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**Adjustable speed electrical power drive systems –
Part 2: General requirements – Rating specifications for adjustable speed
AC power drive systems**

**Entraînements électriques de puissance à vitesse variable –
Partie 2: Exigences générales – Spécifications de dimensionnement pour
entraînements électriques de puissance à vitesse variable en courant alternatif**



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.160.30; 29.200

ISBN 978-2-8322-9450-5

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	9
1 Scope.....	11
2 Normative references	12
3 Terms and definitions	14
4 Guidance for specification of BDM/CDM/PDS and methodologies for compliance	32
4.1 General.....	32
4.2 Methodology for compliance	32
4.2.1 Agreement between <i>customer</i> and <i>manufacturer</i>	32
4.2.2 Methodology to state compliance without <i>customer</i> input.....	33
4.3 Applicable standards.....	38
5 Performance and functionality criteria.....	38
5.1 General.....	38
5.2 <i>BDM/CDM/PDS</i> characteristics and topology	39
5.2.1 General	39
5.2.2 <i>BDM/CDM/PDS</i> characteristics	39
5.2.3 Basic topology for <i>BDM/CDM/PDS</i> s	40
5.2.4 Cooling topology.....	42
5.2.5 Bypass and redundant configurations	43
5.3 Ratings	44
5.3.1 General	44
5.3.2 Input ratings	45
5.3.3 Output ratings.....	46
5.3.4 Operating <i>quadrants</i>	48
5.3.5 Ratings and functionality of the control equipment	49
5.3.6 Special ratings related to <i>BDM/CDM/PDS</i> or <i>motor</i>	49
5.4 Performance	59
5.4.1 Operational.....	59
5.4.2 Fault supervision	68
5.4.3 Minimum status indication required.....	70
5.4.4 I/O devices	70
5.5 General safety	72
5.6 Functional safety	72
5.7 EMC	72
5.8 Ecodesign.....	72
5.8.1 General	72
5.8.2 Energy <i>efficiency</i> and power losses	73
5.8.3 Environmental impact	73
5.9 Environmental condition for service, transport and storage	73
5.9.1 General	73
5.9.2 Operation	73
5.9.3 Storage and transport of equipment.....	78
5.9.4 Mechanical conditions	78
5.9.5 Specific storage hazards	79
5.9.6 Environmental service tests (<i>type test</i>)	80
5.10 Types of load duty profiles	80

5.11	Generic interface and use of profiles for <i>PDS</i>	81
5.12	Voltage on <i>power interface</i>	82
5.13	Driven equipment interface	83
5.13.1	Critical speeds.....	83
5.13.2	Torsion analysis	83
5.14	Explosive environment	84
5.15	Earthing requirements.....	84
6	Test.....	85
6.1	General.....	85
6.2	Items of individual <i>PDS</i> component tests	85
6.3	Overview of standards and tests for <i>PDS</i> components	85
6.4	Performance of tests.....	85
6.5	Standard tests for <i>BDM/CDM/PDS</i>	86
6.5.1	General	86
6.5.2	Current source <i>converter zero power factor</i> test	86
6.6	Test specifications	86
6.6.1	Visual inspections (<i>type test, sample test and routine test</i>)	86
6.6.2	Supply system earthing conditions	86
6.6.3	Static performance and rating test	87
6.6.4	Electrical safety	94
6.6.5	Functional safety	94
6.6.6	EMC	94
6.6.7	Ecodesign.....	95
6.6.8	Environmental condition tests	95
6.6.9	Communication profiles	97
6.6.10	Explosive atmosphere environment	97
7	Information and marking requirements.....	97
7.1	General.....	97
7.2	Marking on product	97
7.3	Information to be supplied with the <i>PDS</i> or <i>BDM/CDM</i>	98
7.4	Information to be supplied or made available	98
7.5	Safety and warning	98
7.5.1	Safety and warning labels.....	98
7.5.2	Additional safety considerations of a <i>PDS</i>	99
Annex A	(informative) Classification of <i>PDS</i> into low-voltage system and high-voltage system.....	100
A.1	General.....	100
A.2	Classification of <i>PDS</i> by voltage	100
A.3	Examples.....	101
A.3.1	<i>PDS</i> with a supply transformer.....	101
A.3.2	<i>PDS</i> with an <i>active infeed converter</i>	101
A.3.3	<i>PDS</i> with an output transformer	102
A.3.4	<i>PDS</i> with a common <i>DC link</i>	103
A.3.5	<i>PDS</i> with a step-up chopper	104
A.3.6	<i>PDS</i> with parallel-connected line-side <i>converters</i>	104
A.3.7	<i>PDS</i> with series-connected line-side <i>converters</i>	105
A.3.8	<i>PDS</i> with star-connected <i>inverters</i>	106
A.3.9	<i>PDS</i> with a multilevel <i>inverter</i>	107
A.3.10	Multiple <i>PDSs</i> with a common supply transformer.....	109

Annex B (informative) Determination of the <i>input current</i> of <i>BDM/CDM/PDS</i>	111
Bibliography	113
Figure 1 – <i>BDM/CDM/PDS manufacturer/customer</i> relationship	18
Figure 2 – Operating quadrants	20
Figure 3 – Example of a <i>power drive system</i>	26
Figure 4 – Typical <i>BDM/CDM/PDS</i>	40
Figure 5 – Common <i>DC link</i> <i>BDM/CDM/PDS</i>	41
Figure 6 – <i>BDM/CDM/PDS</i> with brake	42
Figure 7 – <i>BDM/CDM/PDS</i> with AIC	42
Figure 8 – Bypass configuration for system with indirect <i>converter</i>	44
Figure 9 – Load commutation <i>inverters</i> LCI-synchronous <i>motor</i> in a partly redundant configuration	44
Figure 10 – Example of operating region of a <i>PDS</i>	47
Figure 11 – Overload cycle example	48
Figure 12 – Insulation stressing types	56
Figure 13 – Definition of the transient voltage at the terminals of the <i>motor</i>	57
Figure 14 – Admissible pulse voltage (including voltage reflection and damping) at the <i>motor</i> terminals as a function of the peak rise time t_a	57
Figure 15 – Deviation band	60
Figure 16 – Time response following a step change of reference input – No change in operating variables	63
Figure 17 – Time response following a change in an operating variable – No reference change	64
Figure 18 – Time response following a reference change at specified rate	64
Figure 19 – Frequency response of the control – Reference value as <i>stimulus</i>	66
Figure 20 – Example of relationship of IEC 61800-7 (all parts) to control system software and the <i>BDM/CDM/PDS</i>	82
Figure 21 – Example of protective earthing and interconnection of main components	84
Figure 22 – Measuring circuit of <i>PDS</i>	88
Figure A.1 – Basic configuration of <i>PDS</i>	100
Figure A.2 – Example of <i>low-voltage PDS</i> with a supply transformer	101
Figure A.3 – Example of <i>low-voltage PDS</i> with an <i>active infeed converter</i>	102
Figure A.4 – Example of <i>high-voltage PDS</i> with an <i>active infeed converter</i>	102
Figure A.5 – Example of <i>high-voltage PDS</i> with an output transformer	102
Figure A.6 – Example of <i>low-voltage PDS</i> with a common <i>DC link</i>	103
Figure A.7 – Example of <i>high-voltage PDS</i> with a common <i>DC link</i>	104
Figure A.8 – Example of <i>high-voltage PDS</i> with a step-up chopper	104
Figure A.9 – Example of <i>low-voltage PDS</i> with parallel-connected <i>rectifiers</i>	105
Figure A.10 – Example of <i>high-voltage PDS</i> with parallel-connected line-side <i>converters</i>	105
Figure A.11 – Example of <i>high-voltage PDS</i> with series-connected <i>rectifiers</i>	106
Figure A.12 – Example of <i>high-voltage PDS</i> with series-connected <i>rectifiers</i>	106
Figure A.13 – Example of <i>high-voltage PDS</i> with star-connected <i>inverters</i>	107
Figure A.14 – Example of <i>high-voltage PDS</i> with a multilevel <i>inverter</i>	108

Figure A.15 – Example of a power module	108
Figure A.16 – Example of multiple <i>low-voltage/high-voltage PDSs</i> with a common supply transformer	110
Figure B.1 – Example of distortion effect of the <i>input current</i> affected by a three-phase converter with capacitive load	111
Table 1 – List of general terms.....	14
Table 2 – List of input ratings of <i>BDM/CDM/PDS</i>	15
Table 3 – List of output ratings of <i>BDM/CDM/PDS</i>	15
Table 4 – List of <i>motor speed</i> and <i>torque</i> ratings	16
Table 5 – Basic classification of PDS by voltage	21
Table 6 – Selection of equipment rating, performance, functionality by responsible parties with corresponding test specification	34
Table 7 – Overview of input and output ratings of the <i>BDM/CDM/PDS</i>	45
Table 8 – Example of reduced maximum continuous load as a function of an overload	48
Table 9 – Limiting parts and typical voltage stress capability of the <i>motor</i> insulation system.....	58
Table 10 – Maximum deviation bands (percent)	61
Table 11 – PDS protection functions	69
Table 12 – Environmental service conditions	74
Table 13 – Definitions of pollution degree	75
Table 14 – Environmental vibration limits for fixed <i>installation</i>	75
Table 15 – <i>Installation</i> vibration limits	76
Table 16 – Environmental shock limits for fixed <i>installation</i>	76
Table 17 – Storage and transport limits.....	78
Table 18 – Transportation vibration limits.....	79
Table 19 – Transportation limits of free fall	79
Table 20 – Environmental service tests.....	80
Table 21 – Shock test	96
Table A.1 – Basic classification of PDS by voltage.....	101

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 2: General requirements – Rating specifications for adjustable speed AC power drive systems

FOREWORD

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International Standard IEC 61800-2 has been prepared by subcommittee 22G: Adjustable speed electric power drive systems (PDS), of IEC technical committee 22: Power electronic systems and equipment.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

- a) the requirements from IEC 61800-4 for high-voltage PDS are now merged with requirements from IEC 61800-2:2015, and IEC 61800-4:2002 will be withdrawn upon release of this document;
- b) Clause 1 has been updated to introduce the new concept of Clause 4;

- c) terms and definitions in Table 1 to Table 4 have been classified in logical order; classification in low voltage and high voltage has been considered in Table 5, and Figure 3 clarifies boundaries within *BDM/CDM/PDS*.
- d) Clause 4 is new and creates the methods for evaluating a product to this document;
- e) Clause 5 has been updated with respect to:
 - 1) specific content for high-voltage *BDM/CDM/PDS*;
 - 2) description of the basic topology for *BDM/CDM/PDS* (5.2);
 - 3) ratings and performance (5.3 and 5.4);
 - 4) reference to applicable standards within the IEC 61800 series with respect to EMC (IEC 61800-3), electrical safety (IEC 61800-5-1), functional safety (IEC 61800-5-2), load duty aspects (IEC TR 61800-6), communication profiles (IEC 61800-7 series), *power interface* voltage (IEC TS 61800-8), and ecodesign (IEC 61800-9 series) to avoid conflicting requirements (5.5, 5.6, 5.7, 5.10, 5.11, 5.12);
 - 5) update of requirement for ecodesign (5.8);
 - 6) update of requirement for environmental evaluation (5.9);
 - 7) implementation of requirement for explosive atmosphere (5.14);
- f) Clause 6 has been updated with test requirement in order to provide a clear link between design requirement and test requirement;
- g) Clause 7 has been updated to harmonize the marking and documentation requirement within IEC 61800 (all parts);
- h) existing Annex A and Annex B have been updated to include specific detail pertaining to *high voltage BDM/CDM/PDS*.

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

FDIS	Report on voting
22G/432/FDIS	22G/435/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 in the IEC 61800 series, published under the general title *Adjustable speed electrical power drive systems*, can be found on the IEC website.

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

The committee has decided that the contents of this publication will remain unchanged until the stability 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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INTRODUCTION

0.1 General

This document is part of the IEC 61800 series specifying requirements for adjustable *speed electrical power drive systems (PDS)*. Since the publication of the second edition of IEC 61800-2, several documents of the IEC 61800 series have been developed and maintained, which has resulted in outdated references and conflicting requirements across the IEC 61800 series.

This document contains general requirements for *PDSs* intended to feed AC *motors* and with rated *converter* input voltages (line-to-line voltage) up to 35 000 V AC.

PDSs intended to feed DC *motors* are covered by IEC 61800-1.

0.2 Consistency of requirement

This document specifies requirements for *PDSs* under its scope for the identified topics not covered by any other of the standards in the IEC 61800 series.

The following requirements are covered by other standards in the IEC 61800 series:

- DC *PDS* requirements are covered by IEC 61800-1;
- EMC requirements are covered by IEC 61800-3;
- general safety requirements are covered by IEC 61800-5-1;
- functional safety requirements are covered by IEC 61800-5-2;
- type of load duty guidance is covered by IEC TR 61800-6;
- interface and use of profiles requirements are covered by IEC 61800-7 (all parts);
- *power interface* voltage specification is covered by IEC TS 61800-8;
- *ecodesign energy efficiency* requirements of drive system are covered by IEC 61800-9 (all parts).

Generally, this document provides a basic description of topics and refers to the relevant standard for specific requirement. This is done in order to ensure consistency, to avoid conflicting requirement within IEC 61800 (all parts) and to optimize future maintenance of the documents.

As part of the work inside SC 22G MT9, this document defines basic definitions used across the IEC 61800 series. For issues related to *active infeed converters*, IEC TS 62578 has been considered.

As a result of the development of the IEC 61800 series of standards, the need to reference documents outside the series has decreased and especially the need to reference the IEC 60146 (all parts) has decreased dramatically.

0.3 Tool for agreement between *customer* and *manufacturer*

This document provides a non-exhaustive list of requirements to aid in the development of a functional specification between responsible parties. Each topic should be individually specified by the *responsible party(ies)* as a compliance requirement where appropriate for the intended application. When the *manufacturer* is the only *responsible party*, for any reason, the *manufacturer* may choose to select the specific sections of this document which are relevant for the intended application.

BDM/CDM/PDS may be built into a final installation or imbedded into an extended product as a component. The following are example applications: lift and hoist, machinery, conveyor, switchgears, heating and ventilation, pump, wind, tidal and marine propulsion applications.

In every application, an identification of the environmental conditions under which the product is stored, transported and operated is essential for the proper specification of the *BDM/CDM/PDS*. The environmental conditions considered should include at least those defined in IEC 60721 (all parts) and EMC.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 2: General requirements – Rating specifications for adjustable speed AC power drive systems

1 Scope

This part of IEC 61800 applies to adjustable *speed* electric AC *power drive systems*, which include semiconductor power conversion and the means for their control, protection, monitoring, measurement and the AC *motors*.

It applies to adjustable *speed* electric *power drive systems* intended to feed AC *motors* from a *BDM* or *CDM* connected to line-to-line voltages up to and including 35 kV AC 50 Hz or 60 Hz and/or voltages up to and including 1,5 kV DC input side.

NOTE Adjustable *speed* electric DC *power drive systems* intended to feed DC *motors* are covered by IEC 61800-1.

This documents defines and describes a non-exhaustive list of criteria for the selection of *BDM/CDM/PDS* performance and functional attributes. This list is reviewed by the responsible parties to determine considerations for the design of device(s), equipment or system(s) with related testing specification. It also suggests a selection of performance and functional attributes for driven equipment and extended products. The performance and functional attributes focus on the following categories:

- principal parts topology and classification of the *PDS*;
- ratings, performance and functionality;
- specifications for the environment in which the *PDS* is intended to be installed and operated;
- other specifications which might be applicable when specifying a complete *PDS*.

Traction applications and electric vehicles are excluded from the scope of this document.

This document provides a non-exhaustive list from which minimum requirements can be used for the development of a specification between *customer* and *manufacturer* based on the application requirements. This same non-exhaustive list can be used by a *manufacturer* to determine the minimum requirements for a commoditised *BDM/CDM/PDS* without *customer* interaction based on the specified application of that *BDM/CDM/PDS*.

For some aspects which are covered by specific *PDS* product standards in the IEC 61800 series, this document provides a short introduction and reference to detailed requirements in these product standards.

This applies to the following aspects:

- EMC requirements are covered by IEC 61800-3;
- general safety requirements are covered by IEC 61800-5-1;
- functional safety requirements are covered by IEC 61800-5-2;
- type of load duty guidance is covered by IEC TR 61800-6;
- interface and use of profiles requirements are covered by IEC 61800-7 (all parts);
- power interface voltage specification is covered by IEC TS 61800-8;

- ecodesign energy efficiency requirements of drive system are covered by IEC 61800-9 (all parts).

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 60038, *IEC standard voltages*

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

IEC 60050-113:2011, *International Electrotechnical Vocabulary (IEV) – Part 113: Physics for electrotechnology* (available at www.electropedia.org)

IEC 60050-114, *International Electrotechnical Vocabulary (IEV) – Part 114: Electrochemistry* (available at www.electropedia.org)

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices* (available at www.electropedia.org)

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility* (available at www.electropedia.org)

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IEC 60050-442, *International Electrotechnical Vocabulary (IEV) – Part 442: Electrical accessories* (available at www.electropedia.org)

IEC 60050-551, *International Electrotechnical Vocabulary (IEV) – Part 551: Power electronics* (available at www.electropedia.org)

IEC 60050-601, *International Electrotechnical Vocabulary (IEV) – Part 601: Generation, transmission and distribution of electricity – General* (available at www.electropedia.org)

IEC 60068 (all parts), *Environmental testing*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60076 (all parts), *Power transformers*

IEC 60076-11, *Power transformers – Part 11: Dry-type transformers*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60146-1-1, *Semiconductor convertors – General requirement and line commutated convertors – Part 1-1: Specification of basic requirements*

IEC TR 60146-1-2, *Semiconductor convertors – General requirement and line commutated convertors – Part 1-2: Application guidelines*

IEC 60721-3-0, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Introduction*

IEC 60721-3-1:1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2:1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

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 weather protected locations*

IEC 60721-3-3:1994/AMD1:1995

IEC 60721-3-3:1994/AMD2:1996

IEC 60721-3-4:1995, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weather protected locations*

IEC 60721-3-4:1995/AMD1:1996

IEC 61800-3, *Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods*

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

IEC 61800-5-2:2016, *Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*

IEC TR 61800-6, *Adjustable speed electrical power drive systems – Part 6: Guide for determination of types of load duty and corresponding current ratings*

IEC 61800-7 (all parts), *Adjustable speed electrical power drive systems – Part 7: Generic interface and use of profiles for power drive systems*

IEC 61800-7-1, *Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition*

IEC TS 61800-8, *Adjustable speed electrical power drive systems – Part 8: Specification of voltage on the power interface*

IEC 61800-9-1, *Adjustable speed electrical power drive systems – Part 9-1: Ecodesign for power drive systems, motor starters, power electronics and their driven applications – General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA) and semi analytic model (SAM)*

IEC 61800-9-2, *Adjustable speed electrical power drive systems – Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications – Energy efficiency indicators for power drive systems and motor starters*

IEC TS 62578:2015, *Power electronics systems and equipment – Operation conditions and characteristics of active infeed converter (AIC) applications including design recommendations for their emission values below 150 kHz*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-112, IEC 60050-113, IEC 60050-114, IEC 60050-151, IEC 60050-161, IEC 60050-191, IEC 60050-441, IEC 60050-442, IEC 60050-551, IEC 60050-601, IEC 60146-1-1, IEC TR 60146-1-2, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

Index

Table 1 – List of general terms

3.4	basic drive module (BDM)	3.2	mains supply	3.96	type test
3.6	complete drive module (CDM)	3.51	port for process measurement and control	3.84	routine test
3.29	inverter	3.54	power interface	3.85	sample test
3.7	converter, <of the BDM>	3.88	signal interface	3.1	acceptance test
3.80	rectifier <of the BDM>	3.56	product packaging	3.97	witness test
3.10	DC link	3.86	shipping packaging	3.5	commissioning test
3.3	active infeed converter (AIC)	3.81	regeneration	3.89	special test
3.52	power drive system (PDS)			3.82	resolution
3.30	low-voltage BDM/CMD/PDS <for AC motor>	3.53	power factor (λ)	3.83	responsible party
3.16	high-voltage BDM/CMD/PDS <for AC motor>	3.94	total harmonic distortion (THD)	3.8	customer, <of the BDM/CDM/PDS>
3.28	integrated PDS	3.87	short circuit ratio (R_{SC})	3.14	end user
3.36	motor electric motor	3.12	efficiency <of the CDM>	3.31	manufacturer, <of the BDM/CDM/PDS>
3.27	installation	3.13	efficiency <of the PDS>	3.37	original equipment manufacturer (OEM)
3.50	port	3.46	output overload capability	3.92	system integrator
3.55	power port	3.91	stimulus		

NOTE This document contains the fundamental definitions used across IEC 61800 (all parts) in a way that they can be used in future revisions of all IEC 61800 standards.