BSI Standards Publication

Adjustable speed electrical power drive systems

Part 5-1: Safety requirements – Electrical, thermal and energy (IEC 61800-5-1:2007)

bsi.

National foreword

This British Standard is the UK implementation of EN 61800-5-1:2007+A1:2017. It is identical to IEC 61800-5-1:2007, incorporating amendment 1:2016. It supersedes BS EN 61800-5-1:2007, which will be withdrawn on 28 April 2020.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment A1 is indicated by 〚A1〉 〈A1〛.

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 secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments/corrigenda issued since publication

Date	Text affected
31 May 2018	Implementation of IEC amendment 1:2016 with CENELEC endorsement A1:2017

EUROPEAN STANDARD EN 61800-5-1:2007

NORME EUROPÉENNE

EUROPÄISCHE NORM April 2017

ICS 29.130

Supersedes EN 61800-5-1:2003

English Version

Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1:2007)

Entraînements électriques de puissance à vitesse variable — Partie 5-1: Exigences de sécurité — Electrique, thermique et énergétique (IEC 61800-5-1:2007)

Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl — Teil 5-1: Anforderungen an die Sicherheit — Elektrische, thermische und energetische Anforderungen (IEC 61800-5-1:2007)

This European Standard was approved by CENELEC on 2007-08-01. 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 Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 61800-5-1:2007+A1:2017: E

European Foreword

The text of document 22G/178/FDIS, future edition 2 of IEC IEC 61800-5-1, prepared by SC 22G "Adjustable speed electric drive systems incorporating semiconductor power converters" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61800-5-1 on 2007-08-01.

This European Standard supersedes EN 61800-5-1:2003.

The major areas of change in EN 61800-5-1:2007 are the following:

— addition of alphabetical Table 1 in Clause 3;

— addition of Table 2 in 4.1 for relevance to PDS/CDM/BDM;

— addition of Table 4 summary of decisive voltage class requirements;

— expansion of subclause on protective bonding (4.3.5.3);

— clarification of distinction between touch current and protective conductor current;

— revision of section on insulation (now 4.3.6) to include solid insulation;

— addition of overvoltage categories I and II to HV insulation voltage;

— revision of section on Solid insulation (now 4.3.6.8);

— addition of high-frequency insulation requirements (4.3.6.9, Annex E);

— addition of requirements for liquid-cooled PDS (4.4.5);

— addition of climatic and vibration tests (5.2.6);

— clarification of voltage test procedure to avoid over-stress of basic insulation (5.2.3.2.3);

— revision of short-circuit test requirement for large, high-voltage and one-off PDS (now 5.2.3.6);

— addition of informative Annex B for overvoltage category reduction.

The following dates are fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-05-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-08-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61800-5-1:2007 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 standards indicated:

IEC 60034-9	NOTE	Harmonized as EN 60034-9:2005 (modified).
IEC 60071	NOTE	Harmonized as EN 60071 series (not modified).
IEC 60071-1	NOTE	Harmonized as EN 60071-1:2006 (not modified).

IEC 60071-2	NOTE	Harmonized as EN 60071-2-1997 (not modified).
IEC 60146-1-1	NOTE	Harmonized as EN 60146-1-1:1993 (not modified).
IEC 60309-1	NOTE	Harmonized as EN 60309-1:1999 (not modified).
IEC 60364-4-44	NOTE	Amendment 1:2003 to IEC 60364-4-44:2001 is harmonized as HD 60364-4-443:2006 (modified).
IEC 60664	NOTE	Harmonized as EN 60664 series (not modified).
IEC 60695-2-11	NOTE	Harmonized as EN 60695-2-11:2001 (not modified).
IEC 60695-2-12	NOTE	Harmonized as EN 60695-2-12:2001 (not modified).
IEC 60721	NOTE	Harmonized as EN 60721 series (not modified).
IEC 61082	NOTE	Harmonized as EN 61082 series (not modified).
IEC 61140	NOTE	Harmonized as EN 61140 2002 (not modified).
IEC 61180-1	NOTE	Harmonized as EN 61180-1:1994 (not modified).
IEC 61189-2	NOTE	Harmonized as EN EN 61189-2:2006 (not modified).
IEC 61643-12	NOTE	Harmonized as EN CLC/TS 61643-12:2006 (modified).
IEC 61800-3	NOTE	Harmonized as EN 61800-3:2004 (not modified).
IEC 62079	NOTE	Harmonized as EN 62079:2001 (not modified).

European foreword to amendment A1

The text of document 22G/338/FDIS, future IEC 61800-5-1:2007/A1, prepared by SC 22G "Adjustable speed electric drive systems incorporating semiconductor power converters" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61800-5-1:2007/A1:2017.

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) 2017-10-28
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-04-28

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Endorsement notice

The text of the International Standard IEC 61800-5-1:2007/A1:2016 was approved by CENELEC as a European Standard without any modification.

In the bibliography of EN 61800-5-1:2007, the following notes have to be **added** for the standards indicated:

IEC 60664-1:2007	NOTE	Harmonized as EN 60664-1:2007 (not modified).
IEC 62477-1:2012	NOTE	Harmonized as EN 62477-1:2012 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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 When 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.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60034	Series	Rotating electrical machines	EN 60034	Series
IEC 60034-1	-[1)]	Rotating electrical machines - Part 1: Rating and performance	EN 60034-1	2004[2)]
IEC 60034-5	-[1)]	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification	EN 60034-5	2001[2)]
IEC 60050-111	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 111: Physics and chemistry	-	-
IEC 60050-151	-[1)]	International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices	-	-
IEC 60050-161	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-
IEC 60050-191	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
IEC 60050-441	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 441: Switchgear, controlgear and fuses	-	-
IEC 60050-442	-[1)]	International Electrotechnical Vocabulary (IEV) - Part 442: Electrical accessories	-	-
IEC 60050-551	-[1)]	International Electrotechnical Vocabulary (IEV) - Part 551: Power electronics	-	-
IEC 60050-601	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 601: Generation, transmission and distribution of electricity - General	-	-
IEC 60060-1	1989	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1 S1	1991

1) Undated reference.

2) Valid edition at date of issue.

3) EN 60068-2-2 includes supplement A:1976 to IEC 60068-2-2.

4) IEC 60364-1:2005 (modified) will be submitted to formal vote for acceptance as HD 60364-1.

5) EN 60664-1 is superseded by EN 60664-1:2007, which is based on IEC 60664-1:2007

6) At draft stage.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-2	1974	Environmental testing - Part 2: Tests - Tests B: Dry heat	EN 60068-2-2[3)]	1993
IEC 60068-2-6	-[1)]	Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	1995[2)]
IEC 60068-2-78	-[1)]	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001[2)]
IEC 60112	2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003
IEC 60204-11	-[1)]	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV	EN 60204-11	2000
IEC 60309 (mod)	Series	Plugs, socket-outlets and couplers for industrial purposes	EN 60309	Series
IEC 60364-1 (mod)	-[1)]	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions	-[4)]	-
IEC 60364-4-41 (mod)	2005	Low-voltage electical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41 + corr. July	2007 2007
+A1	2016		+A1	201X[6)]
IEC 60364-5-54 (mod)	2002	Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors	HD 60364-5-54	2007
IEC 60417	Database	Graphical symbols for use on equipment	-	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 1993
IEC 60617	Database	Graphical symbols for diagrams	-	-
IEC 60664-1 +A1 +A2	1992 2000 2002	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1[5)]	2003
IEC 60664-3	2003	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	2003
IEC 60664-4	2005	Insulation coordination for equipment within low-voltage systems - Part 4: Consideration of high-frequency voltage stress	EN 60664-4 + corr. October	2006 2006
IEC 60695-2-10	-[1)]	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2001[2)]
IEC 60695-2-13	-[1)]	Fire hazard testing - Part 2-13: Glowing/hot-wire based test methods - Glow-wire ignitability test method for materials	EN 60695-2-13	2001[2)]

1) Undated reference.

2) Valid edition at date of issue.

3) EN 60068-2-2 includes supplement A:1976 to IEC 60068-2-2.

4) IEC 60364-1:2005 (modified) will be submitted to formal vote for acceptance as HD 60364-1.

5) EN 60664-1 is superseded by EN 60664-1:2007, which is based on IEC 60664-1:2007

6) At draft stage.

Publication	Year	Title	EN/HD	Year
IEC 60695-11-10	-[1)]	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	1999[2)]
IEC 60695-11-20	-[1)]	Fire hazard testing - Part 11-20: Test flames - 500 W flame test methods	EN 60695-11-20	1999[2)]
IEC/TR 60755	-[1)]	General requirements for residual current operated protective devices	-	-
IEC 60947-4-1	2009	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN 60947-4-1	2010
+A1	2012		+A1	2012
IEC 60947-7-1	2002	Low-voltage switchgear and controlgear - Part 7-1: Ancillary equipment - Terminal blocks for copper conductors	EN 60947-7-1	2002
IEC 60947-7-2	2002	Low-voltage switchgear and controlgear - Part 7-2: Ancillary equipment - Terminal blocks for copper conductors	EN 60947-7-2	2002
IEC 60990	1999	Methods of measurement of touch current and protective conductor current	EN 60990	1999
IEC 61230 (mod)	-[1)]	Live working - Portable equipment for earthing or earthing and short-circuiting	EN 61230 +A11	1995[2)] 1999
IEC 61800-1	-[1)]	Adjustable speed electrical power drive systems - Part 1: General requirements - Rating specifications for low voltage adjustable speed d.c. power drive systems	EN 61800-1	1998[2)]
IEC 61800-2	-[1)]	Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems	EN 61800-2	1998[2)]
IEC 61800-4	-[1)]	Adjustable speed electrical power drive systems - Part 4: General requirements - Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV	EN 61800-4	2003[2)]
IEC 62020	-[1)]	Electrical accessories - Residual current monitors for household and similar uses (RCMs)	-	-
IEC 62271-102	-[1)]	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches	EN 62271-102 + corr. March	2002[2)] 2005
ISO 3864	Series	Graphical symbols - Safety colours and safety signs	-	-
ISO 7000	2004	Graphical symbols for use on equipment - Index and synopsis	-	-

1) Undated reference.

2) Valid edition at date of issue.

3) EN 60068-2-2 includes supplement A:1976 to IEC 60068-2-2.

4) IEC 60364-1:2005 (modified) will be submitted to formal vote for acceptance as HD 60364-1.

5) EN 60664-1 is superseded by EN 60664-1:2007, which is based on IEC 60664-1:2007

6) At draft stage.

Contents

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.

International Standard IEC 61800-5-1 has been prepared by subcommittee 22G: Semiconductor power converters for adjustable speed electric drive systems, of IEC technical committee 22: Power electronic systems and equipment.

This second edition cancels and replaces the first edition published in 2003. It constitutes a technical revision.

The major areas of change in this edition are the following:

a) addition of alphabetical Table 1 in Clause 3;

b) addition of Table 2 in 4.1 for relevance to PDS/CDM/BDM;

c) addition of Table 4 summary of decisive voltage class requirements;

d) expansion of subclause on protective bonding (4.3.5.3);

e) clarification of distinction between touch current and protective conductor current;

f) revision of section on insulation (now 4.3.6) to include solid insulation;

g) addition of overvoltage categories I and II to HV insulation voltage;

h) revision of section on Solid insulation (now 4.3.6.8)

i) addition of high-frequency insulation requirements (4.3.6.9, Annex E);

j) addition of requirements for liquid-cooled PDS (4.4.5);

k) addition of climatic and vibration tests (5.2.6);

l) clarification of voltage test procedure to avoid over-stress of basic insulation (5.2.3.2.3);

m) revision of short-circuit test requirement for large, high-voltage and one-off PDS (now 5.2.3.6);

n) addition of informative Annex B for overvoltage category reduction.

The text of this standard is based on the following documents:

FDIS	Report on voting
22G/178/FDIS	22G/181/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

Terms in *italics* in the text are defined in Clause 3.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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 *power drive systems*, or their elements, with respect to electrical, thermal and energy safety considerations. It does not cover the driven equipment except for interface requirements. It applies to adjustable speed electric drive systems which include the power conversion, drive control, and motor or motors. Excluded are traction and electric vehicle drives. It applies to d.c. drive systems connected to line voltages up to 1 kV a.c., 50 Hz or 60 Hz and a.c. drive systems with converter input voltages up to 35 kV, 50 Hz or 60 Hz and output voltages up to 35 kV.

Other parts of IEC 61800 cover rating specifications, EMC, functional safety, etc.

The scope of this part of IEC 61800 does not include devices used as component parts of a *PDS* if they comply with the safety requirements of a relevant product standard for the same environment. For example, motors used in *PDS* shall comply with the relevant parts of IEC 60034.

Unless specifically stated, the requirements of this International Standard apply to all parts of the *PDS*, including the *CDM*/*BDM* (see Figure 1).

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

2 Normative references

The following referenced documents are indispensable for the application 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 This does not mean that compliance is required with all clauses of the referenced documents, but rather that this international standard makes a reference that cannot be understood in the absence of the referenced document.

IEC 60034 (all parts), *Rotating electrical machines*

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

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

IEC 60050-111, *International Electrotechnical Vocabulary (IEV) — Chapter 111: Physics and chemistry*

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) — Part 151: Electrical and magnetic devices*

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic compatibility*

IEC 60050-191, *International Electrotechnical Vocabulary (IEV) — Chapter 191: Dependability and quality of service*

IEC 60050-441, *International Electrotechnical Vocabulary (IEV) — Chapter 441: Switchgear, controlgear and fuses*