IEC 61800-5-2

Edition 2.0 2016-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional

Entraînements électriques de puissance à vitesse variable – Partie 5-2: Exigences de sécurité – Fonctionnelle

IEC 61800-5-2:2016-04(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 5-2: Safety requirements – Functional

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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International Standard IEC 61800-5-2 has been prepared by subcommittee 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee 22: Power electronic systems and equipment.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

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

a) rational added in the scope why low demand mode is not covered by this standard
b) definition added for: "*category*" and "*safety function*"
c) "Other sub-functions" sorted into "Monitoring sub-functions" and "Output functions"
d) deleted "proof test" throughout the document because for *PDS(SR)* a proof test is not applicable

e) replaced the term “safety function” by “*safety sub-function*” throughout the document

f) Updated references to IEC 61508 series Ed.2010

g) Added the principle rules of ISO 13849-1 and reference to tables of ISO 13849-2

h) 6.1.6 Text replaced by Table 2

i) 6.1.7 Integrated circuits with on-chip redundancy matched to changed requirement in IEC 61508-2: 2010, Annex E

j) 6.2.8 Design requirements for thermal immunity of a *PDS(SR)*

k) 6.2.9 Design requirements for mechanical immunity of a *PDS(SR)*

l) 6.1.6 *SIL* for multiple *safety sub-functions* within one *PDS(SR)*

m) 6.1.7 Integrated circuits with on-chip redundancy

n) 6.2.1 Basic and well-tried safety principles

o) 6.2.2.1.4 *Diagnostic test* interval when the hardware fault tolerance is greater than zero

p) 6.2.5.2.7 *PDS(SR)* parameterization

q) 9 Test requirements

r) 9.3 Electromagnetic (EM) immunity testing

s) 9.4 Thermal immunity testing

t) 9.5 Mechanical immunity testing

u) Annex A Sequential task table

v) Annex D, D.3.16, Motion and position feedback sensors updated

w) Annex E Electromagnetic immunity (EM) requirement for *PDS(SR)*

x) Annex F Estimation of PFD_{avg} value for low demand with given PFH value

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

FDIS	Report on voting
22G/332/FDIS	22G/335/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 electric drive systems*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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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INTRODUCTION

As a result of automation, demand for increased production and reduced operator physical effort, control systems of machinery and plant items play an increasing role in the achievement of overall safety. These control systems increasingly employ complex electrical/ electronic/programmable electronic devices and systems.

Prominent amongst these devices and systems are adjustable speed electrical power drive systems (PDS) that are suitable for use in safety-related applications (*PDS(SR)*).

Examples of industrial applications are:

- machine tools, robots, production test equipment, test benches;
- papermaking machines, textile production machines, calendars in the rubber industry;
- process lines in plastics, chemicals or metal production, rolling-mills;
- cement crushing machines, cement kilns, mixers, centrifuges, extrusion machines;
- drilling machines;
- conveyors, materials handling machines, hoisting equipment (cranes, gantries, etc.);
- pumps, fans, etc.

This standard can also be used as a reference for developers using *PDS(SR)* for other applications.

Users of this standard should be aware that some type C standards for machinery currently refer to ISO 13849-1 for safety-related control systems. In this case, *PDS(SR)* manufacturers may be requested to provide further information (e.g. category and performance level PL) to facilitate the integration of a *PDS(SR)* into the safety-related control systems of such machinery.

NOTE ”Type C standards” are defined in ISO 12100 as machine safety standards dealing with detailed safety requirements for a particular machine or group of machines.

There are many situations where control systems that incorporate a *PDS(SR)* are employed, for example as part of safety measures that have been provided to achieve risk reduction. A typical case is guard interlocking in order to exclude personnel from *hazard*s where access to the dangerous area is only possible when rotating parts have stopped. This part of IEC 61800 gives a methodology to identify the contribution made by a *PDS(SR)* to identified *safety sub-function*s and to enable the appropriate design of the *PDS(SR)* and verification that it meets the required performance.

Measures are given to co-ordinate the safety performance of the *PDS(SR)* with the intended risk reduction taking into account the probabilities and consequences of its random and systematic faults.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 5-2: Safety requirements – Functional

1 Scope

This part of IEC 61800, which is a product standard, specifies requirements and makes recommendations for the design and development, integration and validation of safety related power drive systems (*PDS(SR))* in terms of their functional safety considerations. It applies to adjustable speed electrical power drive systems covered by the other parts of the IEC 61800 series of standards as referred in IEC 61800-2.

NOTE 1 The term “integration” refers to the *PDS(SR)* itself, not to its incorporation into the safety-related application.

NOTE 2 Other parts of IEC 61800 cover rating specifications, EMC, electrical safety, etc.

This International Standard is applicable where functional safety of a *PDS(SR)* is claimed and the *PDS(SR)* is operating mainly in the high demand or continuous mode (see 3.15)

While low demand mode operation is possible for a *PDS(SR)*, this standard concentrates on high demand and continuous mode. *Safety sub-function*s implemented for high demand or continuous mode can also be used in low demand mode. Requirements for low demand mode are given in IEC 61508 series. Some guidance for the estimation of average probability of dangerous failure on demand (PFD_{avg}) value is provided in Annex F.

This part of IEC 61800 sets out safety-related considerations of *PDS(SR)*s in terms of the framework of IEC 61508, and introduces requirements for *PDS(SR)*s as *subsystem*s of a safety-related system. It is intended to facilitate the realisation of the electrical/ electronic/ programmable electronic (E/E/PE) parts of a *PDS(SR)* in relation to the safety performance of *safety sub-function*(s) of a PDS.

Manufacturers and suppliers of *PDS(SR)*s by using the normative requirements of this part of IEC 61800 will indicate to users (system integrator, original equipment manufacturer) the safety performance for their equipment. This will facilitate the incorporation of a *PDS(SR)* into a safety-related control system using the principles of IEC 61508, and possibly its specific sector implementations (for example IEC 61511, IEC 61513, IEC 62061 or ISO 13849).

By applying the requirements from this part of the IEC 61800 series, the corresponding requirements of IEC 61508 that are necessary for a *PDS(SR)* are fulfilled.

This part of IEC 61800 does not specify requirements for:

- the *hazard* and risk analysis of a particular application;
- the identification of *safety sub-function*s for that application;
- the initial allocation of *SIL*s to those *safety sub-function*s;
- the driven equipment except for interface arrangements;
- secondary *hazard*s (for example from failure in a production or manufacturing process);
- the electrical, thermal and energy safety considerations, which are covered in +IEC 61800-5-1;
- the *PDS(SR)* manufacturing process;
- the validity of signals and commands to the *PDS(SR)*.