, but is used often as part of the BDM:

- active infeed converters in IEC TS 62578.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 5-1: Safety requirements – Electrical, thermal and energy

1 Scope

This part of IEC 61800 specifies requirements for adjustable speed electrical *power drive systems (PDS)* or their elements, with respect to electrical, thermal, fire, mechanical, energy and other relevant hazards. It does not cover the driven equipment except for interface requirements. It applies to adjustable speed electrical *PDS* which include the power conversion, *basic drive module (BDM)/complete drive module (CDM)* control, and a motor or motors.

Excluded are traction and electric vehicle *BDM/CDM*.

It applies to low-voltage adjustable speed electrical *PDS* intended to feed a motor or motors from a *BDM/CDM* connected to phase-to-phase voltages of up to and including 1,0 kV AC (50 Hz or 60 Hz) and up to and including 1,5 kV DC.

It also applies to high-voltage adjustable speed electrical *PDS* intended to feed a motor or motors from a *BDM/CDM* connected to phase-to-phase voltages of up to and including 35 kV AC (50 Hz or 60 Hz) and up to and including 52 kV DC.

NOTE 1 At the time of publication of this document, the technical upper voltage limit for DC motors is 2,25 kV DC.

NOTE 2 Above voltage and frequency limits reflect the scope of IEC 61800-1 and IEC 61800-2.

NOTE 3 For adjustable speed electrical *PDS* not covered by the scope of this document, applicable requirements of other standards, for example IEC 62477-1 and IEC 62477-2, can be used.

This document also applies to *PDS* which intentionally emit or receive radio waves for the purpose of radio communication.

Motors for driven equipment (see Figure 1) are covered by IEC 60034 (all parts).

NOTE 4 In some cases, safety requirements of the *PDS* (for example, protection against access to hazardous parts) can necessitate the use of special components and/or additional measures.

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 (all parts), *Rotating electrical machines*

IEC 60034-1:2022, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-5:2020, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

IEC 60050-112, *International Electrotechnical Vocabulary (IEV) – Part 112: Quantities and units* (available at www.electropedia.org)