

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



AMENDMENT 1  
AMENDEMENT 1

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

**Entraînements électriques de puissance à vitesse variable –  
Partie 3: Exigences de CEM et méthodes d'essais spécifiques**

<https://standards.iteh.ai/catalog/standards/sist/65078441-c868-4164-afa0-1cc55bdcaf8c/iec-61800-3-2004-amd1-2011>



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## FOREWORD

This Amendment has been prepared by IEC sub-committee 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/227/FDIS	22G/229/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.

The committee has decided that the contents of this amendment and the base 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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- replaced by a revised edition, or
- amended.

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## 2 Normative references

Replace, in the existing list, the existing reference to IEC 61000-2-4 by the following new reference:

IEC 61000-2-4:2002, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

Add, to the existing list, the following new references:

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*

## 3 Terms and definitions

### 3.1 Overview

Replace the existing title of this subclause by the following new title:

### 3.1 Definition of the installation and its content

Delete the existing three paragraphs of this subclause.

Add, before the existing Figure 1, the following new sentence:

Figure 1 shows the major parts of the PDS as defined below and the rest of the installation.

Add, after the existing Figure 1, the following new terms and definitions 3.1.1, 3.1.2, 3.1.3 and 3.1.4:

#### 3.1.1

##### basic drive module

##### **BDM**

electronic power converter and related control, connected between an electric supply and a motor. The BDM is capable of transmitting power from the electric supply to the motor and may be capable of transmitting power from the motor to the electric supply. The BDM controls some or all of the following aspects of power transmitted to the motor and motor output:

- current;
- frequency;
- voltage;
- speed;
- torque;
- force;
- position

**3.1.2**

**complete drive module  
CDM**

drive module consisting of, but not limited to, the BDM and extensions such as protection devices, transformers and auxiliaries. However the motor and the sensors which are mechanically coupled to the motor shaft are not included

**3.1.3**

**power drive system  
PDS**

system consisting of one or more complete drive module(s) (CDM) and a motor or motors. Any sensors which are mechanically coupled to the motor shaft are also part of the PDS; however the driven equipment is not included

**3.1.4**

**installation**

equipment or equipments which include at least both the PDS and the driven equipment

**3.3 Location, ports and interfaces**

**3.3.5**

**port for process measurement and control**

*Delete, in the existing definition, the existing words "as defined in Clause 3 (see Figure 2)".*

**3.3.9**

**mechanical link**

*Delete, in the existing definition, the existing words "as defined in Clause 3".*

**3.4 Components of PDS**

**3.4.2**

**(electric) motor**

*Add, after the existing definition and source, the following new note:*

NOTE For the purposes of this standard, the motor includes all sensors which are mounted on it and which are relevant for supporting the operating mode and interacting with a CDM.

*Delete the existing definition 3.4.3 and renumber the existing definition 3.4.4 as 3.4.3.*

*Add, after definition 3.4.3, the following new subclause 3.5 and the following new terms and definitions 3.5.1 to 3.5.4 as follows:*

**3.5 Phenomena-related definitions**

**3.5.1**

**voltage deviation**

difference, generally expressed as a percentage, between the voltage at a given instant at a point in the system, and a reference voltage such as: nominal voltage, a mean value of the operating voltage, declared supply voltage

[IEV 604-01-17]

### 3.5.2

#### **voltage change**

variation of the r.m.s. or peak value of a voltage between two consecutive levels sustained for definite but unspecified durations

NOTE Whether the r.m.s. or peak value is chosen depends upon the application, and which is used should be specified.

[IEV 161-08-01]

### 3.5.3

#### **voltage fluctuation**

series of voltage changes or a continuous variation of the r.m.s. or peak value of the voltage

NOTE Whether the r.m.s. or peak value is chosen depends upon the application, and which is used should be specified.

[IEV 161-08-05]

### 3.5.4

#### **voltage dip**

sudden reduction of the voltage at a point in an electrical system followed by voltage recovery after a short period of time from a few cycles to a few seconds

[IEV 604-01-25, IEC 161-08-10]

## 4.2.1 Conditions

*Renumber the existing note of this subclause as Note 1.*

*Replace the existing third paragraph of this subclause by the following new paragraph and new Note 2:*

For the tests, the CDM shall be connected to a motor recommended by the manufacturer with a cable and earthing rules defined by the manufacturer. Alternatively, a passive test load (resistive, or resistive and inductive) may be applied (for example, for evaluation of the low-frequency emissions), if permitted by the manufacturer.

NOTE 2 For high frequency emissions, because it is necessary to simulate differential and common mode capacitances and couplings, a passive test load may not be suitable for this application.

## 4.3 Documentation for the user

*Replace the existing second paragraph of this subclause by the following new paragraph and new Notes 1 and 2:*

The manufacturer shall supply the documentation necessary for the correct installation of a BDM, CDM or PDS into a typical system or process in the intended environment. This information includes any emission warnings required by 6.1 and Table 13. It also includes the warnings required by 5.3.2 in the case where the immunity of a BDM, CDM or PDS is not suitable for the second environment.

NOTE 1 From the emission point of view, a PDS (or BDM or CDM) with a lower emission category, such as C1, can always be used instead of one with a higher emission category, such as C3.

NOTE 2 Emission categories are independent of immunity. For example, a statement that a PDS has emission category C1 does not imply that the immunity is only suitable for the first environment.



**5.1 General conditions**

**5.1.1 Acceptance criteria (performance criteria)**

*Add, after the last existing paragraph, the following new paragraph:*

Subclauses 5.2 and 5.3 state the acceptance criterion required for each phenomenon.

**5.2 Basic immunity requirements – low-frequency disturbances**

**5.2.1 Common principle**

*Delete the existing Note 3.*

**5.2.2.1 Low voltage PDSs – (voltage distortion)**

*Replace the existing paragraph, note and Table 2 of this subclause, by the following new paragraph, new note and new Tables 23, 24 and 25:*

The BDM, CDM or PDS shall sustain the immunity levels while meeting the performance criteria given in Tables 23, 24 and 25. It shall be verified that these levels will not cause the ratings for the input circuits (filters, etc.) to be exceeded. Analysis of commutation notches shall be in the time domain. The manufacturer may verify immunity by calculation, simulation, or test, according to 5.2.1. If the chosen verification method is by test, it shall be performed using the PDS with the motor connected. For equipment rated below 16 A per phase, the test method of IEC 61000-4-13 can be applied.

NOTE Frequency domain analysis of the contribution from notches to the total harmonic distortion will not fully account for harmful effects, see B.1.

**Table 23 – Minimum immunity requirements for total harmonic distortion on power ports of low voltage PDSs**

Phenomenon	First environment		Second environment		Performance (acceptance) criterion
	Reference document	Level	Reference document	Level	
Harmonics – THD	IEC 61000-2-2	8 %	IEC 61000-2-4 class 3	12 %	A



**Table 24 – Minimum immunity requirements for individual harmonic orders on power ports of low voltage PDSs**

Phenomenon  Harmonic order	First environment		Second environment		Performance (acceptance) criterion
	Reference document	Level	Reference document	Level	
2	IEC 61000-4-13 class 2	3 %	IEC 61000-4-13 class 3	5 %	A
3		8 %		9 %	
4		1,5 %		2 %	
5		9 %		12 %	
Even orders $6 \leq h \leq 50$		No requirement		1,5 %	
7		7,5 %		10 %	
9		2,5 %		4 %	
11		5 %		7 %	
13		4,5 %		7 %	
15		No requirement		3 %	
17		3 %		6 %	
19		2 %		6 %	
21		No requirement		2 %	
23		2 %		6 %	
25		2 %		6 %	
27		No requirement		2 %	
29		1,5 %		5 %	
31		1,5 %		3 %	
33		No requirement		2 %	
35		1,5 %		3 %	
37	1,5 %	3 %			
39	No requirement	2 %			
NOTE 1 For individual harmonic orders, levels are from Class 2 in IEC 61000-4-13 (these are approximately 1,5 times the compatibility levels of IEC 61000-2-4).					
NOTE 2 For individual harmonic orders, levels are from Class 3 in IEC 61000-4-13 (these are approximately 1,5 times the compatibility levels of IEC 61000-2-4).					

**Table 25 – Minimum immunity requirements for commutation notches on power ports of low voltage PDSs**

Phenomenon	First environment		Second environment		Performance (acceptance) criterion
	Reference document	Level	Reference document	Level	
Commutation notches	(None)	No requirement	IEC 60146-1-1 Class B	Depth = 40 %, total area = 250 in % degrees	A

**Table 3 – Minimum immunity requirements for harmonics and commutation notches/voltage distortion on main power ports of PDSs of rated voltage above 1 000 V**

*Delete, the existing table footnotes "a" and "b", and renumber existing footnote "c" as "a".*

*Delete the entire two rows starting with "Interharmonics steady state", and "Interharmonics short term (< 15 s)".*

**5.2.2.2 Auxiliary power port**

*Replace the existing first sentence of the subclause by the following new sentence:*

The auxiliary power ports of PDSs shall sustain the immunity levels for the second environment given in Tables 23, 24 and 25 while meeting the performance criteria in those tables.

*Delete the existing Table 4 of this subclause.*

**5.2.3 Voltage deviations (variations, changes, fluctuations), dips and short interruptions**

*Delete, in the existing title of this subclause, the words "(variations, changes, fluctuations)".*

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**Table 5 – Minimum immunity requirements for voltage deviations, dips and short interruptions on power ports of low voltage PDSs**

Replace the existing Table 5 by the following new Table 5:

**Table 5 – Minimum immunity requirements for voltage deviations, dips and short interruptions on power ports of low voltage PDSs**

Phenomenon	First environment			Second environment			Performance (acceptance) criterion
	Reference document	Level		Reference document	Level		
Voltage deviations (> 60 s)	IEC 61000-2-2	$\pm 10\%$ <sup>a</sup>		IEC 61000-2-4 Class 2	$\pm 10\%$ <sup>a</sup>		A <sup>b</sup>
Voltage dips <sup>e</sup>	IEC 61000-4-11 Class 2 or IEC 61000-4-34 Class 2 <sup>f</sup>	Volts remaining 0 % 70 %	Cycles 1 25/30 <sup>c</sup>	IEC 61000-4-11 Class 3 or IEC 61000-4-34 Class 3 <sup>f</sup>	Volts remaining 0 % 40 % 70 % 80 %	Cycles 1 10/12 <sup>c</sup> 25/30 <sup>c</sup> 250/300 <sup>c</sup>	C <sup>d</sup>
Short interruptions	IEC 61000-4-11 Class 2 or IEC 61000-4-34 Class 2 <sup>f</sup>	Volts remaining 0 %	Cycles 250/ 300 <sup>c</sup>	IEC 61000-4-11 Class 3 or IEC 61000-4-34 Class 3 <sup>f</sup>	Volts remaining 0 %	Cycles 250/300 <sup>c</sup>	C <sup>d</sup>
<p><sup>a</sup> "Voltage deviation" is a supply voltage variation from the nominal supply voltage. Testing of voltage deviations for three phase PDS requires increasing or reducing the voltage of all three phases simultaneously.</p> <p><sup>b</sup> When the voltage is below nominal, the maximum output power ratings – speed and/or torque – may be reduced, because they are voltage dependent.</p> <p><sup>c</sup> "x/y cycles" means "x cycles for 50 Hz test" and "y cycles for 60 Hz test".</p> <p><sup>d</sup> Opening of fuses is allowed for line-commutated converters operating in inverting mode.</p> <p><sup>e</sup> Power ports with current rating <math>\geq 75</math> A, the method of the voltage drop test according to 7.5 of IEC 61400-21:2008 may be used.</p> <p><sup>f</sup> IEC 61000-4-11 applies to equipment rated less than or equal to 16 A and IEC 61000-4-34 to equipment rated above 16 A.</p>							

**Table 6 – Minimum immunity requirements for voltage deviations, dips and short interruptions on main power ports of rated voltage above 1 000 V of PDSs**

Replace the existing Table 6 by the following new Table 6:

**Table 6 – Minimum immunity requirements for voltage deviations, dips and short interruptions on main power ports of rated voltage above 1 000 V of PDSs**

Phenomenon	Reference document	Level		Performance (acceptance) criterion
Voltage deviations exceeding 1 min	IEC 61000-2-4 Class 3	± 10 %		A <sup>a</sup>
Voltage deviations not exceeding 1 min	IEC 61000-2-4 Class 3	+ 10 % / - 15 %		A <sup>a</sup>
Voltage dips	IEC 61000-4-34 <sup>b</sup>	Volts remaining	Cycles	C <sup>d</sup>
		0 %	1	
		40 %	10/12 <sup>c</sup>	
		70 %	25/30 <sup>c</sup>	
		80 %	250/300 <sup>c</sup>	
Short interruptions	IEC 61000-4-34 <sup>b</sup>	Volts remaining	Cycles	C <sup>d</sup>
		0 %	250/300 <sup>c</sup>	
<p><sup>a</sup> "Voltage deviation" is a supply voltage variation from the nominal supply voltage. Testing of voltage deviations for three phase PDSs requires increasing or reducing the voltage of all three phases simultaneously.</p> <p>When considering voltage deviations, any voltage steps shall not exceed ± 12 % of nominal voltage and the time between steps shall not be less than 2 s.</p> <p>When the voltage is below nominal, the maximum output power ratings – speed and/or torque – may be reduced, because they are voltage dependent.</p> <p><sup>b</sup> Typical depths and durations of voltage dips are given in IEC 61000-2-8.</p> <p><sup>c</sup> "x/y cycles" means "x cycles for 50 Hz test" and "y cycles for 60 Hz test".</p> <p><sup>d</sup> Opening of fuses is allowed for line-commutated converters operating in inverting mode.</p>				

**Table 7 – Minimum immunity requirements for voltage deviations, dips and short interruptions on auxiliary low voltage power ports of PDSs**

Replace the existing Table 7 by the following new Table 7:

**Table 7 – Minimum immunity requirements for voltage deviations, dips and short interruptions on auxiliary low voltage power ports of PDSs**

Phenomenon	Reference document	Level		Performance (acceptance) criterion
Voltage deviations exceeding 1 min	IEC 61000-2-4 Class 3	± 10 %		A
Voltage deviations not exceeding 1 min	IEC 61000-2-4 Class 3	+10 % to –15 %		A
Voltage dips	IEC 61000-4-11 or IEC 61000-4-34 <sup>b</sup>	Volts remaining	Cycles	C
		0 %	1	
		40 %	10/12 <sup>a</sup>	
		70 %	25/30 <sup>a</sup>	
		80 %	250/300 <sup>a</sup>	
Short interruptions	IEC 61000-4-11 Class 3 or IEC 61000-4-34 Class 3 <sup>b</sup>	Volts remaining	Cycles	C
		0 %	250/300 <sup>a</sup>	

<sup>a</sup> “x/y cycles” means “x cycles for 50 Hz test” and “y cycles for 60 Hz test”.

<sup>b</sup> IEC 61000-4-11 applies to equipment less or equal to 16 A and IEC 61000-4-34 applies to equipment above 16 A.

#### 5.2.4.1 Low voltage PDSs

Add, at end of the existing second paragraph of this subclause, the following new sentence:

During verification, the rated load condition shall be used.

#### 5.2.4.2.1 Main power port

Add, at end of the existing second paragraph of this subclause, the following new sentence:

During verification, the rated load condition shall be used.