

**REGULEERITAVA KIIRUSEGA ELEKTRIAJAMISÜSTEEMID.
OSA 5-1: OHUTUSNÕUDED. ELEKTRILISED, SOOJUSLIKUD
JA ENERGEETILISED NÕUDED**

Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1:2007 + IEC 61800-5-1:2007/A1:2016)

EESTI STANDARDI EESSÕNA**NATIONAL FOREWORD**

See Eesti standard EVS-EN 61800-5-1:2007 +A1+A11:2021 sisaldab Euroopa standardi EN 61800-5-1:2007 ja selle muudatuste A1:2017 ja A11:2021, ingliskeelset teksti.	This Estonian standard EVS-EN 61800-5-1:2007 +A1+A11:2021 consists of the English text of the European standard EN 61800-5-1:2007 and its amendments A1:2017 and A11:2021.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 23.11.2007, muudatused A1 28.04.2017 ja A11 05.02.2021.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. Date of Availability of the European standard is 23.11.2007, for A1 28.04.2017 and A11 05.02.2021.
Muudatusega A1 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega A1 A1 . Muudatusega A11 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega A11 A11 . Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.	The start and finish of text introduced or altered by amendment A1 is indicated in the text by tags A1 A1 . The start and finish of text introduced or altered by amendment A11 is indicated in the text by tags A11 A11 . The standard is available from the Estonian Centre for Standardisation and Accreditation.

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ICS 29.130

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English Version

**Adjustable speed electrical power drive systems -
Part 5-1: Safety requirements - Electrical, thermal and energy
(IEC 61800-5-1:2007 + IEC 61800-5-1:2007/A1:2016)**

Entraînements électriques de puissance à vitesse variable -
Partie 5-1: Exigences de sécurité - Electrique, thermique et
énergétique
(CEI 61800-5-1:2007 + IEC 61800-5-1:2007/A1:2016)

Elektrische Leistungsantriebssysteme mit einstellbarer
Drehzahl - Teil 5-1: Anforderungen an die Sicherheit -
Elektrische, thermische und energetische Anforderungen
(IEC 61800-5-1:2007 + IEC 61800-5-1:2007/A1:2016)

This European Standard was approved by CENELEC on 2007-08-01. Amendment A1 was approved by CENELEC on 2016-10-05. Amendment A11 was approved by CENELEC on 2020-11-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard and its amendments the status of a national standard without any alteration.

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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

Foreword

The text of document 22G/178/FDIS, future edition 2 of 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 were 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 in 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 in 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 in EN 60721 series (not modified).
IEC 61082	NOTE Harmonized in 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 61189-2:2006 (not modified).
IEC 61643-12	NOTE Harmonized as 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).

A1 Amendment A1 European foreword

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 (dop) 2017-10-28
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (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.

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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).

A11 Amendment A11 European foreword

This document (EN 61800-5-1:2007/A11:2021) has been prepared by CLC/TC 22X "Power electronics".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-08-05
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2023-11-17

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For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document. **A11**



IEC 61800-5-1

Edition 2.1 2016-08

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**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 – Electrique, thermique et énergétique**



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CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**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 – Electrique, thermique et énergétique**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –**Part 5-1: Safety requirements –
Electrical, thermal and energy**

FOREWORD

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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

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- replaced by a revised edition, or
- amended.

A1 AMENDMENT A1 FOREWORD

This amendment has been prepared by subcommittee SC 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee 22: Power electronic systems and equipment.

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

FDIS	Report on voting
22G/338/FDIS	22G/342/RVD

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

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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*

IEC 60050-442, *International Electrotechnical Vocabulary (IEV) – Part 442: Electrical accessories*

IEC 60050-551, *International Electrotechnical Vocabulary (IEV) – Part 551: Power electronics*

IEC 60050-601, *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*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests. Tests B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-78, *Environmental testing – Part 78: Tests – Test Cab: Damp heat, steady state*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60204-11, *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*

IEC 60309, *Plugs, socket-outlets and couplers for industrial purposes*

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

■^{A1} IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-41:2005/AMD1:—¹ ■^{A1}

IEC 60364-5-54:2002, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

IEC 60617, *Graphical symbols for diagrams*

¹ Under preparation. Stage at the time of publication: IEC DEC 60364-4-41:2016.

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*²⁾
 Amendment 1 (2000)
 Amendment 2 (2002)

IEC 60664-3:2003, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coatings to achieve insulation coordination of printed board assemblies*

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-13, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignitability test method for materials*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60695-11-20, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods*

IEC 60755, *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*
 IEC 60947-4-1:2009/AMD1:2012

IEC 60947-7-1:2002, *Low-voltage switchgear and control gear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

IEC 60947-7-2:2002, *Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors*

IEC 60990:1999, *Methods of measurement of touch current and protective conductor current*

IEC 61230, *Live working – Portable equipment for earthing or earthing and short-circuiting*

IEC 61800-1, *Adjustable speed electrical power drive systems – Part 1: General requirements – Rating specifications for low voltage adjustable speed d.c. power drive systems*

IEC 61800-2, *Adjustable speed electrical power drive systems – Part 2: General requirements – Rating specifications for low voltage adjustable frequency a.c. power drive systems*

IEC 61800-4, *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*

IEC 62020, *Electrical accessories – Residual current monitors for household and similar uses (RCMs)*

IEC 62271-102, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

² There exists a consolidated edition 1.2 (2002) including IEC 60664-1:1992 and its Amendments 1 and 2.

ISO 3864 (all parts), *Graphical symbols – Safety colours and safety signs*

ISO 7000:2004, *Graphical symbols for use on equipment – Index and synopsis*

3 Terms and definitions

For the purposes of this international standard, the terms and definitions given in IEC 60050-111, IEC 60050-151, IEC 60050-161, IEC 60050-191, IEC 60050-441, IEC 60050-442, IEC 60050-551, IEC 60050-601, IEC 60664-1, IEC 61800-1, IEC 61800-2, IEC 61800-3 and IEC 61800-4 (some of which are repeated below for convenience), and the following definitions apply.

Table 1 provides an alphabetical cross-reference listing of terms.

Table 1 – Alphabetical list of terms

Term	Term number	Term	Term number	Term	Term number
adjacent circuit	3.1	(earth) leakage current	3.16	protective screening	3.31
basic drive module (BDM)	3.2	live part	3.17	protective separation	3.32
basic insulation	3.3	low-voltage <i>PDS</i>	3.18	reinforced insulation	3.33
CDM (complete drive module)	3.4	open-type (product)	3.19	routine test	3.34
closed electrical operating area	3.5	power drive system (PDS)	3.20	safety <i>ELV</i> (SELV) circuit	3.35
commissioning test	3.6	protective <i>ELV</i> (PELV) circuit	3.21	sample test	3.36
decisive voltage class (DVC)	3.7	prospective short-circuit current	3.22	supplementary insulation	3.37
double insulation	3.8	protective bonding	3.23	system voltage	3.38
extra low voltage (ELV)	3.9	protective class 0	3.24	temporary overvoltage	3.39
electrical breakdown	3.10	protective class I	3.25	touch current	3.40
expected lifetime	3.11	protective class II	3.26	type test	3.41
functional insulation	3.12	protective class III	3.27	user terminal	3.42
high-voltage <i>PDS</i>	3.13	protective earthing (PE)	3.28	working voltage	3.43
installation	3.14	protective earthing conductor	3.29	zone of equipotential bonding	3.44
integrated <i>PDS</i>	3.15	protective impedance	3.30		

3.1

adjacent circuit

circuit having no galvanic connection to the circuit under consideration

NOTE A protective impedance is not considered to be a galvanic connection.