IEC 62061

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems

Sécurité des machines – Sécurité fonctionnelle des systèmes de commande électriques, électroniques et électroniques programmables relatifs à la sécurité

IEC 62061:2005/A1:2012

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FOREWORD

This amendment has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects.

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

CDV	Report on voting
44/655/CDV	44/663/RVC

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Delete the tenth paragraph of this clause.

Delete the following text below Figure 1:

Information on the recommended application of IEC 62061 and ISO 13849-1 (under revision)

Replace the text of the paragraph above Table 1 by the following:

IEC 62061 and ISO 13849-1 specify requirements for the design and implementation of safety-related control systems of machinery. The use of either of these standards, in accordance with their scopes, can be presumed to fulfil the relevant essential safety requirements. IEC/TR 62061-1 provides guidance on the application of IEC 62061 and ISO 13849-1 in the design of safety-related control systems for machinery.

Delete the note above Table 1.

Delete Table 1.

1 Scope

Replace the text of Note 2 by the following:

NOTE 2 In this standard, it is presumed that the design of complex programmable electronic subsystems or subsystem elements conforms to the relevant requirements of IEC 61508 and uses Route 1_H (see IEC 61508-2:2010, 7.4.4.2). It is considered that Route 2_H (see IEC 61508-2:2010, 7.4.4.3) is not suitable for

general machinery. Therefore, this standard does not deal with Route 2_H. This standard provides a methodology for the use, rather than development, of such subsystems and subsystem elements as part of a SRECS.

2 Normative references

Replace the references to ISO 12100-1:2003 and ISO 12100-2:2003 by the following new reference:

ISO 12100:2010, *Safety of machinery – General principles for design – Risk assessment and risk reduction*

Replace the existing reference to ISO 13849-1 by the following new reference:

ISO 13849-1:2006, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

3.2.5
subsystem

Replace definition 3.2.5 by the following new definition:

3.2.5
subsystem
entity of the top-level architectural design of the SRECS where a dangerous failure of any subsystem will result in a dangerous failure of a safety-related control function

[IEC 61508-4, 3.4.4 modified]

NOTE 1 A complete subsystem can be made up from a number of identifiable and separate subsystem elements, which when put together implement the function blocks allocated to the subsystem.

NOTE 2 This differs from common language where "subsystem" may mean any sub-divided part of an entity, the term "subsystem" is used in this standard within a strongly defined hierarchy of terminology: "subsystem" is the first level subdivision of a system. The parts resulting from further subdivision of a subsystem are called "subsystem elements".

3.2.7
low complexity component

Replace the reference above Note 1 by the following new reference:

[IEC 61508-4, 3.4.3 modified]

3.2.9
functional safety
Replace the reference by the following new reference:

[IEC 61508-4, 3.1.12 modified]

3.2.10
hazard (from machinery)
Replace the reference by the following new reference:

[ISO 12100, 3.6 modified]

3.2.11
hazardous situation
Replace the reference by the following new reference:

[ISO 12100, 3.10 modified]

3.2.12
protective measure
Replace the reference by the following new reference:

[ISO 12100, 3.19 modified]

3.2.13
risk
Replace the reference by the following new reference:

[ISO 12100, 3.12]

3.2.15
safety function
Replace the reference by the following new reference:

[ISO 12100, 3.30]

3.2.19
safety integrity
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.4 modified]

3.2.20
hardware safety integrity
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.7 modified]

3.2.21
software safety integrity
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.5 modified]

3.2.22
systematic safety integrity
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.6 modified]

3.2.23
Safety Integrity Level
SIL
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.8 modified]

3.2.26
low demand mode
Replace the first paragraph by the following new paragraph:

mode of operation in which the frequency of demands on a SRECS is no greater than one per year

3.2.27
high demand or continuous mode
Replace the first paragraph by the following new paragraph:

mode of operation in which the frequency of demands on a SRECS is greater than one per year or the SRCF retains the machine in a safe state as part of normal operation

Replace the reference by the following new reference:

[IEC 61508-4, 3.5.16 modified]

3.2.28
Probability of dangerous Failure per Hour
***PFH*$_D$**

Replace definition 3.2.28 by the following new definition:

3.2.28
Probability of dangerous Failure per Hour
***PFH*$_D$**

average probability of a dangerous failure per hour of a safety related system/subsystem to perform the specified safety function over a given period of time

NOTE *PFH*$_D$ should not be confused with probability of dangerous failure on demand (*PFD*).

3.2.29
target failure value
Replace the reference by the following new reference:

[IEC 61508-4, 3.5.17 modified]

3.2.35
architecture
Replace the reference by the following new reference:

[IEC 61508-4, 3.3.4 modified]

3.2.37
proof test
Replace the first paragraph by the following new paragraph:

periodic test performed to detect dangerous hidden failures and degradation in a SRECS and its subsystems so that, if necessary, the SRECS and its subsystems can be restored to an “as new” condition or as close as practical to this condition

3.2.38
diagnostic coverage
Replace the first paragraph by the following new paragraph:

fraction of dangerous failures detected by automatic on-line diagnostic tests

Add, at the end of this subclause, new Note 2 as follows:

NOTE 2 The fraction of detected dangerous failures is computed to be the rate of dangerous failures that are detected by automatic on-line diagnostic tests divided by the rate of total dangerous failures.

and number the existing note as Note 1.

3.2.40
dangerous failure
Delete the reference “[IEC 61508-4, 3.6.7 modified]”.

3.2.41
safe failure
Delete the reference “[IEC 61508-4, 3.6.8 modified]”.

3.2.43
Common Cause Failure
CCF
Replace, in the first paragraph, the word "coincident" *by* "concurrent".

5.2.3 Functional requirements specification for SRCFs

Replace the existing text of this subclause (including 5.2.3.1 and 5.2.3.2) by the following:

The functional requirements specification for SRCFs shall describe details of each SRCF to be performed including, as applicable:

– the condition(s) (e.g. operating mode) of the machine in which the SRCF shall be active or disabled;
– the priority of those functions that can be simultaneously active and that can cause conflicting action;
– the frequency of operation of each SRCF;
– the required response time of each SRCF;
– the interface(s) of the SRCFs to other machine functions;
– the required response times (e.g. input and output devices);
– a description of each SRCF;
– a description of fault reaction function(s) and any constraints on, for example, re-starting or continued operation of the machine in cases where the initial fault reaction is to stop the machine;
– a description of the operating environment (e.g. temperature, humidity, dust, chemical substances, mechanical vibration and shock);
– tests and any associated facilities (e.g. test equipment, test access ports);
– rate of operating cycles, duty cycle, and/or utilisation category, for electromechanical devices intended for use in the SRCF.

NOTE 1 In addition to the requirements of IEC 61000-6-2, when a SRECS is intended for use in an industrial environment, electromagnetic (EM) immunity levels are given in IEC 61326-3-1. SRECS intended for use in another EM environment (e.g. residential) should have immunity levels based on those specified in different EMC standards (e.g., for a residential environment, IEC 61000-6-1).

NOTE 2 When specifying EM immunity levels it is necessary to consider whether the levels used in different EMC standards cover cases which can occur in a SRECS application even with a low probability of occurrence.

NOTE 3 EM immunity performance criterion for functional safety of a SRECS is given in 6.4.3.

6.4 Requirements for systematic safety integrity of the SRECS

Delete the note.

6.4.2 Requirements for the control of systematic faults

Replace Note 2 by the following:

NOTE 2 Further information can be found in IEC 61784-3 and IEC 61508-2.

6.4.3 Electromagnetic (EM) immunity

*Replace, in this subclause, "*Annex E*" by "*IEC 61326-3-1".

Replace, in the note of this subclause, "Annex E" *by* "IEC 61326-3-1".

6.6.3.1 General

Replace the last sentence of this subclause by the following:

The SIL that can be achieved by the SRECS is less than or equal to the lowest SILCLs of any of the subsystems that comprise the SRECS.

6.6.3.4 Systematic safety integrity

Delete subclause 6.6.3.4.

6.7.2.1

Replace this subclause by the following:

6.7.2.1 The subsystem shall be realised by either selection (see 6.7.3) or design (see 6.7.4) in accordance with its safety requirements specification (see 6.6.2.1.7), taking into account all the requirements of 6.2. Subsystem(s) incorporating complex components shall comply with IEC 61508-2 and IEC 61508-3 as appropriate for the required SIL and the design shall use Route 1_H (see IEC 61508-2:2010, 7.4.4.2).

EXCEPTION: Where a subsystem design includes a complex component as a subsystem element, 6.7.4.2.3 is applicable.

NOTE In this standard, it is presumed that the design of complex programmable electronic subsystems or subsystem elements conforms to the relevant requirements of IEC 61508 and uses Route 1_H (see IEC 61508-2:2010, 7.4.4.2). It is considered that Route 2_H (see IEC 61508-2:2010, 7.4.4.3) is not suitable for general machinery. Therefore, this standard does not deal with Route 2_H. This standard provides a methodology for the use, rather than development, of such subsystems and subsystem elements as part of a SRECS.

6.7.2.2

Replace Note 1 of item b) by the following:

NOTE 1 For electromechanical subsystems, the probability of failure should be estimated taking into account the number of operating cycles declared by the manufacturer and the duty cycle (see 5.2.3). This information should be based upon a B10 value (see IEC 61649) under the operating conditions stated by the manufacturer. See for example IEC 60947-4-1, Annex K.

6.7.3.2

Add the following text at the end of the first sentence:

and the design shall use Route 1_H (see IEC 61508-2:2010, 7.4.4.2).

Add the following note at the end of the subclause:

NOTE In this standard, it is presumed that the design of complex programmable electronic subsystems or subsystem elements conforms to the relevant requirements of IEC 61508 and uses Route 1_H (see IEC 61508-2:2010, 7.4.4.2). It is considered that Route 2_H (see IEC 61508-2:2010, 7.4.4.3) is not suitable for general machinery. Therefore, this standard does not deal with Route 2_H. This standard provides a methodology for the use, rather than development, of such subsystems and subsystem elements as part of a SRECS.

6.7.4.2.2

Replace, in the second dashed item of item b), "7.4.7.5 to 7.4.7.12" *by* "7.4.10".

6.7.4.2.3

Replace this subclause by the following:

6.7.4.2.3 Where the design of a subsystem incorporates a complex component (as a subsystem element) which satisfies all relevant requirements of IEC 61508-2 and IEC 61508-3 in relation to the SILCL and uses Route 1_H (see IEC 61508-2:2010, 7.4.4.2), it can be considered as a low complexity component in the context of a subsystem design since its relevant failure modes, behaviour on detection of a fault, rate of failure, and other safety-related information are known. Such components shall only be used in accordance with their specification and the relevant information for use provided by their supplier.

NOTE In this standard, it is presumed that the design of complex programmable electronic subsystems or subsystem elements conforms to the relevant requirements of IEC 61508 and uses Route 1_H (see IEC 61508-2:2010, 7.4.4.2). It is considered that Route 2_H (see IEC 61508-2:2010, 7.4.4.3) is not suitable for general machinery. Therefore, this standard does not deal with Route 2_H. This standard provides a methodology for the use, rather than development, of such subsystems and subsystem elements as part of a SRECS.

6.7.4.4.2

Replace the note of item c) by the following:

NOTE For electromechanical subsystems, the probability of failure should be estimated taking into account the number of operating cycles declared by the manufacturer and the duty cycle (see 5.2.3). This information should be based upon a B10 value (see IEC 61649) under the operating conditions stated by the manufacturer. See for example IEC 60947-4-1, Annex K.

6.7.6.5

Delete this entire subclause and Table 6.

6.7.7.2

Delete the following text at item b):

(see references in Annex D)

Delete item c).

Existing item d) becomes item c).

Add the following new notes at the end of the subclause:

NOTE 1 Information of the failure mode ratios for electrical/electronic component can be found in several sources including:

– MIL-HDBK 217F(Notice 2) Reliability Prediction of Electronic Equipment (28-02-95), Parts Stress Analysis

– MIL-HDBK 217F(Notice 2) Reliability Prediction of Electronic Equipment (28-02-95), Appendix A, Parts Count Reliability Prediction

– SN 29500 Part 7, Failure Rates of Components, Expected Values for Relays, April 1992

– SN 29500 Part 11, Failure Rates of Components, Expected Values for Contactors, August 1990

– The documents in the SN 29500 series are publicly available and can be obtained from:

  • Siemens AG, CT SR SI
    Otto-Hahn-Ring 6
    D-81739 München:

– UTE C 80-810 RDF 2000: Reliability data handbook – A universal model for reliability prediction of electronic components, PCBs and equipment

– Failure mode/mechanism distributions FMD-91, RAC 1991.

NOTE 2 It is recommended to use failure rate data and failure mode ratio data provided by manufacturers.

NOTE 3 Some component standards have relevant data (e.g. Annex K of IEC 60947-4-1).

NOTE 4 Where a detailed analysis of each failure mode is not practically possible, a division of failures into 50 % safe, 50 % dangerous is generally accepted.

NOTE 5 Lists of faults to be considered for mechanical, pneumatic, hydraulic and electrical technologies are given in Annexes A, B, C and D of ISO 13849-2.

6.7.8.1.2

*Replace, in item f), the word "*mission time*" by "*useful lifetime*".*

Replace, in item g), Note 4, the existing items b) and c) by the following:

b) Markov models (see B.6.6.6 of IEC 61508-7 and IEC 61165);
c) reliability block diagrams (see B.6.6.7 of IEC 61508-7 and IEC 61078).

6.7.8.1.6

Delete this subclause.

Delete Table 7.

6.7.9 Requirements for systematic safety integrity of subsystems

Delete the note.

6.12.1.2

*Replace, in Note 1, the reference "*B.5*" by "*B.5.2*".*

A.1 General

*Delete Note 2 and replace "*NOTE 1*" by "*NOTE*".*

Table A.2 – Frequency and duration of exposure (Fr) classification

Replace, in the first column, third row of the table, the text "≤ 1 per h*" by "*≥ 1 per h*".*

Annex D – Failure modes of electrical/electronic components

Delete Annex D.

Annex E – Electromagnetic (EM) phenomenon and increased immunity levels for SRECS intended for use in an industrial environment according to IEC 61000-6-2

Delete Annex E.

Annex F – Methodology for the estimation of susceptibility to common cause failures (CCF)

Table F.1 – Criteria for estimation of CCF

*Replace the text in the last row of the "*Item*" column with the following new text:*

Is the subsystem immune to adverse influences from electromagnetic interference up to and including the limits specified in IEC 61326-3-1?

_____