
**Funkcijska varnost električnih/elektronskih/programirljivih elektronskih
varnostnih sistemov - 3. del: Programske zahteve (IEC 61508-3:1998 +
popravek 1999)**

(istoveten EN 61508-3:2001)

Functional safety of electrical/electronic/programmable electronic safety-related
systems - Part 3: Software requirements (IEC 61508-3:1998 + Corrigendum 1999)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

EUROPEAN STANDARD

EN 61508-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2001

ICS 25.040.40

English version

**Functional safety of electrical/electronic/programmable electronic
safety-related systems**

Part 3: Software requirements

(IEC 61508-3:1998 + corrigendum 1999)

Sécurité fonctionnelle des systèmes
électriques/électroniques/électroniques
programmables relatifs à la sécurité
Partie 3: Prescriptions concernant les
logiciels
(CEI 61508-3:1998 + corrigendum 1999)

Funktionale Sicherheit
sicherheitsbezogener elektrischer/
elektronischer/programmierbarer
elektronischer Systeme
Teil 3: Anforderungen an Software
(IEC 61508-3:1998 + Corrigendum 1999)

STANDARD PREVIEW
(standards.iteh.ai)

This European Standard was approved by CENELEC on 2001-07-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 61508-3:1998 including its corrigendum April 1999, prepared by SC 65A, System aspects, of IEC TC 65, Industrial-process measurement and control, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 61508-3 on 2001-07-03 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-08-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B and ZA are normative and annex C is informative.

Annex ZA has been added by CENELEC.

IEC 61508 is a basic safety publication covering the functional safety of electrical, electronic and programmable electronic safety-related systems. The scope states:

"This International Standard covers those aspects to be considered when electrical/electronic/programmable electronic systems (E/E/PESs) are used to carry out safety functions. A major objective of this standard is to facilitate the development of application sector international standards by the technical committees responsible for the application sector. This will allow all the relevant factors associated with the application, to be fully taken into account and thereby meet the specific needs of the application sector. A dual objective of this standard is to enable the development of electrical/electronic/programmable electronic (E/E/PE) safety-related systems where application sector international standards may not exist".

The CENELEC Report R0BT-004, ratified by 103 BT (March 2000) accepts that some IEC standards, which today are either published or under development, are sector implementations of IEC 61508. For example:

- IEC 61511, Functional safety - Safety instrumented systems for the process industry sector;
- IEC 62061, Safety of machinery – Functional safety of electrical, electronic and programmable electronic control systems;
- IEC 61513, Nuclear power plants – Instrumentation and control for systems important to safety – General requirements for systems.

The railways sector has also developed a set of European Standards (EN 50126; EN 50128 and prEN 50129).

NOTE EN 50126 and EN 50128 were based on earlier drafts of IEC 61508. prEN 50129 is based on the principles of the latest version of IEC 61508.

This list does not preclude other sector implementations of IEC 61508 which could be currently under development or published within IEC or CENELEC.

Endorsement notice

The text of the International Standard IEC 61508-3:1998 including its corrigendum April 1999 was approved by CENELEC as a European Standard without any modification.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61508-1 + corr. May	1998 1999	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements	EN 61508-1	2001
IEC 61508-2	2000	Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems	EN 61508-2	2001
IEC 61508-4 + corr. April	1998 1999	Part 4: Definitions and abbreviations	EN 61508-4	2001
IEC 61508-5 + corr. April	1998 1999	Part 5: Examples of methods for the determination of safety integrity levels	EN 61508-5	2001
IEC 61508-6	2000	Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3	EN 61508-6	2001
IEC 61508-7	2000	Part 7: Overview of techniques and measures	EN 61508-7	2001
ISO/IEC Guide 51	1990	Guidelines for the inclusion of safety aspects in standards	-	-
IEC Guide 104	1997	The preparation of safety publications and the use of basic safety publications and group safety publications	-	-

INTERNATIONAL STANDARD

IEC 61508-3

First edition
1998-12

BASIC SAFETY PUBLICATION

Functional safety of electrical/electronic/ programmable electronic safety-related systems –

Part 3: Software requirements

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

© IEC 1998 Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

X

For price, see current catalogue

CONTENTS

	Page
FOREWORD	7
INTRODUCTION	9
Clause	
1 Scope	13
2 Normative references	19
3 Definitions and abbreviations	19
4 Conformance to this standard	19
5 Documentation	19
6 Software quality management system	21
6.1 Objectives	21
6.2 Requirements	21
7 Software safety lifecycle requirements	23
7.1 General	23
7.2 Software safety requirements specification	35
7.3 Software safety validation planning	39
7.4 Software design and development	43
7.5 Programmable electronics integration (hardware and software)	55
7.6 Software operation and modification procedures	57
7.7 Software safety validation	57
7.8 Software modification	61
7.9 Software verification	65
8 Functional safety assessment	73
Annex A (normative) Guide to the selection of techniques and measures	75
Annex B (normative) Detailed tables	87
Annex C (informative) Bibliography	95
Tables	
1 Software safety lifecycle: overview	29
A.1 Software safety requirements specification (see 7.2)	77
A.2 Software design and development: software architecture design (see 7.4.3)	77
A.3 Software design and development: support tools and programming language (see 7.4.4)	79
A.4 Software design and development: detailed design (see 7.4.5 and 7.4.6)	79

Table	Page
A.5 Software design and development: software module testing and integration (see 7.4.7 and 7.4.8)	81
A.6 Programmable electronics integration (hardware and software) (see 7.5)	81
A.7 Software safety validation (see 7.7)	81
A.8 Modification (see 7.8)	83
A.9 Software verification (see 7.9)	83
A.10 Functional safety assessment (see clause 8)	85
B.1 Design and coding standards (referenced by table A.4)	87
B.2 Dynamic analysis and testing (referenced by tables A.5 and A.9)	87
B.3 Functional and black-box testing (referenced by tables A.5, A.6 and A.7)	89
B.4 Failure analysis (referenced by table A.10)	89
B.5 Modelling (referenced by table A.7)	89
B.6 Performance testing (referenced by tables A.5 and A.6)	91
B.7 Semi-formal methods (referenced by tables A.1, A.2 and A.4)	91
B.8 Static analysis (referenced by table A.9)	91
B.9 Modular approach (referenced by table A.4)	93

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Figures	
1 Overall framework of this standard	17
2 E/E/PES safety lifecycle (in realisation phase)	25
3 Software safety lifecycle (in realisation phase)	25
4 Relationship between and scope of IEC 61508-2 and 61508-3	27
5 Software safety integrity and the development lifecycle (the V-model)	27
6 Relationship between the hardware and software architectures of programmable electronics	35

FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS –

Part 3: Software requirements

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61508-3 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control.

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

FDIS	Report on voting
65A/269/FDIS	65A/277/RVD

Full information on the voting for the approval of this standard can be found in the voting report indicated in the above table.

Annexes A and B form an integral part of this standard.
Annex C is for information only.

IEC 61508 consists of the following parts, under the general title *Functional safety of electrical/electronic/programmable electronic safety-related systems*:

- Part 1: General requirements
- Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
- Part 3: Software requirements
- Part 4: Definitions and abbreviations
- Part 5: Examples of methods for the determination of safety integrity levels
- Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3
- Part 7: Overview of techniques and measures

The contents of the corrigendum of April 1999 have been included in this copy.

INTRODUCTION

Systems comprised of electrical and/or electronic components have been used for many years to perform safety functions in most application sectors. Computer-based systems (generically referred to as programmable electronic systems (PESs)) are being used in all application sectors to perform non-safety functions and, increasingly, to perform safety functions. If computer system technology is to be effectively and safely exploited, it is essential that those responsible for making decisions have sufficient guidance on the safety aspects on which to make those decisions.

This International Standard sets out a generic approach for all safety lifecycle activities for systems comprised of electrical and/or electronic and/or programmable electronic components (electrical/electronic/ programmable electronic systems (E/E/PESs)) that are used to perform safety functions. This unified approach has been adopted in order that a rational and consistent technical policy be developed for all electrically-based safety-related systems. A major objective is to facilitate the development of application sector standards.

In most situations, safety is achieved by a number of protective systems which rely on many technologies (for example mechanical, hydraulic, pneumatic, electrical, electronic, programmable electronic). Any safety strategy must therefore consider not only all the elements within an individual system (for example sensors, controlling devices and actuators), but also all the safety-related systems making up the total combination of safety-related systems. Therefore, while this International Standard is concerned with electrical/electronic/programmable electronic (E/E/PE) safety-related systems, it may also provide a framework within which safety-related systems based on other technologies may be considered.

It is recognized that there is a great variety of E/E/PES applications in a variety of application sectors and covering a wide range of complexity, hazard and risk potentials. In any particular application, the required safety measures will be dependent on many factors specific to the application. This International Standard, by being generic, will enable such measures to be formulated in future application sector international standards.

This International Standard

- considers all relevant overall, E/E/PES and software safety lifecycle phases (for example, from initial concept, through design, implementation, operation and maintenance to decommissioning) when E/E/PESs are used to perform safety functions;
- has been conceived with a rapidly developing technology in mind; the framework is sufficiently robust and comprehensive to cater for future developments;
- enables application sector international standards, dealing with safety-related E/E/PESs, to be developed; the development of application sector international standards, within the framework of this International Standard, should lead to a high level of consistency (for example, of underlying principles, terminology etc.) both within application sectors and across application sectors; this will have both safety and economic benefits;
- provides a method for the development of the safety requirements specification necessary to achieve the required functional safety for E/E/PE safety-related systems;
- uses safety integrity levels for specifying the target level of safety integrity for the safety functions to be implemented by the E/E/PE safety-related systems;

- adopts a risk-based approach for the determination of the safety integrity level requirements;
- sets numerical target failure measures for E/E/PE safety-related systems which are linked to the safety integrity levels;
- sets a lower limit on the target failure measures, in a dangerous mode of failure, that can be claimed for a single E/E/PE safety-related system; for E/E/PE safety-related systems operating in
 - a low demand mode of operation, the lower limit is set at an average probability of failure of 10^{-5} to perform its design function on demand,
 - a high demand or continuous mode of operation, the lower limit is set at a probability of a dangerous failure of 10^{-9} per hour;

NOTE – A single E/E/PE safety-related system does not necessarily mean a single-channel architecture.

- adopts a broad range of principles, techniques and measures to achieve functional safety for E/E/PE safety-related systems, but does not use the concept of fail safe, which may be of value when the failure modes are well defined and the level of complexity is relatively low. The concept of fail safe was considered inappropriate because of the full range of complexity of E/E/PE safety-related systems that are within the scope of the standard.

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS –

Part 3: Software requirements

1 Scope

1.1 This part of IEC 61508

- a) is intended to be utilised only after a thorough understanding of IEC 61508-1 and IEC 61508-2;
- b) applies to any software forming part of a safety-related system or used to develop a safety-related system within the scope of IEC 61508-1 and IEC 61508-2. Such software is termed safety-related software.
 - Safety-related software includes operating systems, system software, software in communication networks, human-computer interface functions, support tools and firmware as well as application programs.
 - Application programs include high level programs, low level programs and special purpose programs in limited variability languages (see 3.2.7 of IEC 61508-4).
- c) requires that the software safety functions and software safety integrity levels are specified.

NOTE 1 – If this has already been done as part of the specification of the E/E/PE safety-related systems (see 7.2 of IEC 61508-2), then it does not have to be repeated in this part.

NOTE 2 – Specifying the software safety functions and software safety integrity levels is an iterative procedure; see figures 2 and 6.

NOTE 3 – See clause 5 and annex A of IEC 61508-1 for documentation structure. The documentation structure may take account of company procedures, and of the working practices of specific application sectors.

- d) establishes requirements for safety lifecycle phases and activities which shall be applied during the design and development of the safety-related software (the software safety lifecycle model). These requirements include the application of measures and techniques, which are graded against the safety integrity level, for the avoidance of and control of faults and failures in the software.
- e) provides requirements for information relating to the software safety validation to be passed to the organisation carrying out the E/E/PES integration.
- f) provides requirements for the preparation of information and procedures concerning software needed by the user for the operation and maintenance of the E/E/PE safety-related system.
- g) provides requirements to be met by the organisation carrying out modifications to safety-related software.
- h) provides, in conjunction with IEC 61508-1 and IEC 61508-2, requirements for support tools such as development and design tools, language translators, testing and debugging tools, configuration management tools.

NOTE 4 – Figures 4 and 6 show the relationship between IEC 61508-2 and IEC 61508-3.

1.2 Parts 1, 2, 3 and 4 of this standard are basic safety publications, although this status does not apply in the context of low complexity E/E/PE safety-related systems (see 3.4.4 of part 4). As basic safety publications, they are intended for use by technical committees in the preparation of standards in accordance with the principles contained in *IEC Guide 104* and *ISO/IEC Guide 51*. Parts 1, 2, 3, and 4 are also intended for use as stand-alone publications.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications. In this context, the requirements, test methods or test conditions of this basic safety publication will not apply unless specifically referred to or included in the publications prepared by those technical committees.

NOTE – In the USA and Canada, until the proposed process sector implementation of IEC 61508 (i.e. IEC 61511) is published as an international standard in the USA and Canada, existing national process safety standards based on IEC 61508 (i.e. ANSI/ISA S84.01-1996) can be applied to the process sector instead of IEC 61508.

1.3 Figure 1 shows the overall framework of parts 1 to 7 IEC 61508, and indicates the role that IEC 61508-3 plays in the achievement of functional safety for E/E/PE safety-related systems. Annex A of IEC 61508-6 describes the application of IEC 61508-2 and IEC 61508-3.

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61508-3:2007

<https://standards.iteh.ai/catalog/standards/sist/c8589842-66c0-4320-b08e-579ce86635bf/sist-en-61508-3-2007>

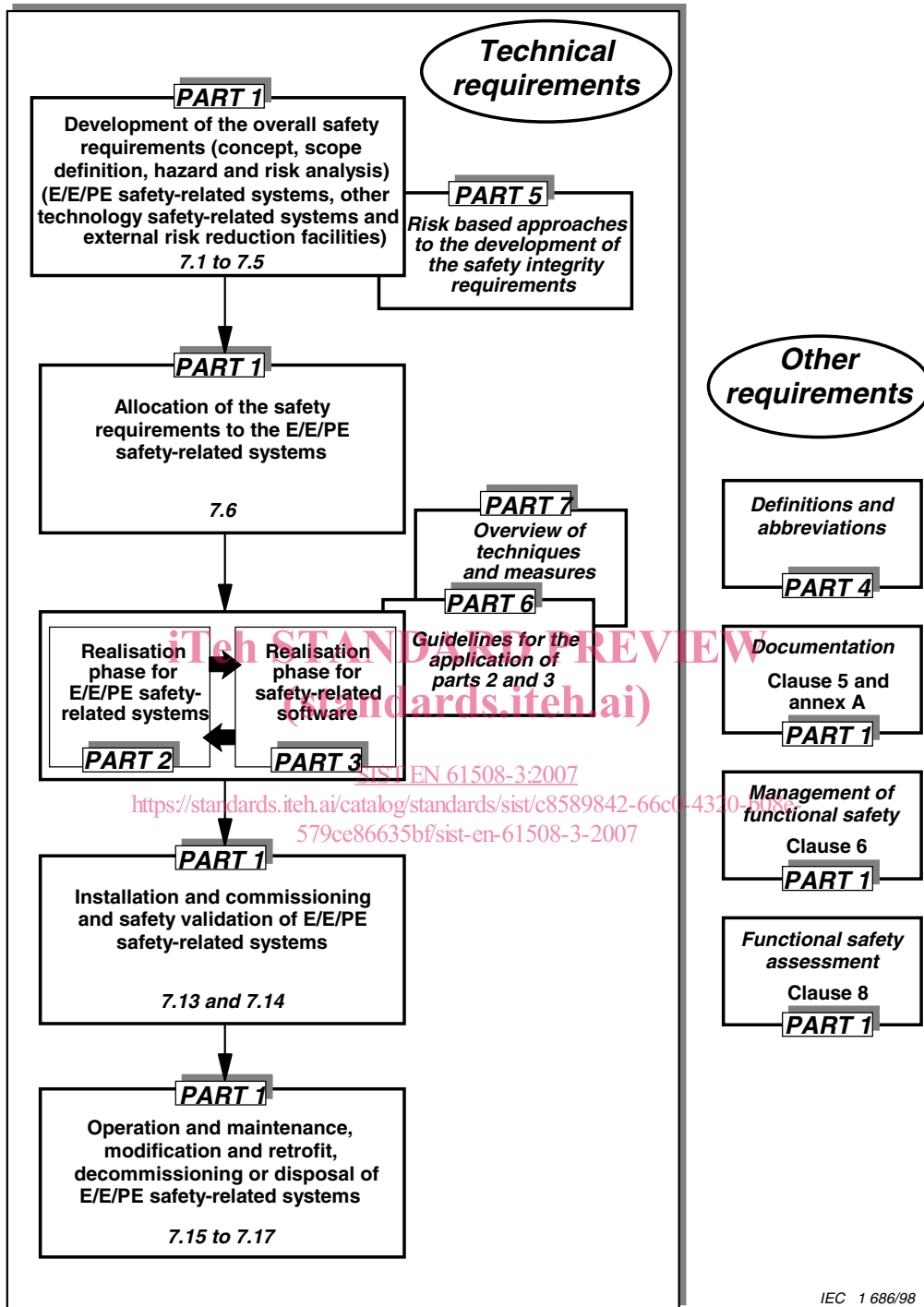


Figure 1 – Overall framework of this standard