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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 3: EMC requirements and specific test methods

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 3: EMC requirements and specific test methods

1 Scope ~~and object~~

This part of IEC 61800 specifies electromagnetic compatibility (EMC) requirements for power drive systems (PDSs, defined in 3.1). These are adjustable speed AC or DC motor drives. Requirements are stated for PDSs with converter input and/or output voltages (line-to-line voltage), up to 35 kV AC RMS.

PDSs covered by this document are those installed in residential, commercial and industrial locations with the exception of traction applications, and electric vehicles. PDSs ~~may~~ can be connected to either industrial or public power distribution networks. Industrial networks are supplied by a dedicated distribution transformer, which is usually adjacent to or inside the industrial location, and supplies only industrial customers. Industrial networks can also be supplied by their own electric generating equipment. On the other hand, PDSs can be directly connected to low-voltage public mains networks which also supply ~~domestic~~ residential premises, and in which the neutral is generally earthed (grounded).

The scope of this part of IEC 61800, related to EMC, includes a broad range of PDSs from a few hundred watts to hundreds of megawatts. PDSs are often included in a larger system. The system aspect is not covered by this document but guidance is provided in the informative annexes.

The requirements have been selected so as to ensure EMC for PDSs at residential, commercial and industrial locations. The requirements cannot, however, cover extreme cases which ~~may~~ can occur with an extremely low probability. Changes in the EMC behaviour of a PDS, as a result of fault conditions, are not taken into account.

The object of this document is to define the limits and test methods for a PDS according to its intended use. This document includes immunity requirements and requirements for electromagnetic emissions.

NOTE 1 Emission can cause interference in other electronic equipment (for example radio receivers, measuring and computing devices). Immunity is ~~required~~ meant to protect the equipment from continuous and transient conducted and radiated disturbances including electrostatic discharges. The emission and immunity requirements are balanced against each other and against the actual environment of the PDS.

This document defines the minimum EMC requirements for a PDS.

Immunity requirements are given according to the environment classification. Low-frequency emission requirements are given according to the nature of the supply network. High-frequency emission requirements are given according to four categories of intended use, which cover both environment and bringing into operation.

As a product standard, this document ~~may~~ can be used for the assessment of PDS. It ~~may~~ can also be used for the assessment of complete drive modules (CDM) or basic drive modules (BDM) (see 3.1), which can be marketed separately.

This document contains

- conformity assessment requirements for products to be placed on the market, and

- recommended engineering practice (see 6.5) for cases where high frequency emissions cannot be measured before the equipment is placed on the market (such PDSs are defined in 3.2.7 as category C4).

NOTE 2 The first edition of IEC 61800-3 identified that the intended use could require engineering for putting into service. This was done by the "restricted distribution mode". Equipment ~~that used to be covered by the~~ formerly identified under "restricted distribution mode" is now covered ~~in the second edition~~ by categories C2 and C4 (see 3.2).

This document is intended as a complete EMC product standard for the EMC conformity assessment of products of categories C1, C2 and C3, when placing them on the market (see definitions 3.2.4 to 3.2.6).

Radio frequency emission of equipment of category C4 is only assessed when it is installed in its intended location. It is therefore treated as a fixed installation, for which this document gives rules of engineering practice in 6.5 and Annex E, although it gives no defined emission limits (except in case of complaint).

This document does not specify any safety requirements for the equipment such as protection against electric shocks, insulation co-ordination and related dielectric tests, unsafe operation, or unsafe consequences of a failure. It also does not cover safety and functional safety implications of electromagnetic phenomena.

In special cases, when highly susceptible apparatus is being used in proximity, additional mitigation measures ~~may~~ can have to be employed to reduce the electromagnetic emission further below the specified levels or additional countermeasures ~~may~~ can have to be employed to increase the immunity of the highly susceptible apparatus.

As an EMC product standard for PDSs, this document takes precedence over all aspects of the generic standards, and no additional EMC tests are ~~required or necessary~~ performed. If a PDS is included as part of equipment covered by a separate EMC product standard, the EMC standard of the complete equipment applies.

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 60050 (131):2002, *International Electrotechnical Vocabulary (IEV) – Chapter 131: Circuit theory*~~

~~IEC 60050 (151):2001, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*~~

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IEC 61000-3-3:~~1994~~ 2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

~~IEC 61000-3-4:1998, *Electromagnetic compatibility (EMC) – Part 3: Limits – Section 4: Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*~~

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IEC 61000-3-11:2000, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12: 2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test* ~~– Basic EMC publication~~

IEC 61000-4-3:~~2002~~ 2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test* ~~Basic EMC publication~~

IEC 61000-4-4:~~1995~~ 2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test* ~~Basic EMC publication~~
~~Amendment 1 (2000)~~
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IEC 61000-4-5:~~1995~~ 2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:~~2003~~ 2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:~~2001~~ 2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test~~ – Basic EMC publication~~

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~~IEC 61800-2:1998, *Adjustable speed electrical power drive systems – Part 2: General requirements – Rating specifications for low voltage adjustable frequency a.c. power drive systems*~~

~~IEC 61800-4:2002, *Adjustable speed electrical power drive systems – Part 4: General requirements – Rating specifications for a.c. power drive systems above 1000 V and not exceeding 35 kV*~~

CISPR 11:~~2003~~ 2015, *Industrial, scientific and medical~~ (ISM) radio-frequency~~ equipment – ~~Electromagnetic~~ Radio-frequency disturbance characteristics – Limits and methods of measurement*
CISPR 11:2015/AMD1:2016

~~CISPR 14, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus*~~

~~CISPR 16-1:2002, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*~~

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*

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

Entrainements électriques de puissance à vitesse variable – Partie 3: Exigences de CEM et méthodes d'essai spécifiques

IEC 61800-3:2017-02(en-fr)

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CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

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Partie 3: Exigences de CEM et méthodes d'essai spécifiques

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La Norme internationale IEC 61800-3 a été établie par le sous-comité 22G: Systèmes d'entraînement électrique à vitesse variable comprenant des convertisseurs à semiconducteurs, du comité d'études 22 de l'IEC: Systèmes et équipements électroniques de puissance.

Cette troisième édition annule et remplace la seconde édition parue en 2004 et l'Amendement 1:2011. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) éclaircissement des exigences concernant le rapport d'essai, notamment quand il existe plusieurs autres méthodes d'essai;

b) introduction d'une configuration d'essai plus détaillée pour les mesures des émissions rayonnées, ainsi que d'une distance de mesure de 3 m pour les petits matériels;

c) mises à jour générales des annexes informatives.

Le texte de cette norme est issu des documents suivants:

FDIS	Report on voting
22G/347/FDIS	22G/350/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2, et le Guide IEC 107.

Une liste de toutes les parties de la série IEC 61800, publiées sous le titre général *Entraînements électriques de puissance à vitesse variable*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

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ENTRAINEMENTS ELECTRIQUES DE PUISSANCE A VITESSE VARIABLE –

Partie 3: Exigences de CEM et méthodes d'essai spécifiques

1 Domaine d'application

La présente partie de l'IEC 61800 spécifie les exigences de compatibilité électromagnétique (CEM) applicables aux entraînements de puissance (PDS, définis en 3.1). Il s'agit d'entraînements à vitesse variable pour moteurs électriques à courant alternatif ou continu. Le présent document spécifie les exigences relatives aux PDS avec convertisseurs ayant des tensions d'entrée et/ou sortie (tensions entre phases) d'une valeur efficace allant jusqu'à 35 kV en courant alternatif.

Les PDS couverts par le présent document sont ceux installés dans des locaux résidentiels, commerciaux et industriels, à l'exception des applications de traction et des véhicules électriques. Les PDS peuvent être connectés à un réseau de distribution industriel ou public. Les réseaux industriels sont alimentés par un transformateur de distribution dédié qui se trouve normalement à proximité ou à l'intérieur du site industriel; ils n'alimentent que des clients industriels. Ces réseaux industriels peuvent aussi être alimentés par leurs propres équipements de génération électrique. Les PDS peuvent, par ailleurs, être aussi raccordés directement au réseau public basse tension qui alimente également des locaux résidentiels et dont le neutre est généralement relié à la terre.

Le domaine d'application de la présente partie de l'IEC 61800, traitant de la CEM, comprend une vaste gamme de PDS qui va de quelques centaines de watts à des centaines de mégawatts. Les PDS font souvent partie intégrante d'un système plus important. L'aspect système n'est pas couvert par le présent document, mais ses annexes informatives fournissent des préconisations.

Les exigences ont été choisies de façon à assurer la CEM des PDS dans les locaux résidentiels, commerciaux et industriels. Les exigences ne peuvent toutefois pas couvrir les cas extrêmes qui peuvent survenir avec une très faible probabilité. Les changements de comportement CEM d'un PDS résultant de conditions de défaut ne sont pas pris en considération.

Le présent document a pour objet de définir les limites et les méthodes d'essai des PDS en fonction de leur utilisation prévue. Il comporte des exigences d'immunité et des exigences concernant les émissions électromagnétiques.

NOTE 1 Les émissions peuvent perturber d'autres équipements électroniques (par exemple les récepteurs radio, appareils de mesure et calculateurs). L'immunité vise à protéger l'équipement contre les perturbations continues et transitoires, conduites et rayonnées, y compris les décharges électrostatiques. Les exigences d'émissions et d'immunité sont homogènes entre elles et avec l'environnement réel du PDS.

Le présent document définit les exigences minimales de CEM auxquelles chaque PDS doit répondre.

Les exigences d'immunité sont données selon des classes d'environnement. Les exigences d'émission basses fréquences sont données selon la nature du réseau d'alimentation. Les exigences d'émission hautes fréquences sont données selon quatre catégories d'utilisation prévue qui couvrent à la fois l'environnement et la mise en fonctionnement.

En tant que norme de produit, le présent document peut être utilisée pour l'évaluation des PDS. Elle peut aussi être utilisée pour l'évaluation des modules d'entraînement principal

(BDM) ou modules d'entraînement complet (CDM) (voir 3.1), qui peuvent être mis sur le marché séparément.

Le présent document contient

- des exigences relatives à l'évaluation de conformité des produits qui sont mis sur le marché, et
- des règles d'ingénierie recommandées (voir 6.5) pour les cas où les émissions haute fréquence ne peuvent pas être mesurées avant que l'équipement soit mis sur le marché (ces PDS sont définis comme des PDS de la catégorie C4 en 3.2.7).

NOTE 2 La première édition de l'IEC 61800-3 a identifié que l'utilisation prévue pourrait nécessiter des études d'ingénierie pour la mise en service. Cela était établi par le "mode de distribution restreinte". Les équipements qui étaient couverts par le "mode de distribution restreinte" se retrouvent aujourd'hui dans les catégories C2 et C4 (voir 3.2).

Le présent document est conçue comme une norme de produit CEM complète destinée évaluer la conformité CEM des produits des catégories C1, C2 et C3 quand ils sont mis sur le marché (voir définitions 3.2.4 à 3.2.6).

L'émission radiofréquence d'un équipement de catégorie C4 est uniquement mesurée lorsqu'il est installé sur son lieu d'utilisation. L'équipement est alors considéré comme une installation fixe, pour laquelle le présent document donne des règles d'ingénierie et des recommandations techniques en 6.5 et à l'Annexe E, bien qu'elle ne définisse pas de limites d'émission (excepté en cas de plainte).

Le présent document ne spécifie aucune exigence de sécurité pour les équipements, par exemple en matière de protection contre les chocs électriques, de coordination d'isolement et d'essais diélectriques associés, ni concernant un fonctionnement dangereux ou les conséquences dangereuses d'une défaillance. Elle ne couvre pas non plus les conséquences des phénomènes électromagnétiques sur la sécurité et la sécurité fonctionnelle.

Dans des cas spécifiques, par exemple lorsqu'un appareil de grande susceptibilité électromagnétique est utilisé dans le voisinage immédiat d'un PDS, des mesures d'atténuation supplémentaires peuvent devoir être mises en place pour réduire les émissions électromagnétiques à des niveaux inférieurs à ceux spécifiés ou pour augmenter l'immunité de l'appareil très susceptible.

En tant que norme de produit CEM, le présent document prévaut sur tous les aspects spécifiés par les normes génériques, et aucun essai CEM supplémentaire n'est effectué. Lorsqu'un PDS est incorporé dans un équipement couvert par une norme de produit CEM spécifique, la norme CEM pour l'équipement complet s'applique.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60146-1-1:2009, *Convertisseurs à semiconducteurs – Exigences générales et convertisseurs commutés par le réseau – Partie 1-1: Spécification des exigences de base*

IEC 61000-2-2:2002, *Compatibilité électromagnétique (CEM) – Partie 2-2: Environnement – Niveaux de compatibilité pour les perturbations conduites à basse fréquence et la transmission des signaux sur les réseaux publics d'alimentation basse tension*

IEC 61000-2-4:2002, *Compatibilité électromagnétique (CEM) – Partie 2-4: Environnement – Niveaux de compatibilité dans les installations industrielles pour les perturbations conduites à basse fréquence*

IEC 61000-3-2:2014, *Compatibilité électromagnétique (CEM) – Partie 3-2: Limites – Limites pour les émissions de courant harmonique (courant appelé par les appareils ≤ 16 A par phase)*

IEC 61000-3-3:2013, *Compatibilité électromagnétique (CEM) – Partie 3-3: Limitation des variations de tension, des fluctuations de tension et du papillotement dans les réseaux publics d'alimentation basse tension pour les matériels ayant un courant assigné ≤ 16 A par phase et non soumis à un raccordement conditionnel*

IEC 61000-3-11:2000, *Compatibilité électromagnétique (CEM) – Partie 3-11: Limitation des variations de tension, des fluctuations de tension et du papillotement dans les réseaux publics d'alimentation basse tension – Equipements ayant un courant appelé ≤ 75 A et soumis à un raccordement conditionnel*

IEC 61000-3-12:2011, *Compatibilité électromagnétique (CEM) – Partie 3-12: Limites – Limites pour les courants harmoniques produits par les appareils connectés aux réseaux publics basse tension ayant un courant appelé > 16 A et ≤ 75 A par phase*

IEC 61000-4-2:2008, *Compatibilité électromagnétique (CEM) – Partie 4-2: Techniques d'essai et de mesure – Essai d'immunité aux décharges électrostatiques*

IEC 61000-4-3:2006, *Compatibilité électromagnétique (CEM) – Partie 4-3: Techniques d'essai et de mesure – Essai d'immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques*

IEC 61000-4-4:2012, *Compatibilité électromagnétique (CEM) – Partie 4-4: Techniques d'essai et de mesure – Essai d'immunité aux transitoires électriques rapides en salves*

IEC 61000-4-5:2014, *Compatibilité électromagnétique (CEM) – Partie 4-5: Techniques d'essai et de mesure – Essai d'immunité aux ondes de choc*

IEC 61000-4-6:2013, *Compatibilité électromagnétique (CEM) – Partie 4-6: Techniques d'essai et de mesure – Immunité aux perturbations conduites, induites par les champs radioélectriques*

IEC 61000-4-8:2009, *Compatibilité électromagnétique (CEM) – Partie 4-8: Techniques d'essai et de mesure – Essai d'immunité au champ magnétique à la fréquence du réseau*

IEC 61000-4-11:2004, *Compatibilité électromagnétique (CEM) – Partie 4-11: Techniques d'essai et de mesure – Essais d'immunité aux creux de tension, coupures brèves et variations de tension*

IEC 61000-4-13:2002, *Compatibilité électromagnétique (CEM) – Partie 4-13: Techniques d'essai et de mesure – Essais d'immunité basse fréquence aux harmoniques et inter-harmoniques incluant les signaux transmis sur le réseau électrique alternatif*

IEC 61000-4-34:2005, *Compatibilité électromagnétique (CEM) – Partie 4-34: Techniques d'essai et de mesure – Essais d'immunité aux creux de tension, coupures brèves et variations de tension pour matériel ayant un courant d'alimentation de plus de 16 A par phase*

CISPR 11:2015, *Appareils industriels, scientifiques et médicaux – Caractéristiques de perturbations radioélectriques – Limites et méthodes de mesure*
CISPR 11:2015/AMD1:2016

CISPR 16-1-2:2014, *Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Partie 1-2: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Dispositifs de couplage pour la mesure des perturbations conduites*

CISPR 16-1-4:2010, *Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Partie 1-4: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Antennes et emplacements d'essai pour les mesures des perturbations rayonnées*

CISPR 22, *Appareils de traitement de l'information – Caractéristiques des perturbations radioélectriques – Limites et méthodes de mesure*

CISPR 32:2015, *Compatibilité électromagnétique des équipements multimédia – Exigences d'émission*